Republic of North Macedonia

Public Enterprise for State Roads

A2 MOTORWAY: BUKOJCHANI – KICHEVO SECTION

Environmental and Social Impact Assessment

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1 INTRODUCTION

1.1 THE PROJECT

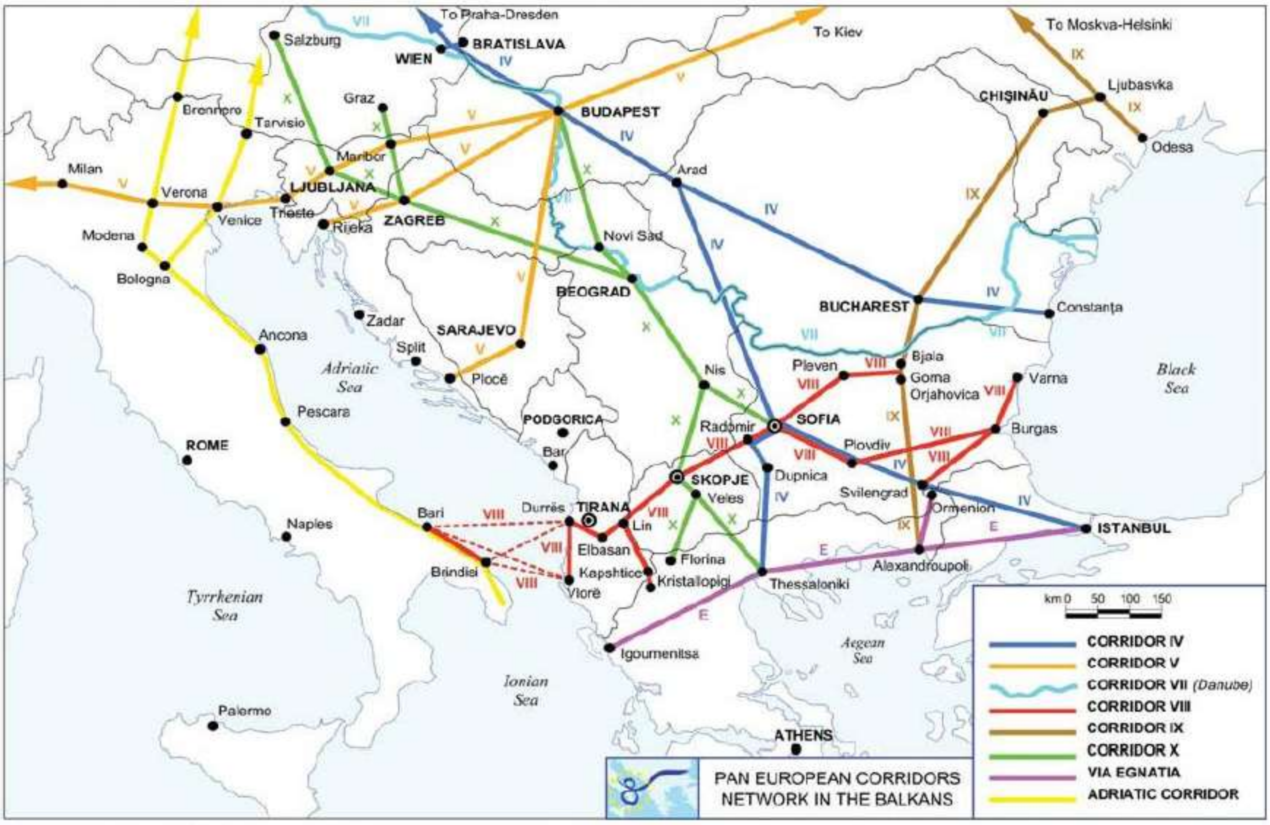
1.1.1. This Environmental and Social Impact Assessment (ESIA) Study for the A2 motorway, Bukojchani – Kichevo section (the Project) has been prepared in line with the contract between the Public Enterprise for State Roads (the Investor) and GEING Krebs und Kiefer International and others Ltd. – Skopje (no. 08-16/7 from 26.01.2018). It has also been supplemented by assessments undertaken by WSP to meet EU and EBRD requirements.

1.2 THE NEED FOR THE PROJECT

1.2.1. The Project is part of the investment program of the Public Enterprise for State Roads (PESR) for improving the road infrastructure and to support regional connectivity in the Republic of North Macedonia. The Republic of North Macedonia, as part of its commitment to EU membership, aims to develop a sustainable transport sector by constantly developing and improving the network of state roads, which includes the international road sections belonging to the Trans-European Transport Network (Figure 1-1).

1.2.2. In addition, the Republic of North Macedonia follows the EU's plans to improve multi-modal corridors in order to facilitate the anticipated growth in transport movements.

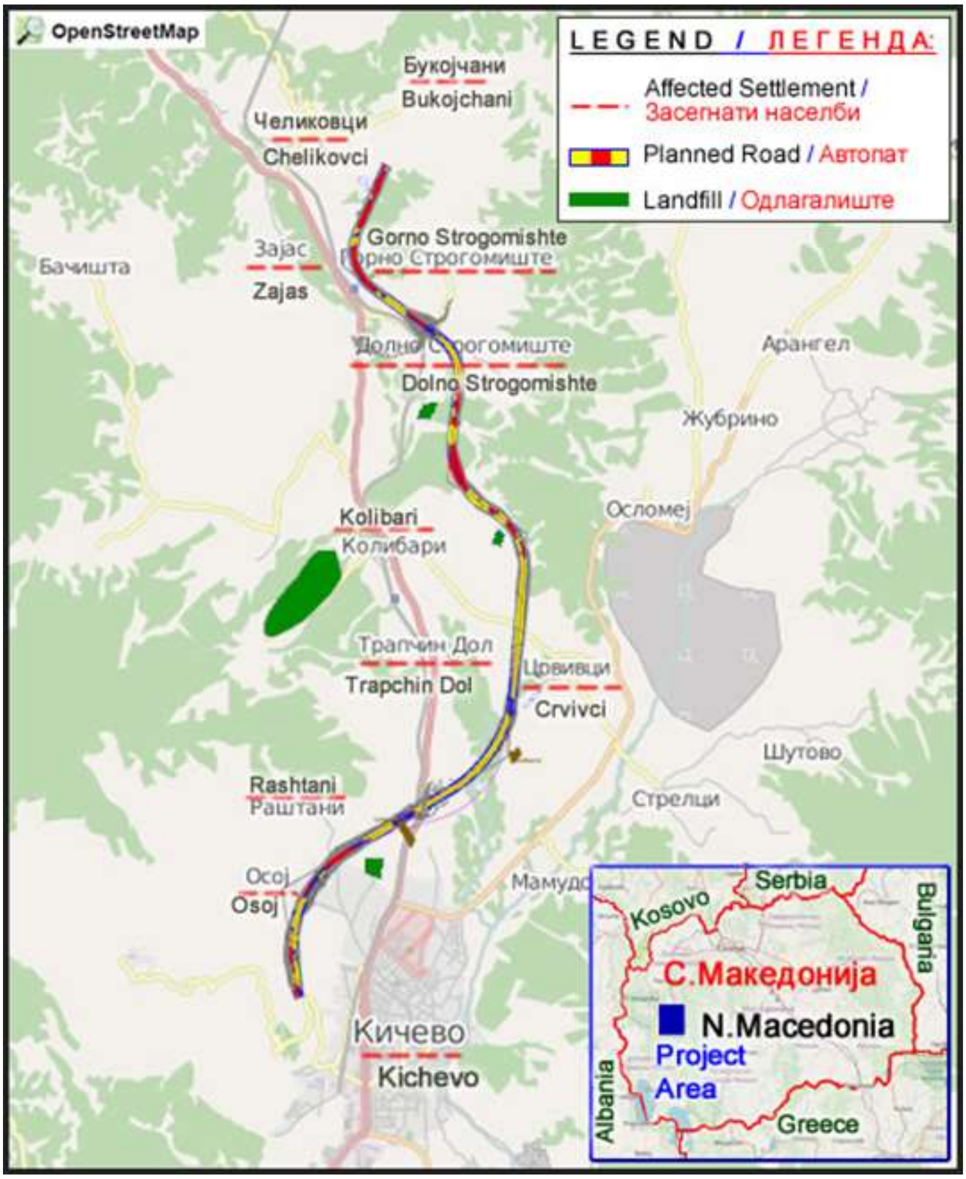
Figure 1-1 - Trans-European Transport Network corridors in the Balkans and Republic of North Macedonia



Source: Corridor VIII Secretariat

1.2.3. The Project forms part of Corridor VIII which runs through the territory of the Republic of North Macedonia, and is approximately 305 km in length, from the border with Bulgaria (Deve Bair Border Crossing) to the border with Albania (Kjafasan Border Crossing).

Figure 1-2 - Location of the Project



1.2.4. This Project connects Bukojchani – Kichevo, it will be a 10.7 km subsection of the M2 motorway. The location of the Project is shown on Figure 1-2.

1.2.5. The Project was originally designed from north to south, starting at a location to the south west of Bukojchani at its most northerly point, then connecting to the A4 Kichevo to Ohrid scheme in the south, with a total length of approximately 12.7 km. However, a 2 km section to the north of the Strogomishte interchange has been removed from the Project, as it would have created a section that did not connect with the existing highways network and would not be utilised until the next phase of the wider scheme had been designed and constructed at a future date.

1.2.6. The Project now consists of a 10.7 km section, which starts at the Strogomishte interchange in the north and connects with the A2 Kichevo to Ohrid scheme in the south.

1.3 SCHEMES ADJACENT TO THE NORTH AND SOUTH OF THE PROJECT

1.3.1. The A2 Motorway alignment to the south of the Project (A2 Kichevo – Ohrid) has been designed and is currently being constructed. The section that is immediately adjacent to the Project will be constructed towards the end of the construction period for the Kichevo – Ohrid scheme.

1.3.2. The wider A2 Gostivar – Kichevo scheme will be designed and built in three phases (three subsections):

- Phase 1 (Subsection III Bukojchani – Kichevo) (this Project);
- Phase 2 (Subsection I Gostivar – Gorna Gjonovica) and
- Phase 3 (Subsection II Gorna Gjonovica – Bukojchani).

1.3.3. Phase 2 and 3 of the A2 Gostivar – Kichevo scheme are located to the north of the Project, and these sections of the A2 are currently planned for design and construction in the future. Phase 2 Gorna Gjonovica – Bukojchani will be immediately adjacent to the southern end of the Project.

1.3.4. Although the Project can be considered a phase in the wider A2 Gostivar – Kichevo scheme, it is a standalone section of Motorway which can be constructed and operate regardless of whether the future phases are constructed.

1.4 THE PROJECT SETTING

1.4.1. The Project is located on the western side of the Republic of North Macedonia, approximately 61 km south west of Skopje, in the region of Kichevo. The Kichevo region is located in the Kichevo Valley and is surrounded by hills and mountainous terrain on all sides. The region is largely agricultural with several large settlements, including Kichevo at the southern end of the alignment and Zajas near the northern end. There are existing transport links in close proximity to the Project, including the existing A2 state road and the Bukojchani to Kichevo railway line.

2 DESCRIPTION OF THE PROJECT

2.1 INTRODUCTION

2.1.1. This chapter provides a description of the Project, including a description of how the Project would be constructed. It also sets out the assumptions used for the assessments, where this information is yet to be confirmed.

2.2 DESCRIPTION OF THE PROJECT

2.2.1. The Project is for the construction of the 10.7 km long 'Bukojchani – Kichevo' subsection of A2 motorway. The northern end of the alignment starts at the Strogomishte intersection, which provides connection to the villages of Dolno and Gorno Strogomishte. The southern end of the alignment, both horizontally and vertically fits with the A2 Kichevo – Ohrid, which is currently under construction. Construction of the Project is expected to commence in 2021 and finish in 2025.

2.2.2. The motorway will be designed in accordance with Macedonian road design standards. It will have a design speed of 100 km/hour, as higher design speeds are not possible due to the hilly terrain and some tight horizontal curves.

2.2.3. The Project has the following technical parameters:

Table 2-1 - Specification for the motorway

Technical Parameter	Width
Lanes	2 x (2 x 3.50)
Border lanes	2 x 0.50+2 x 0.25 m
Profile of carriageway	10.25 m
Dividing lane (central reservation)	3.0 m
Shoulders	2 x 1.2 m
Gutter+berm (drainage)	0.75+3.0 m
Min. transversal slope	2.5 %
Max. longitudinal slope	5 %
Additional lanes for slow vehicles	3.50 m
Smallest horizontal curve radius in plan	450 m
Minimal length of a transition curve	70 m
Maximum longitudinal slope	5%

2.2.4. There are a number of small local roads that intercept the motorway alignment and underpasses and overpasses will be provided to maintain local access. These roads will not be modified as part of the Project, but they may be affected during construction so have been considered in this ESIA.

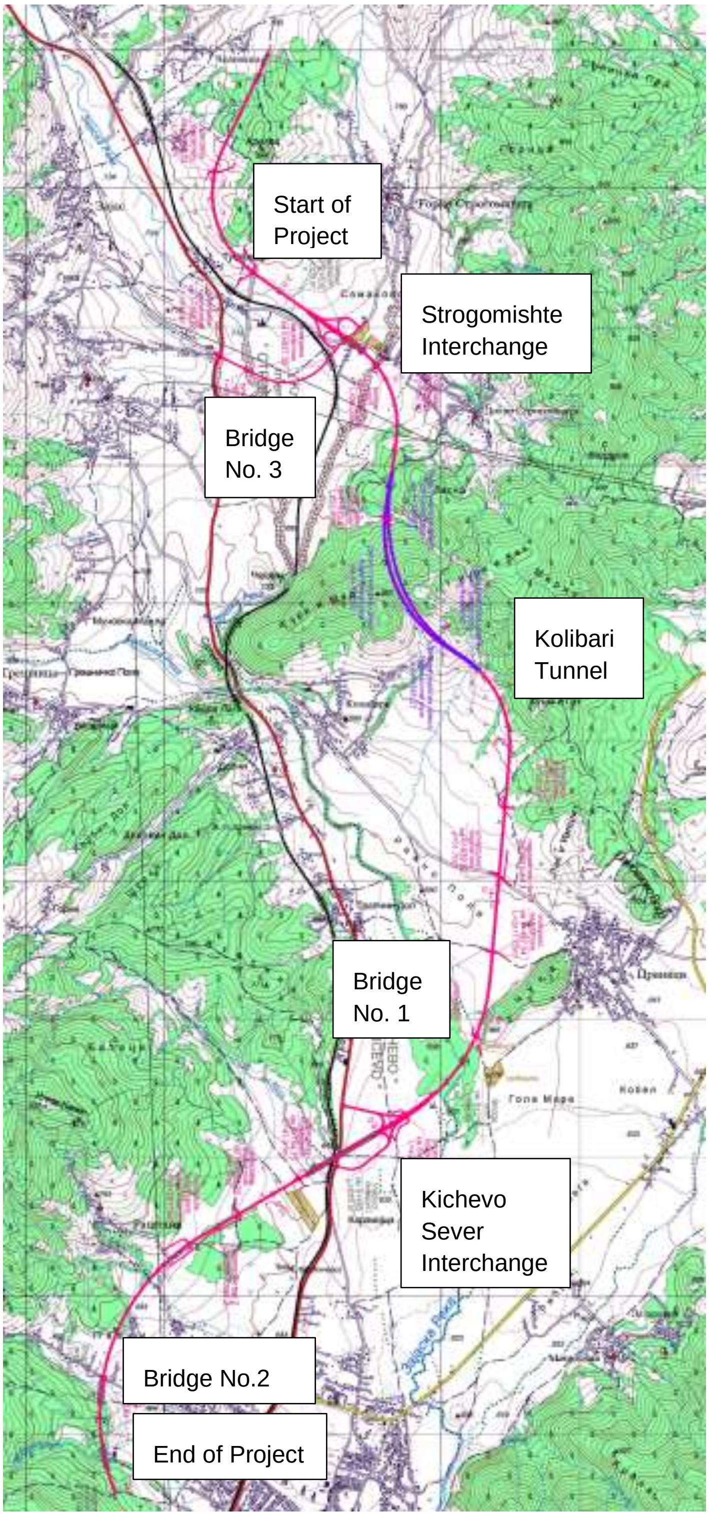


Figure 2-1 - Project Alignment

2.3 VERTICAL ALIGNMENT

2.3.1. The vertical alignment for the road has been designed to provide the best route, with as few structures as possible. Two key locations dictate the design of the finished road level. The first location is the village cemetery in Strogomishte (within the area of the Strogomishte interchange), and the second is the railway line within the area of the Kichevo interchange.

2.3.2. The route goes through the village of Strogomishte, and is adjacent to the village cemetery, which will be bridged with a viaduct structure. Therefore, the finished road level must be raised in order to provide continuous access to the cemetery. Within Strogomishte there are numerous unpaved roads providing access to nearby fields. These were additional considerations for raising the finished road level, as this will ensure this access is maintained.

2.3.3. At the Kichevo interchange, the Kichevo-Ohrid railway line is located parallel to the existing A2 national road. The Project has been designed to pass over the national road and the railway line, with a free height of 6.5 m in accordance with the relevant standards for an electrified railway line (this is also an appropriate height to pass over the existing national road).

2.3.4. Parts of the Project alignment are located in mountainous terrain, which results in a requirement for large excavations and high embankments. The maximum height of the excavations is likely to be 22 m in mountainous areas (before and after the tunnel). The height of the finished road level in the area of the Kichevo interchange reaches 18 m and will require high embankments due to the proximity of the Kichevo-Ohrid railway line. A maximum inclination of 5 % will be used on this route due to the steep terrain.

2.3.5. There are two parts of the route which will have additional lanes for heavy goods vehicles. The length of these lanes has been determined in line with relevant standards, they will have a width of 3.50 m, which is the same as the driving lanes.

2.4 EARTHWORKS BALANCE

2.4.1. The Project has been designed to reduce the volume of waste generated by, balancing the earthworks i.e. to reuse the excavated material from the tunnel and cuttings in the embankments (see Chapter 13 – Waste Generation and Resource Efficiency).

2.4.2. Slope stabilisation measures will be used, where required, to protect the alignment and adjacent areas from rockfalls and landslides. Approximately 4,731 tonnes of stabilisation material will be used on the Project.

2.5 PAVEMENT STRUCTURE

2.5.1. The specification of the pavement has been designed to take into account the expected 5% Average Annual Daily Traffic (AADT) increase in traffic volume expected in the next 20 years. The pavement structure consists of the following layers:

Table 2-2 - Pavement Structure

Component	Detail	Thickness/ Depth
Asphalt concrete with polymer bitumen	AB16s PmB	6 cm

Component	Detail	Thickness/ Depth
	PmB 45-80/65. 45-80/65	
Bituminous bearing layer	PmB 25-55/55. BNS 22sA PmB 25-55/55	6 cm
Bituminous bearing layer	BIT50/70. BNS 32sA BIT50/70	7 cm
Crushed stone base course	Crushed stone base	35 cm
Improved bedding	Dependent on the geomechanical properties of the base	20-60 cm

2.6 DRAINAGE

2.6.1. The Project includes all necessary drainage elements, including box and pipe culverts. All pipe culverts will have Ø1000 mm opening, except for one in the area of the tunnel which will have an Ø1900 mm opening. Drainage, sewage, oil and grease interceptors, are included in the design at several locations along the motorway alignment.

2.6.2. Since the entire route is located in mountainous / hilly terrain, most water will drain into this local terrain. The discharge of water will be in accordance with national and EU requirements.

2.7 LOCAL ROAD CROSSINGS AND PARALLEL ROADS

2.7.1. There are fourteen road crossing and two parallel roads planned along the route of the Project. Two of the road crossings go over the motorway (overpasses), and the other twelve will pass under it (underpasses).

2.7.2. The road crossings and parallel roads have the following dimensions:

Table 2-3 - Local Road Crossings

Crossing Number	Description
Crossing 1 - underpass-	An underpass at Ch 00+940 km, where the Project passes over the existing unpaved road. This existing unpaved road is located in mountainous terrain.
Crossing 2 - underpass	An underpass at Ch 01+760 km, where the Project crosses over an existing unpaved road. This part of the route is also located in a mountainous terrain.

Crossing Number	Description
Crossing 3 - underpass	An underpass at Ch 02+732 km, where the Project crosses the existing unpaved road in the village of Dolno Strogomishte. This unpaved road goes through a settlement and provides access to fields.
Crossing 4 - underpass	An underpass at Ch 02+931 km, where the Project crosses an existing unpaved road. The existing unpaved road provides access to fields.
Crossing 5 - underpass	An underpass at Ch 04+024 km on the Project alignment; where the Project passes over an existing unpaved road.
Crossing 6 - underpass	An underpass at Ch 06+439 km on the Project alignment, where the alignment passes over a small network of unpaved roads.
Crossing 7 - underpass	An underpass at Ch 06+939 km on the Project alignment, where the alignment passes over the asphalt road to the village of Crvivci.
Crossing 8 - overpass	An overpass at Ch 07+487 km on the Project alignment, where the alignment will pass under the existing unpaved road. Due to the flat terrain in this area, and the low alignment of the motorway, this crossing will be an overpass over the motorway.
Crossing 9 - underpass	An underpass at Ch 08+109 km on the Project alignment, where the alignment passes over the existing unpaved road.
Crossing 10 - underpass	An underpass at Ch 08+889 km on the Project alignment, where the alignment passes over the existing unpaved road.
Crossing 11 - underpass	An underpass at Ch 09+784 km on the Project alignment, where the alignment passes over adjacent unpaved road
Crossing 12 - underpass	An underpass at Ch 10+289 km on the Project alignment, beginning at the intersection with the previous crossing and ending at the existing unpaved road. In this location, the motorway crosses a longer section of the unpaved road, so the unpaved road has been relocated and will be parallel to the motorway.
Crossing 13 - overpass	An overpass at Ch 10+709 km on the Project alignment, where the alignment passes under the existing asphalt road.
Crossing 14 - underpass	The alignment will pass over both the road and watercourse on a viaduct.

2.8 INTERCHANGES

Table 2-4 - Interchanges

Name	Description
Strogomishte Interchange	The grade separated “Strogomishte” interchange is designed to connect the proposed A2 motorway (Bukojchani – Kichevo) with the existing state road A2. The interchange is located at a chainage of approximately Ch 02 +300 km, near Gorno Strogomishte, Dolno Strogomishte and Zajas. The interchange connects to a paved road which leads from the villages Gorno and Dolno Strogomishte to a local school. The local paved road passes under the Kichevo – Gostivar railway through an underpass. At the intersection with the local road there are cemeteries and residential housing. This interchange includes the Strogomishte Viaduct (Viaduct No. 1), detailed in Table 2-6
Kichevo Sever (North) Interchange	The grade separated “Kichevo Sever” interchange connects the A2 motorway (Bukojchani – Kichevo) with the existing A2state road and is located at km 8.869 on the Project alignment.

2.9 BRIDGES

Table 2-5 - Location and Specification of Noise Barriers

Bridge Number and Name	Chainage	Description
Bridge No. 3 over the Zajaska River	Ch 01 +093 km	The structure is needed in order to bridge Zajaska River as part of the Strogomishte interchange. The proposed construction consists of semi prefabricated girders with length of 16 m.
Bridge No. 1 over the Zajaska River	Ch 08+315 km	This will consist of two parallel structures that will accommodate the two carriageways. The proposed structure consists of semi-prefabricated girders with a length of 28.3 m.
Bridge No.2 over the Susica River	Ch 11+949 km	Two parallel structures are proposed for the carriageways.

BRIDGE PROTECTION MEASURES

2.9.1. Proper hydro-isolation[1] is proposed for all three bridges. Polymerised bituminous strips[2] will be used which will provide resistance to ice and other aggressive substances, such as grease, oil, etc, waterproofing, and consistency when heated.

2.9.2. In order to improve the slope stability, and to prevent landslides and rockslides, gabions[3] are proposed for bridge no.1 and bridge no.3.

2.9.3. Once the bridges become operational, the authority responsible for the maintenance of the road will be obligated maintain the structures. This obligation consists of regular and controlled checks of the structures at legislatively compliant intervals. During the initial period of operation, any structural irregularities must be identified in order to be corrected and addressed in a timely manner. During the first two years, geodetic surveys of the structure are to be performed at four-month intervals, in order to identify any vertical and horizontal displacements.

2.9.4. Hydraulic analysis has been undertaken on the bridge structures. The designs will maintain the stability of the riverbed to ensure the Project doesn't not result in additional erosion. The designs provide protection for the bridge structure as well as the riverbed. The bridges have been designed for the 1 in 100-year flood event.

2.10 VIADUCTS

Table 2-6 - Viaducts

Viaduct Number and Name	Chainage	Description
Viaduct No. 1 at Strogomishte Interchange	Ch 02+630 km	The viaduct structure will pass over the local village cemetery, and one local road. It will consist of two parallel constructions, one for the left and the other for the right carriageway. The structure will have three spans and two piers. Three design variants for the viaduct component of the Strogomishte Interchange are being considered. The variants have been prepared to investigate whether it will be possible to locate the viaduct piers outside the graveyard at Gorno Strogomishte. Further details are provided in Chapter 4, Section 4.11. This assessment has therefore assessed the design parameters with the maximum impacts from all the options / variants, to ensured that the worst case scenario has been assessed, and that appropriate mitigation has been identified.

[1] Isolation from water
[2] Flexible rubber strips
[3] Wire cages filled with rocks and boulders.

Viaduct Number and Name	Chainage	Description
		The assessment has been undertaken based on the following parameters: ▪ Maximum height of structure – 7.12 m ▪ Maximum depth of structure - 3.50 m ▪ Maximum width – 28.2 m ▪ Maximum length – 148.00 m ▪ Minimum length between retaining walls – 100.25m ▪ Minimum clearance under structure – 3.44 m ▪ Minimum distance between piers – 27.75m ▪ Piers located within the graveyard The maximum impact of the viaduct has been assessed in all chapters.
Viaduct No. 2 at Kichevo North Intersection	Ch 09+485 km	This viaduct structure will pass over the existing Gostivar – Kichevo railway line, as well as the A2 state road, which is parallel to the railway. Two parallel constructions are proposed, one for the left and the other for the right carriageway. The structure will have 12 spans totalling 535.9 m, where each span consists of five semi prefabricated girders, with a length of 44.3 m. The viaduct avoids the need for high embankments in this part of the route. The vertical alignment providing the necessary height of 6.50m over the railway line.
Viaduct No.3	Ch 12+460 km	This structure bridges the dry Stiborani ravine. Two parallel structures are proposed, one for the left and one for the right carriageway. The left and right structures have different lengths, due to the unfavourable terrain. The structures consist of semi prefabricated girders with a length of 32 m

2.11 TUNNELS

KOLIBARI TUNNEL

2.11.1. A tunnel is required in the 'Guri i Mad' locality, as the hilly terrain provides a natural obstacle to the A2 motorway.

KOLIBARI TUNNEL – CH 04+116 TO 847 KM

2.11.2. Two tunnels will be built, one for each direction of vehicle movements. The specifications of the tunnels are as follows

- The south bound tunnel, extends from Ch 00+433.51 to Ch 01+055.56 (local chainage on the right axis) with total length of 622.0 m.
- The north bound tunnel, extends from Ch 00+414.32 to Ch 01+120.09 (local chainage on the left axis) with total length of 705.80 m.

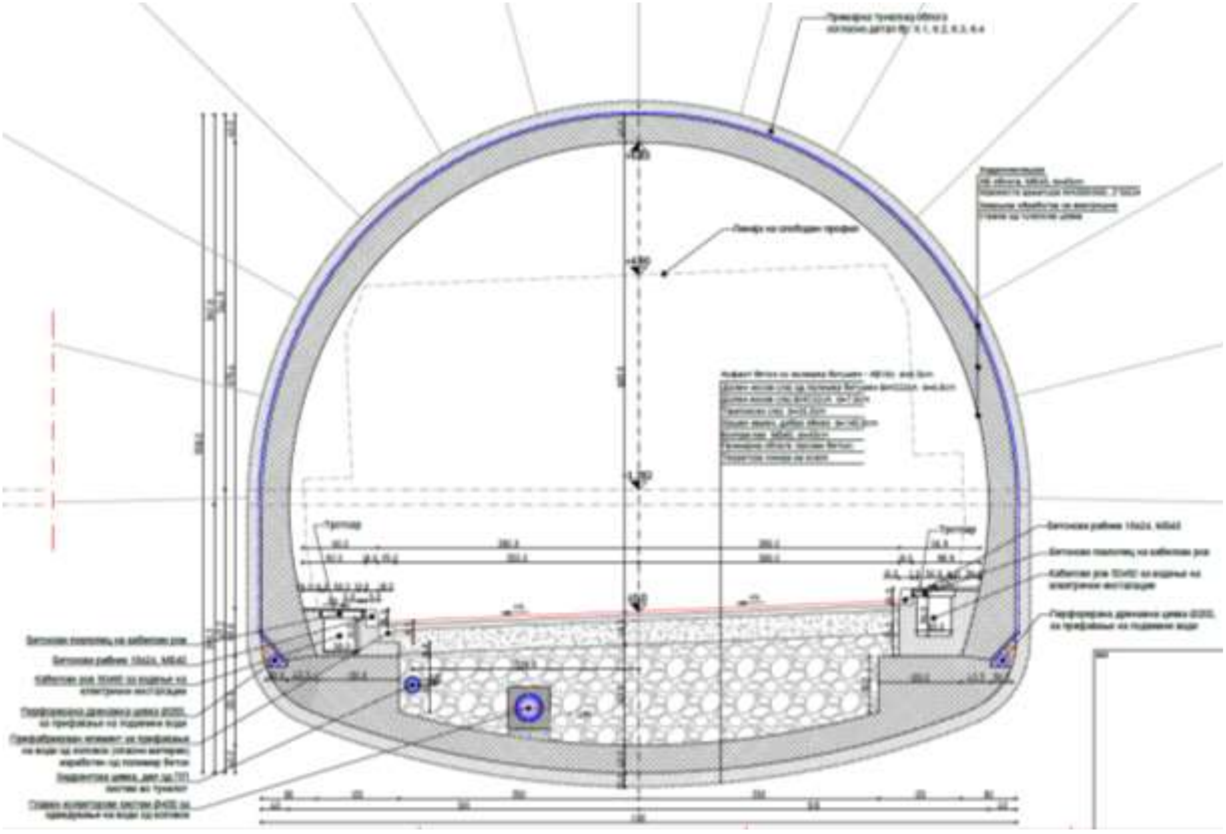


Figure 2-2 - Tunnel cross-section

2.11.3. The height of the free profile of the hallway (pedestrian path) for maintenance of the tunnel should be 2.25 m above the tread, and its width should be at least 1.00 m, which in this case is respected.

2.11.4. An integral part of the drainage system will be located on either side of the tunnel. This will be constructed from semi-perforated drainage pipes, which will collect the underground or storm water that has penetrated the soil.

2.11.5. In addition to the drainage system, the channel along the lower edge of the carriageway will collect liquid pollutants that would otherwise flow onto the carriageway.

2.12 LIGHTING

2.12.1. Lighting will be provided at the two interchanges and in the tunnel, as a safety measure. The rest of the Project will be unlit, thereby reducing light impacts on the local population and biodiversity assets. The current lighting design comprises luminaires of between 85 watts and 433 watts.

2.13 RETAINING WALLS

2.13.1. Retaining walls will be required at the following locations.

Table 2-7 - Retaining Walls

Chainage	Side of road	Description
Ch 02+689 km to Ch 02+771 km	East	Required to construct the road embankment and to reach the necessary finished road level
Ch 02+703 km to Ch 02+840 km	West	
Ch 09+688 km to Ch 09+783 km	East	Required as there is not enough space for the embankment to be constructed as slopes,
Ch 11+694 km to Ch 11+768 km	West	Required due to the proximity of structures

2.13.2. The embankments will be constructed as a system of modular wire units with a face finish of gabion baskets (see Figure 2-3), with reinforced geogrids.

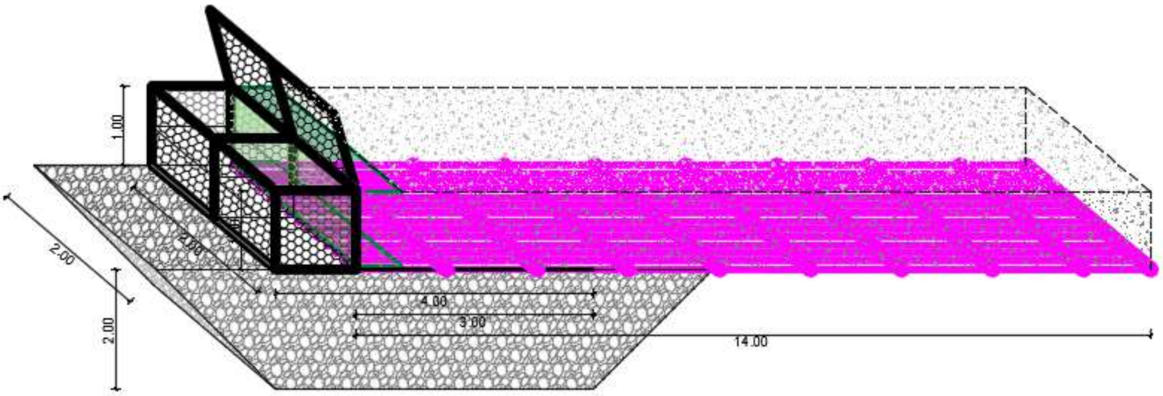


Figure 2-3 - Geometry of the planned modular wire units with gabion face

2.14 EARTHWORKS, RESOURCES AND RAW MATERIALS

2.14.1. The location of the designed cuts (excavations) along the Project are given below:

Table 2-8 - Excavations

	West side	East side
Excavation 1	Ch 00+120 - Ch 00+400	Ch 00+000.00 - Ch 00+380

	West side	**East side**
Excavation 2	Ch 00+460.00 - Ch 00+840	Ch 00+540.00 - Ch 00+840
Excavation 3	Ch 01+100.00 - Ch 01+700	Ch 01+140.00 - Ch 01+220
Excavation 4	Ch 03+430.00 - Ch 03+949.00	Ch 03+430 - Ch 03+949
Excavation 5	Ch 05+089 - Ch 05+269	Ch 0 5+102 -Ch 05+249
Excavation 6	Ch 05+389	Ch 0 5+889
Excavation 7	Ch 10+609.00 – Ch 11+030	Ch 10+609.00 - Ch 11+049
Excavation 8	Ch 11+149.00 – Ch 11+409	Ch 11+149.00 - Ch 11+409
Excavation 9	Ch 12+080 - Ch 12+270	Ch 12+089 – Ch 12+369
Excavation 10		Ch 12+569 – Ch 12+727

2.14.2. The resources and raw materials proposed for use are typical of similar projects.

2.14.3. Borrow pits are likely to be required for subgrade material for the Project, as the material from excavation is unlikely to meet the prescribed criteria.

2.14.4. Borrow pit material will be used for the construction of bridges, viaducts, shoulders, transversal and longitudinal culverts, channels, gutters, overpasses and underpasses and other structures

2.14.5. The likely borrow pits are outlined below:

BORROW PIT FASHKOVCI – KICHEVO

2.14.6. This proposed borrow pit is located in close proximity to the village of Greshnica, which is located approximately 5 km from the Project alignment. The materials taken from this location will include gravel sands which will be used in the construction of the embankments.

BORROW PIT “BIGOR DOLENCI” – KICHEVO

2.14.7. This proposed borrow pit is located in the vicinity of Kichevo and is located approximately 5 km from the Project alignment. The quarry is run by the company “AD Tajmishte” – Kichevo. Materials sought from this location will include dolomites and dolomitized limestones which will be used as a base course.

ADDITIONAL BORROW PITS

2.14.8. There may be a need for additional borrow pits to provide material for the construction of embankments and for stone and aggregate. If they are required, the Contractor will be required to notify the PESR of the need to request permission for additional borrow pits from the Ministry of Economy in accordance with the Law on Mineral Resources[4]. The PESR will notify the EBRD of the need for additional borrow pits and will outline the measures they will take to ensure that the Contractor takes into consideration EBRD requirements to select appropriate locations for the borrow pits. The PESR is responsible for submitting the request of permission for a concession to use the material to the Ministry of Economy. The PESR is then granted permission for the concession, which they then transfer to the Contractor.

2.14.9. The Contractor will prepare Environmental Protection Elaborates and all the required documentation to apply for the permission for a concession to create new borrow pits and use the material. The Environmental Protection Elaborates will be prepared in line with National Legislation as well as EBRD Performance Requirements and will be reviewed/ signed off by the PIU/ PESR ahead of submission to the Ministry of Economy.

2.14.10. The requirement to assess and mitigate the environmental and social impact of borrow pits will form part of the scope of works for the Contractor, and this information will inform the Environmental Protection Elaborates. The relevant permission will be obtained prior to the commencement of any excavation of materials from new borrow pits.

EXCESS MATERIAL

2.14.11. Excess excavated material generated during the construction activities, will be disposed to designated deposit areas. The volume of tunnel excavation material is expected to be around 2,001,401 tonnes.

2.14.12. Due to the small quantity of excavated material which would eventually be used for construction of the embankments, three locations are proposed for deposit of the excess material from the excavations on the route. The first at the northern end of the Project, the second to the south of the tunnel and the third to the west of Crvica.

2.14.13. The Municipality of Kichevo has granted consent for the locations of these sites. The locations of these spoil disposal sites are shown below (in orange):

[4] Law on Minerals ("Official Gazette of RM no. 136/2012") – article 40a award of concession for exploitation of mineral raw materials for construction of state roads, Law on Environment ("Official Gazette of RM no. 53/2005, 81/2005, 24/2007, 159/08, 83/09, 48/10, 124/10)

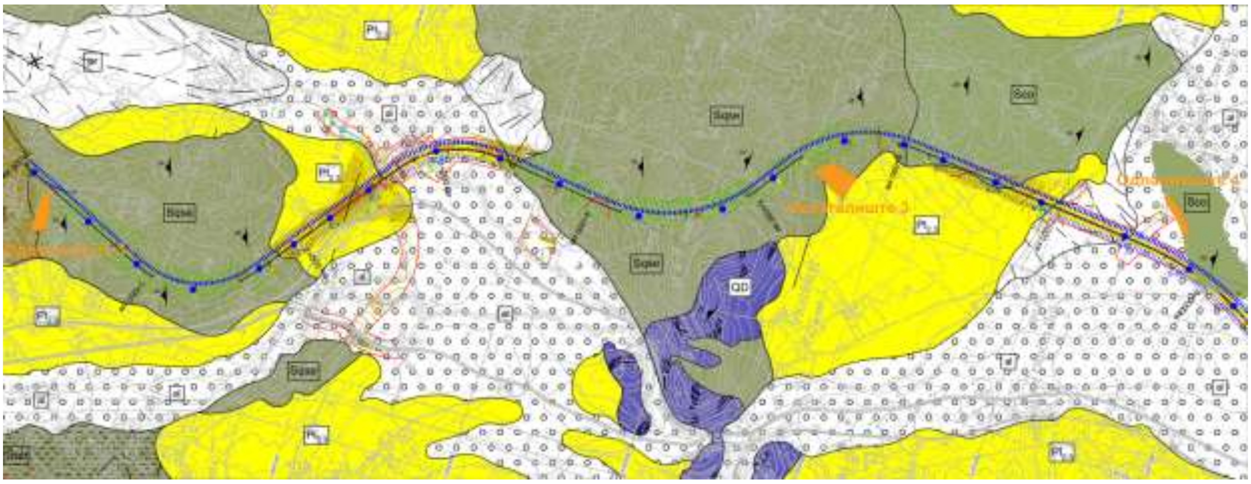


Figure 2-4 - Spoil disposal locations (shown in orange)

2.15 QUARRYING, DRILLING AND BLASTING

2.15.1. The following methods are likely to be used for drilling and mining:

- Line blasting method[5] or;
- Presplitting blasting method[6];

2.15.2. These methods are recommended in order to achieve smooth, stabile and uncracked final slopes.

2.15.3. A Design for Drilling-Blasting Works was not available at the time of writing. It has only been possible to provide recommendations regarding the blasting process, as follows:

- The drilling-blasting works will be performed in accordance with the relevant laws and regulations in the area of mining and construction, particularly in accordance with the Law on Explosive Substances ("Official Gazette of SRM" no. 4/78), the Rulebook for Technical Norms while handling Explosive Substances and Blasting in the area of Mining ("Official Gazette of SFRJ" no.26/88);
- Execution of the blasting process will occur during precisely defined weather conditions, and in accordance with a previously defined schedule and plan, communicate to the local community, thus decreasing the negative environment and social impacts;
- The spatial extent of the blasting danger zones will be calculated, taking into consideration: the spread of material, spreading of vibration that is dangerous for people, spread of vibration that is dangerous for structures, and the risk of seismic impacts due to the blasting.

[5] Blasting using drilled holes to remove sections of a rock face.
[6] Using cracks created by blasting prior to drilling the holes for further blasting.

2.16 NOISE BARRIERS

2.16.1. Noise barriers will be constructed as part of the Project to mitigate against increases in noise as a result of vehicles using the new infrastructure. Further information on the noise barriers is provided in Chapter 14 – Noise and Vibration. A summary of the new barriers is included in Table 2-9.

Table 2-9 - Location and Specification of Noise Barriers

Location		Side	Length (m)	Height (m)
From	To			
Ch 02+640	Ch 02+780	West	140	2
Ch 02+800	Ch 03+020	East	220	3
Ch 11+331	Ch 11+471	East	140	4.5
Ch 11+471	Ch 11+529	East	58	2
Ch 11+701	Ch 11+885	West	184	3
Ch 11+723	Ch 11+912	East	189	2
Ch 12+020	Ch 12+051	East	31	2
Ch 12+343	Ch 12+528	East	185	2

2.17 CONSIDERATION OF NATURAL HAZARDS IN THE DESIGN

2.17.1. As per the EIA Directive requirements, the project has taken into account the risks of natural hazards. The three key risks associated with the Project include: seismicity, landslides and intense rainfall events (including flooding). As outlined in Chapter 23: Environmental and Social Management Plan, an Emergency Response Plan, including a Natural Disaster Response will be implemented during construction activities and an Emergency Preparedness and Response Plans (EPRP), including a Tunnel Emergency Response Plan will be implemented during operation.

SEISMICITY

2.17.2. The territory of Macedonia, situated in the Mediterranean seismic belt, and is an area of high seismicity. The local seismic activity is as a result of local geological structures including the Graben of Kicheco and Syncline of Bukojchani. The seismic intensity of the region is level 7 on the Mercali, Cancani and Zieberg scale.

2.17.3. The Project is designed to accord to Eurocode 8 - Design of structures for earthquake resistance. This Eurocode is a European standard relating to the design and construction of structures in seismic zones. It includes measures for buildings, bridges, retaining structures, towers and pipelines

2.17.4. Further information on seismicity can be found in Chapter 12 – Geology and Soils.

LANDSLIDES AND EROSION

2.17.5. Geotechnical survey information has been used to design measures to prevent landslides and reduce erosion. The following measures have been designed into the Project:

- Store-Norfors Anchors[7] and shotcrete (sprayed concrete)
- Anchored netting
- Composite geogrid
- Vegetating embankments (bio-protection).

FLOODING

2.17.6. The bridge and culvert structures have been designed to allow for the 1 in 100-year flood event. The drainage system has been designed for the 1 in 10-year event in 10 minutes (allowing for 210l/s/ha).

2.18 CONSTRUCTION CAMPS

2.18.1. The location of Construction Camps has not been finalised, but it is expected that there will be two camps, one located in the vicinity of Kichevo, at the southern end of the Project and one in the vicinity of Zajas at the northern end of the Project. The Contractor will be responsible for the final locations, but there will be a set of restrictions to location. The camp will not be located in the following:

- Protected ecological area or areas of high quality habitat
- Areas that are subject to flooding
- In close proximity to residential areas including houses, schools and cultural areas (mosques and churches)

2.18.2. The Contractor will be responsible for gaining all necessary permits and licenses. The local community will be consulted on the final location of the construction camp. The Contractor will be responsible for returning the compound site to its pre-construction condition. The Contractor will implement a Construction Workers' Accommodation Management Plan which will set out rules and limits for the construction camp. All employees will also be required to sign the Code of Conduct.

[7] Mortar embedded concrete reinforced steel anchors

3 ESIA LEGISLATION AND REQUIREMENTS

3.1.1. This ESIA has been prepared in accordance with national Environmental Impact Assessment (EIA) procedures and environmental standards, (see Section 3.2) EU environmental standards (see Section 3.2) and in accordance with the Performance Requirements of the European Bank for Reconstruction and Development (EBRD) (see Section 3.6).

3.2 MACEDONIAN EIA PROCEDURES

3.2.1. According to national legislation on environmental protection, the potential impacts of the Project on the environment must be assessed through an EIA procedure as outlined in Chapter XI Assessment of the impact of certain projects on the environment (Articles 76 to 94 from the law) and regulations in the field of EIA.

3.2.2. According to the Decree on defining projects and criteria for conducting EIA (Official Gazette of Republic of Macedonia no: 74/05 and corresponding amendments), the project falls within Annex 1 - Projects which require mandatory EIA (Point 7 (b) motorways).

3.2.3. Macedonian national EIA legislation is in accordance with the EIA Directive (85/337/EEC and its amendments). These regulations determine the type and size of projects that are subject to EIA. In accordance with the Law on environment (Official Gazette of Republic of Macedonia (OG of RM) no.53/2005, 81/2005, 24/2007, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 31/15, 44/15, 129/15, 192/15 and 39/16), the investor (PESR) has previously prepared and submitted a notice of intent for implementation of the project, as well as a request for determination of the scope of the ESIA. Following this request, the state administration for environmental affairs then advised on the scope of the ESIA, and this scoping opinion has informed the scope of this ESIA.

3.2.4. This ESIA will be sent to the Ministry of Environment and Physical Planning (MOEPP), who will decide whether to approve or reject the application for implementation of the project, taking into consideration: this ESIA, their compliance report, the public hearing and public feedback. This decision will be made after a period of 40 days from the date of submission of the ESIA (Environmental Law, Article 87).

3.2.5. The ESIA has been undertaken in alignment with the following regulations:

- Decree on defining the projects and the criteria on which the need for conducting EIA is determined (“OG of RM” no.74/05 and 109/09);
- Rulebook on the content of the announcement of the notice of intent for project implementation, the decision on the need for assessment of the environmental impact of the project, the EIA for the project, the EIA compliance report, and the decision which provides approval or rejection of the project implementation, as well as the method of public consultation (Official Gazette of RM” no.33/06);
- Rulebook on the type and costs of conducting the EIA, which are compensated for by the Investor (OG of RM no.116/09);

3.2.6. The MOEPP is responsible for the preparation of a compliance report, which states whether the EIA has been done in accordance with the Law on Environment, (Environmental Law, Article 86). The MOEPP has 60 days from the date of submission of the EIA to prepare the compliance report. The MOEPP is also responsible for organising a public hearing in relation to the EIA (Article 91 of the

Law on Environment). The public hearing is held during the 60 days period between the submission of the EIA and the issue of the compliance report.

LETTER OF INTENT TO IMPLEMENT THE PROJECT

3.2.7. The PESR submitted a letter of their intent to implement the project to the state administration in charge of environmental affairs on May 02, 2018. The state administration then issued a Decision that confirmed the need for an EIA for the project – "Construction of a state road A2, section Bukojchani - Kichevo (variant with a tunnel)". The Decision is provided in Appendix 3.1.

3.3 SCOPE OF THE ESIA

3.3.1. The MOEPP advised that this ESIA should contain the following information:

- The alternatives to be considered;
- The desk-based research required;
- The methods and criteria used for the assessment of the likely significant effects;
- The improvement measures to be considered, legal entities to be consulted during the preparation of the ESIA; and
- The structure, content and volume of environmental information.

3.3.2. The Ministry's opinion on the scope of the ESIA is enclosed with Appendix 3.1 of this study.

ENVIRONMENTAL CONSENTS AND PERMITTING

3.3.3. The MOEPP is also responsible for issuing various consents, approvals and permits at different stages of the Project planning process, as follows:

- Issuing the Environmental Consent (Issuing of a Decision for approval of the EIA / ESIA), in accordance with the Law on Environment;
- Issuing the water management consent, prior to issuing of construction permit in accordance with the Law on waters;
- Issuing the Integrated Pollution Prevention and Control (IPPC) permit, or elaborate for environmental protection, required by the Law on Environment, and Decrees for IPPC/ Elaborate for environmental protection, for newly opened quarries, borrow pits, open pit mining's, installation of asphalt and concrete plant;

3.3.4. The following approvals and permits are under the jurisdiction of the Ministry of Transports and Communications:

- Approval of the Infrastructure Design in accordance with the Law on construction and the Law on Spatial Planning;
- Issuing the Construction Permit in accordance with the Law on construction;
- The issuing of concessions for exploitation of mineral resources in accordance with the Law on Mineral Resources is undertaken by the Ministry of Economy;
- The Project includes the disposal sites for surplus material / spoil with the design. The intention is to obtain all necessary permits for their location, where possible, with prior discussion/ approval by the local municipality, in accordance with the Law on waste management.
- An overview of relevant laws governing the permitting process is provided in Table 3-1.

3.3.5. The Contractor will be responsible for obtaining all required licences, permits and agreements as per Chapter 23 – Environmental and Social Management Plan (C3).

Table 3-1 - Laws Governing the Permitting Process

Law	No.	Relevance for this ESIA
Law on environment	No. 53/2005 and its amendments	*Article 86* – Preparation of the EIA compliance report, before issuing the Decision for EIA approval *Article 87* – MOEPP Decision for consent or refusal of the request for the implementation of the project. This Decision ceases to be valid if construction work does not start within a period of 2 years from the date of issue. The duration of the Decision can be extended, but only if that two years period, there are no significant changes in: the conditions in the affected area, new knowledge related to the basic content of the study and the development of new technology that could be used in the project.
Law on Urban and Spatial Planning	No 199/2014 and its amendments	*Article 52* – Stipulates that the Infrastructural Design must be developed in alignment with: the relevant spatial planning, urban plans or urban planning documentation. The Design must contain a technical solution for the infrastructure, with all its elements (shafts, wells, measuring stations, retaining walls, bridges, viaducts, overpasses, underpasses, tunnels, interchanges, etc.)
Law on construction	No. 25/2013 and its amendments (updating: 30/09, 124/10, 18/11, 36/11, 54/11, 13/12, 144/12)	*Article 45a* which stipulates preparation of Infrastructural Design for linear infrastructural installations and preparation of an EIA. Line infrastructural installations, such as - railways, public roads (i.e. highways/ motorways), gas pipelines, oil pipelines, water supply and sewage systems, telecommunications, etc., are first category constructions – *Article 57-16* First category constructions are those that are of significance for the Republic of North Macedonia. The construction permit is issued by the state administration body responsible for the execution of the works – i.e. the Ministry of transport and communications – *Article 58* The construction permit ceases to be valid if the Contractor does not start construction within two years from the date on which the construction permit became legally valid – *Article 66*

Law	No.	Relevance for this ESIA
Law on waters	No. 87/2008 and its amendments	Water management consent is required for: - Bridge construction; and - other objects that influence the water regime. This consent is issued by MOEPP in accordance with *Article 174-176*
Law on environment and Decrees for IPPC/ Elaborate for environmental protection	No. 53/2005 and its amendments	An IPPC permit, or Elaborate for environmental protection, is required to open any new open pit mines, quarries, or borrow pits and for the installation of any asphalt and concrete plants that are required for construction.
Law on mineral resources	No.136/2012 and its amendments	The Employer/Contractor needs to request a concession permit for obtaining material (if it requires construction material from new borrow pits) from the competent institutions in accordance with the requirements of *Article 40a*
Law on waste management	No. 68/2004 and its amendments	Locations for waste dumps should be approved by the municipality of Kichevo. Management of generated waste, especially hazardous waste[8] is regulated in such a way that only authorised companies can be involved in the collection, storage and export. Any temporary storage of hazardous waste generated during the construction of the Project shall be at locations that have obtained a permit by the municipality for this purpose.

3.4 RELEVANT NATIONAL LEGISLATION

3.4.1. Detail on the National legislation relevant to this ESIA is included in Appendix 3.2. A brief outline of the legislation is outlined below.

- **Law on Environment** (OG of RM no. 53/05 and its amendments). This law regulates protection of environmental elements (soil, water and air), environmental areas (waste, noise, vibrations, etc.), protection of biodiversity, etc. Preparation of an EIA is outlined in Chapter XI – EIA of projects. Public involvement into the EIA procedure and access to information is also regulated by this law. Public involvement must be carried out by:

[8] Hazardous waste can include: asbestos roofing materials generated upon demolition of existing buildings, waste oil, oil-contaminated filters, contaminated soil with leaked oil, etc.

- Disclosing information about the project and EIA process to the public;
- Public participation where the public is actively be involved in public discussions and can submit their written opinion within the different phases of the EIA procedures; and
- Through the mechanism of access to justice, when the public can influence the decision making by submitting appeals to the Court or the Second Instance Commission of the Government.

- **Law on Ambient Air Quality** (OG of RM no. 67/04 and its amendments). This law regulates the measures for avoidance, prevention or reducing the harmful effects of ambient air pollution and its impact on human health, as well as the environment.
- **Law on Waters** (OG of RM no. 87/08 and its amendments). This law regulates the issues that relate to surface waters, including permanent watercourses or watercourses in which water flows occasionally.
- **Law on Nature Protection** (OG of RM no. 67/06 and its amendments). This law regulates the protection of nature through protection of the biological and landscape diversity and protection of the natural heritage, in protected areas and outside protected areas, as well as the protection of natural rarities.
- **Law on Waste** (OG of RM no. 68/04 and its amendments). This law regulates waste management, principles and objectives for waste management, plans and management programs, rights and obligations of legal and physical entities in connection with waste management.
- **Law on Noise Protection** (OG of RM no. 79/07 and its amendments). This law regulates environmental noise management and **protection** against environmental noise.

NATIONAL SOCIAL LEGISLATION

Health and Safety

3.4.2. Health and Safety Laws that are of Particular Interest Relating to this Project are:

- **Law on Social Protection** (OG of RM no. 79/09, 148/13,164/13, 187/13, 38/14, 44/14, 116/14, 180/14, 33/15, 72/15, 104/15, 150/15, 173/15, 192/18, 30/16, 163/17, 51/18).
- **Law for Health Protection** (OG of RM no. 43/12, 145/12, 87/13, 164/13, 39/14, 43/14, 132/14, 188/14, 10/15, 61/15, 154/15, 132/15, 154/15, 192/15, 37/16).
- **Law on Public Health** (OG of RM no. 22/10, 136/11, 144/14, 149/15, 37/16).:
- Labour Law of Republic of Macedonia (OG of RM no. 62/05; 106/08; 161/08; 114/09; 130/09; 149/09; 50/10; 52/10; 124/10; 47/2011; 11/12; 39/12; 13/13; 25/2013; 170/2013; 187/13; 113/14; 20/15; 33/15; 72/15; 129/15, 27/16),
- **Law on Pensions and Disability Insurance** (OG of RM no. 53/13, 170/13, 43/14, 44/14, 97/14, 113/14, 160/14, 188/14, 20/15, 61/15, 97/15, 129/15, 147/15, 154/15, 173/15, 217/15, 27/16, 120/16, 132/16)
- **The Law on Safety at Work** (OG of RM no. No. 92/07, 30/16) is the key law that defines measures and obligations in the field of OHS (Occupational Health and Safety)

Other Labour and Workforce Related Laws are:

- Law on employment and insurance against unemployment
- Law on labour inspection;
- Law on records in the field of labour;
- Law on employment of disabled persons;
- Law on holidays in the Republic of North Macedonia;

- Law on temporary employment agencies;
- Law on volunteering;
- Law on peaceful settlement of labour disputes
- Law on employment and work of foreigners;
- Law on minimum wage;
- Law on protection from harassment in the workplace
- Law on Equal Opportunities for Women and Men

Other Relevant By-Laws are:

- Rulebook on Preparation of the Health and Safety Statement - defines mandatory health and safety statements for each workplace and engagement of an authorised Health and Safety officer;
- Rulebook on minimum requirements for safety and health of employees at work (OG of RM No. 154/08) - defines the obligations of employers;
- Rulebook on Personal Protective Equipment used by workers at work (OG of RM No. 116/07) - defines mandatory provision of Personal Protection Equipment for workers;
- Rulebook for Safety and Health at Work on equipment for work (OG of RM No.116 / 07) - defines that adequate and safe work equipment must be available to workers, employers must take measures to minimize risks;
- Rulebook on safety and health at work of employees at risk of noise (OG of RM No. 21/08) - defines mandatory measurement of noise levels at workplaces.
- Regulation on Use of Work Equipment - defines mandatory periodical testing of work equipment.
- Regulation on Minimum OHS Requirements in Temporary Mobile Sites - defines the obligation of contractors to develop an OHS Plan.
- Regulation on Form and Content of Report on Start of Work Activities - defines that contractor is required to notify the State Labour Inspectorate about the construction site,
- Regulation on OHS Signs - defines mandatory health and safety signs for any hazardous work activities and providing suitable instructions to workers.

LAND ACQUISITION / EXPROPRIATION

3.4.3. Macedonian legislation deals with involuntary resettlement and livelihood restoration under its legal framework for expropriation, with the basic notion that owners of properties are to be compensated for their losses, most often in monetary terms.

3.4.4. In the Republic of North Macedonia, the legislative acts given below regulate the issues of obtaining State ownership rights to privately owned land parcels based on the necessary public needs caused due to strictly defined development projects of public interests:

- **Expropriation Law** (OG of RM No. 95/12, 131/12, 24/13, 27/14, 104/15, 192/15, 23/16, 178/16) regulates the procedure for the expropriation of property for projects that are of public interest and the connected rights for real estates (immovable properties).
- **Law on ownership and other real rights** (OG of RM No. 18/01, 92/08, 139/09, 35/10) regulates the rights and obligations of the owners of the property. The right to ownership can be acquired by all domestic and foreign natural persons and legal entities, including the state and the units of the local self-government, under conditions and in a manner stipulated by this and other laws.
- **Law on Housing** (OG of RM no. 99/09, 57/10, 36/11, 54/11, 13/12, 55/13, 163/13, 42/14, 199/14, 146/15, 31/16). The key point from social perspective relevant to this project in the Law on Housing is that it envisages the possibility for renting state-owned apartments to socially

endangered and homeless persons in accordance with the Law on Social Protection. This Law deals, among other things, with the issue of social housing and the housing of the vulnerable groups (children without parents or without parental care, users of social and permanent financial assistance, persons affected by natural disasters, disabled persons and persons who need assistance and care by other persons, the socially endangered persons belonging to the Roma community, lone parents with minor children).

CULTURAL HERITAGE

3.4.5. The key Cultural Heritage legislation in the Republic of North Macedonia is as follow:

- **Law on Protection of Cultural Heritage** (OG of RM no. 20/04, 71/04, 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 104/15, 154/15, 192/15, 39/16) specifies the types, categories, identification, manners of settling under protection and other instruments of the cultural heritage protection, the regime of protection and use of cultural heritage, rights and obligations of holders and limitations of the property right on the cultural heritage of public interest, the organization, co-ordination and supervision, professional titles and other issues significant for the unity and the functioning of the cultural heritage protection system in the Republic of North Macedonia.
- **Law on Memorials and Monuments** (OG of RM no. 66/04, 89/08, 152/15) regulates the issues related to the marking of important events and distinguished persons with memorial monuments and memorial signs, the conditions and procedure for raising memorial monuments and memorial symbols, the entities responsible for their installation, protection, keeping, the register of their records, as well as the supervision and control over the implementation of the provisions of this law.
- **Law on Museums** (OG of RM no. 66/04, 89/08, 116/10, 51/11, 88/15, 152/15, 39/16)
- Rulebook on National Registry of Cultural Heritage (OG of RM no. 25/05)
- The Republic of North Macedonia ratified the (UNESCO) Convention for the protection of the World Cultural and Natural Heritage in 1991. Law on Culture (OG of RM no. 31/98, 49/2003, 82/2005, 24/2007, 116/10, 47/11, 51/11, 136/12, 23/13, 187/13, 44/14, 61/15, 154/15, 39/16)

3.5 EU DIRECTIVES

3.5.1. A list of the EU directives relevant to the ESIA are as follows:

- Directive 2014/52/EU[9] amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (EIA Directive);
- Directive 2008/50/EC[10] on ambient air quality and cleaner air for Europe;
    - Directive 2008/105/EC[11] on environmental quality standards in the field of water policy (amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC);
    - Directive 2008/98/EC[12] on waste (Waste Framework Directive)

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[9] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0052
[10] http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32008L0050
[11] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:0097:en:PDF
[12] http://ec.europa.eu/environment/waste/framework/

- Directive 2006/11/EC[13] on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community;
- Directive 2006/118/EC[14] on the protection of groundwater against pollution and deterioration;
- Directive 2012/18/EU[15] on the control of major-accident hazards involving dangerous substances (amending and subsequently repealing Council Directive 96/82/EC);
- Directive 2002/49/EC[16] relating to the assessment and management of environmental noise;
- Directive 92/43/EEC[17] on the conservation of natural habitats and of wild fauna and flora (Habitats Directive);
- Directive 2009/147/EC[18] on the conservation of wild birds
- Directive 2008/96/EC[19] on road infrastructure safety management
- Directive 89/391/EEC[20] on Occupational Health and Safety.

3.6 INTERNATIONAL TREATIES AND CONVENTIONS

3.6.1. The Republic of North Macedonia has ratified a number of international treaties and conventions along with the ongoing process of transposing European Union (EU) law into the National legal and policy framework. The following international conventions ratified by the Republic of North Macedonia were taken into account during the preparation of the ESIA:

- UNECE Convention on Access to Information, Public Participation in Decision - making and Access to Justice in Environmental Matters. Adopted on the 25th of June 1998 (Aarhus Convention);
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention, February 1991);
- Convention on Biological Diversity (Official Gazette No. 54/97);
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Official Gazette No. 38/99);
- Convention on the Conservation of European Wildlife and Natural Habitats, Bern, 1972 (Official Gazette No. 49/97);
- Fungal species proposed for protection by the European Council for Conservation of Fungi (33 European fungal species candidates for listing in Appendix I of the Bern Convention, August 2003);
- International Covenant on Economics, Social and Cultural Rights (New York, 16 December 1966). Ratified by Macedonia on 18 January 1994;
- United Nations Framework Convention on Climate Change (New York, 9 May 1992). Ratified by Macedonia on 28 January 1998 (entrance into force on 28 April 1998);

[13] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0052:0059:EN:PDF
[14] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0019:0031:EN:PDF
[15] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0018
[16] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32002L0049
[17] http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A31992L0043
[18] http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32009L0147
[19] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008L0096
[20] https://osha.europa.eu/en/legislation/directives/the-osh-framework-directive/1

- Kyoto Protocol on Climate Change (Kyoto, December 1997). Ratified by Macedonia on 18 November 2004 (entrance into force on 16 February 2005);
- UNESCO World Heritage Convention (November 1972). Notification of succession by Macedonian government on 30/04/1997;

3.6.2. The Republic of North Macedonia has ratified seventy nine International Labour Organisation (ILO) Conventions, of which seventy seven are in force. One convention has been denounced and none have been ratified in the past 12 months.

3.6.3. The following documents define worker's health and safety, as a basic human right, and set out the development of workers' rights:

- National Strategy for Employment in the Republic of Macedonia (2016-2020), the Ministry for Labour and Social Policy, followed by Action Plan for Employment 2018-2020 and Action plan for employment of young people in Republic of Macedonia 2016-2020; and
- The Occupational Health and Safety Strategy 2020 (OHS Strategy 2020) in Republic of Macedonia and the Action plan that accompanies it.

3.7 EBRD PROJECT CATEGORISATION

3.7.1. The EBRD Environmental and Social Policy (ESP) (2014)[21] categorises projects as A, B, C or FI to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. The categorisation corresponds to the nature, location, sensitivity, scale and likely significance of adverse effects of the project.

3.7.2. The EBRD has assigned the Project a Category A status, as described in ESP Appendix 2: 6:

"*construction of highways, express roads and lines for long-distance railway traffic; airports with a basic runway length of 2,100 metres or more; new roads of four or more lanes, or realignment and/or widening of existing roads to provide four or more lanes, where such new roads, or realigned and/or widened sections of road would be 10 km or more in a continuous length "*.

3.7.3. The Project is categorised as a Category A project as it could result in potentially significant adverse future environmental and/or social impacts which, at the time of categorisation, cannot readily be identified or assessed. It therefore, requires a formalised and participatory ESIA in accordance with the Performance Requirements established under the EBRD ESP (2014).

3.7.4. The ESIA process includes a public disclosure and consultation process of 120 days as specified in PR 10. – Information Disclosure and Stakeholder Engagement.

3.7.5. The Project falls within Annex II of the EIA Directive. It is considered as the following:

- 10. Infrastructure Project
  - e) Construction of roads, harbours and ports installations, including fishing harbours (projects not included in Annex I).

[21] https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html

3.8 EBRD PROJECT REQUIREMENTS

3.8.1. The Project has been structured to comply with EBRD requirements, including core environmental and social safeguarding measures that reflect international good practice. It requires all its projects to:

- Comply with EU environmental principles, standards and practices, if practical and feasible in some regions;
- Comply with the relevant EU Directives, as identified in section 2.5;
- Comply with international conventions and agreements ratified by the EU;
- Comply with the EU social regulations;
- Apply “best available techniques”, as appropriate;
- Apply good environmental management practices during project implementation and operation; and
- Adhere to other specific international good environmental and social practices.

3.8.2. Where Macedonian regulations differ from EU substantive environmental standards, the Project will be expected to meet whichever is the more stringent.

3.8.3. Environmental and social sustainability according to the EBRD requirements is a condition for projects to receive support from the Bank. Environmental and social assessment is therefore an integral part of the Bank’s appraisal and monitoring process.

3.8.4. To help clients and/or their projects achieve to environmental and social sustainability, the EBRD has defined specific PRs for key areas of environmental and social sustainability as listed below:

- PR 1 - Assessment and Management of Environmental and Social Impacts and Issues;
- PR 2 - Labour and Working Conditions;
- PR 3 - Resource Efficiency, Pollution Prevention and Control;
- PR 4 - Health and Safety;
- PR 5 - Land Acquisition, Involuntary Resettlement and Economic Displacement;
- PR 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PR 7 - Indigenous Peoples;
- PR 8 - Cultural Heritage;
- PR 9 - Financial Intermediaries; and
- PR 10 - Information Disclosure and Stakeholder Engagement.

3.8.5. Each PR defines, in its objectives, the desired outcomes, followed by specific requirements for projects to help clients achieve these outcomes. Compliance with relevant national law is an integral part of all PRs. The planned Project should meet the minimum requirements of the following PRs (Table 3-2):

Table 3-2 - Summary of the Relevant EBRD Performance Requirements from this ESIA, objectives and aspects

Performance Requirement	Objectives	Relevant chapter of this ESIA
PR1 - Assessment and Management of Environmental and Social Impacts and Issues	▪ Identify and evaluate environmental and social impacts and issues of the project; ▪ Adopt a mitigation hierarchy approach to address adverse environmental or social impacts and issues to workers, affected communities, and the environment from project activities; ▪ Promote improved environmental and social performance of clients through the effective use of management systems; and ▪ Develop an ESMS tailored to the nature of the project, for assessing and managing environmental and social issues.	**Entire ESIA** **Chapter 23: Environmental and Social Management Plan**
PR2 - Labour and Working Conditions	▪ Respect and protect the fundamental principles and rights of workers; ▪ Promote the decent work agenda, including fair treatment, non-discrimination and equal opportunities of workers; ▪ Establish, maintain and improve a sound worker-management relationship; ▪ Promote compliance with any collective agreements to which the client is a party, national labour and employment laws; ▪ Protect and promote the safety and health of workers, especially by promoting safe and healthy working conditions; and ▪ prevent the use of forced labour and child labour (as defined by the ILO) as it relates to project activities.	**Chapter 19 – Occupational Health, Safety and Security**
PR3 - Resource Efficiency, Pollution Prevention and Control	▪ Identify project-related opportunities for energy, water and resource efficiency improvements and waste minimisation; ▪ Adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the project; and	**Chapter 8 – Air Quality** **Chapter 9 – Climate** **Chapter 10 – Groundwater**

Performance Requirement	Objectives	Relevant chapter of this ESIA
	▪ Promote the reduction of project-related greenhouse gas emissions.	**Chapter 11 – Surface Water** **Chapter 12 – Geology and Soils** **Chapter 13 – Waste Generation and Resource Efficiency** **Chapter 14 – Noise and Vibration**
PR 4 - Health and Safety	▪ Protect and promote the safety and health of workers by ensuring safe and healthy working conditions and implementing a health and safety management system, appropriate to the relevant issues and risks associated with the project; and ▪ Anticipate, assess, and prevent or minimise adverse impacts on the health and safety of project-affected communities and consumers during the project life cycle from both routine and non-routine circumstances.	**Chapter 17 – Social and** **Community Impacts** **Chapter 18 – Occupational Health, Safety and Security**
PR 5 - Land Acquisition, Involuntary Resettlement and Economic Displacement	▪ Avoid or, when unavoidable, minimise, involuntary resettlement by exploring alternative project designs; ▪ Mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected;	**Chapter 19 – Property and Livelihood**

Performance Requirement	Objectives	Relevant chapter of this ESIA
	▪ Restore or, where possible, improve the livelihoods and standards of living of displaced persons to pre-displacement levels; and ▪ Improve living conditions among physically displaced persons through the provision of adequate housing, including security of tenure at resettlement sites.	
PR 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources	▪ Protect and conserve biodiversity using a precautionary approach; ▪ Adopt the mitigation hierarchy 3 approach, with the aim of achieving no net loss of biodiversity, and where appropriate, a net gain of biodiversity; and ▪ Promote good international practice (GIP) in the sustainable management and use of living natural resources.	**Chapter 15 - Biodiversity**
PR 7 Indigenous Peoples	▪ Not applicable for this project.	**Not Applicable**
PR 8 - Cultural Heritage	▪ Support the protection and conservation of cultural heritage; ▪ Adopt the mitigation hierarchy approach to protecting cultural heritage from adverse impacts arising from the project; ▪ Promote the equitable sharing of benefits from the use of cultural heritage in business activities; and ▪ Promote the awareness and appreciation of cultural heritage where possible	**Chapter 16 – Landscape and Visual Impact** **Chapter 20 – Cultural Heritage**
PR 9 - Financial Intermediaries (FIs)	▪ Not applicable for this project.	**Not Applicable**

Performance Requirement	Objectives	Relevant chapter of this ESIA
PR 10 - Information Disclosure and Stakeholder Engagement	▪ Outline a systematic approach to stakeholder engagement that will help clients build and maintain a constructive relationship with their stakeholders, in particular the directly affected communities; ▪ Promote improved environmental and social performance of clients through effective engagement with the project's stakeholders; ▪ Promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that meaningful environmental and social information is disclosed to the project's stakeholders; and ▪ Ensure that grievances from affected communities and other stakeholders are responded to and managed appropriately.	**Chapter 5 – Environmental and Social Impact Assessment Methodology** **Chapter 23: Environmental and Social Management Plan** **Stakeholder Engagement Plan (separate document to ESIA).**

3.9 THE COMPANY

3.9.1. The Company (the PESR) will be the developer for the Project. The PESR was founded by Government of the Republic of Macedonia in 2013 as legal successor of the Agency for Public Roads for the purpose of planning, construction, reconstruction, rehabilitation, maintenance, protection of public roads, and managing state roads.

3.10 RESPONSIBLE BODIES

3.10.1. A summary of key organisations and their function in relation to the Project, are presented in Table 3-3 below.

Table 3-3 - Summary of Responsible Bodies

Organisation	Project Function	Reporting Line
Public Enterprise for State Roads	Project lead	MoTC / National Government
Ministry of Environment and Physical Planning	Project approvals and consents.	State / National Government
Ministry of Transport and Communications	Project approvals and consents.	State / National Government
Other national institutions and public utility companies or providers (water supply, electricity, etc)	Project approvals and consents.	PESR
Kichevo Municipality	Local Authority	Local Self - Government
Local Village Councillors (and head of Village Council)	Representative of local communities.	Local Self - Government
Balkan Consulting	Designers (Detailed Design)	PESR
GEING	Leading on Preparation of the ESIA and Infrastructure Design	PESR

3.11 PURPOSE OF THIS REPORT

3.11.1. This ESIA has been prepared in line with EU and Macedonian environmental standards that are relevant to the Project. This ESIA has been informed by the following reports included in the submission:

- Stakeholder Engagement Plan (SEP);

- Land Acquisition Framework (LAF);
- Environmental and Social Management Plan (ESMP);
- Environmental and Social Action Plan (ESAP); and
- Performance Requirements (PR) Compliance Assessment Report.

3.11.2. This ESIA presents the findings of the assessment of the following environmental and social topics, including the potential for significant effects and suitable mitigation measures:

- Air Quality (Chapter 8);
- Climate (Chapter 9);
- Groundwater (Chapter 10)
- Surface Water (Chapter 11)
- Geology and Soils (Chapter 12);
- Waste Generation and Resource Efficiency (Chapter 13)
- Noise and Vibration (Chapter 14);
- Biodiversity (Chapter 15);
- Landscape and Visual Impacts (Chapter 16)
- Social and Community Effects (Chapter 17)
- Occupational Health, Safety and Security (Chapter 18);
- Property and Livelihood (Chapter 19)
- Cultural Heritage (Chapter 20);
- Cumulative Effects (Chapter 21).

3.11.3. The ESIA process, the details of the Project as assessed, the alternatives considered, and the summary are outlined in the following chapters:

- Chapter 2 - Description of the Project
  - Presents an overview of the Project, the consideration of natural hazards in the design, and details on construction activities.
- Chapter 3 – ESIA Legislation and Requirements
  - Provides and overview of the legislation and regulations which have been used in the preparation of the ESIA.
- Chapter 4 - Consideration of Alternatives
  - Provides information on alternative road corridors and alignments that were considered.
- Chapter 5 – ESIA Methodology
  - Provides details the ESIA methodology for the environmental assessment.
- Chapter 6 - Stakeholder Engagement
  - Includes general details on the stakeholder engagement that has been undertaken and the further consultation that is required.
- Chapter 7 – Limitations and Assumptions
  - Limitations in the assessment due to lack of information and assumptions that have been made.
- Chapter 22 – Summary of Effects

- Presents a summary of the potential impacts and suitable mitigation measures identified in each assessment.

- Chapter 23 – Environmental and Social Management Plan
  - Presents the mitigation and monitoring requirements outlined in the ESIA.

4 CONSIDERATION OF ALTERNATIVES

4.1 INTRODUCTION

4.1.1. This chapter outlines the main alternatives to the Project that have been considered, together with the principal reasons for proceeding with the Project.

4.2 REQUIREMENT FOR THE CONSIDERATION OF ALTERNATIVES

4.2.1. The EIA Directive states that an EIA should include:

"… a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".

4.2.2. EBRD PR1 states that an ESIA should include:

"… an examination of technically and financially feasible alternatives […], including the non-project alternatives, and document the rationale for selecting the particular course of action proposed".

4.3 ALTERNATIVES

4.3.1. The following alternatives been considered:

- The "do nothing" scenario;
- Alternative Road Corridors;
- Alternative Alignments:
  - Alternative 1 – road alignment prepared by ADG Mavrovo EE Mavrovoproekt;
  - Alternative 2 (variant with tunnel); - The preferred option

4.4 DO-NOTHING SCENARIO

4.4.1. A 'do-nothing' scenario has been considered as an alternative to the Project. The following conditions are likely to remain or occur if the Project does not proceed:

- The condition of the motorway infrastructure in the region will remain poor;
- The strategic plans and goals of the Government and PESR will not be realised;
- There will be no stimulus to the development potential of the area;
- Road safety issues will remain;
- Travel times will increase as traffic volumes increase over time;
- Access to people, goods, services, and employment opportunities will not be improved along the corridor; and
- Economic growth will be constrained, and investment will decline.

4.4.2. If the project is not implemented, the biodiversity and landscape will remain unchanged, there will be no land conversion, no demolition of structures along the road alignment, and it will not be necessary to perform works on the Strogomishka River. However, the air quality and noise impacts along the existing A2 state road alignment will continue to worsen as traffic levels and congestion increases, particularly as other sections of the A2 are improved.

4.4.3. Most notably, the potential benefits of the other A2 improvements, which includes the adjacent Kichevo – Ohrid section, which is currently in construction, would not be realised. The final part of the Kichevo – Ohrid section would be unusable as it would not link to the highway network.

4.4.4. The do-nothing alternative is considered to be unacceptable, mainly due to the Project being an integral part of the wider transport network, which is part of the existing Pan-European corridor VIII (A2 state road).

4.5 ALTERNATIVE ROAD CORRIDOR

4.5.1. In 2015 a Strategic Environmental Assessment (SEA) was prepared for the project corridor. The SEA considers the extent to which the Project aligned with the existing spatial and/or economic strategies/plans for the region.

4.5.2. The SEA confirmed that the construction of the Project:

- is in compliance with the National Transportation Strategy (which specifies the construction, maintenance, tolling and operation of new state roads in North Macedonia);
- is in compliance with the transportation aims of the Spatial Plan of the Republic of North Macedonia, which states that the construction of new roads will minimise the environmental impacts of the current road infrastructure and will maximise the economic benefit to the rural areas of the country;
- might influence the strategy of the Polog Region which aims for better road connections for all rural settlements;
- is in compliance with the economic development goals of the Southwestern Region, through the reduction of the travel time to the tourist hot spots in the Ohrid and Prespa region;
- will not impact the municipal infrastructure activities of the Southwestern Region, which include the development of additional water supplies and wastewater treatment systems.

4.5.3. The SEA for the Project included a high level analysis of three alternatives of the scheme. These are named as Eastern corridor, Central corridor and Western corridor.

4.5.4. The Western corridor was not selected because it required multiple river crossings, including many bridge and viaduct structures, which made it unfeasible from a technical and construction point of view.

4.5.5. The Eastern corridor was not chosen due to its close proximity to multiple villages.

4.5.6. The Central corridor was considered the most appropriate, based on the technical features of the road, greater distance from settlements, and better construction feasibility. Following the selection of the Central Corridor, a tunnel variant option was considered during the design evolution, and this option was developed further and is now the selected design (the Project).

4.6 ALTERNATIVE ALIGNMENTS

4.6.1. Two alternative road alignments were considered during the preparation of the Project. The alternative road alignments were prepared by the Designers through consultation with the relevant public bodies and institutions including (but not limited) to:

- Public Enterprise for State Roads (2018 and 2019)
- The Municipality of Kichevo (2018 and 2019)
- National Conservatory Center-Skopje (2018)

- Ministry of Agriculture, Forestry and Water Economy (2018)
- Macedonian Railways Infrastructure (2018)
- Cultural Heritage Protection Office (2018)
- Directorate for Protection and Rescue (2018)
- Ministry of Defence - Real Estate and Services Sector (2018)
- Agency for Electronic Communications of Macedonia (2018)
- MEPSO (state-owned electricity company) (2018)

4.6.2. The preferred road alignment was selected by the PESR following a period of detailed analysis, as summarised in Section 4.9.

4.6.3. Following the detailed analysis, Alternative 2 was selected as the chosen road alignment (the Project).

4.6.4. The two alternative road alignments are shown in Figure 4-1. Alternative 1 is marked in grey, Alternative 2 is marked in magenta, while the existing national – Kichevo – Ohrid highway is marked in red and the existing railway station in black.

- Alternative 1: 0.000 to 29.989 km chainage at Bukojchani to 11.995 km from the next section (Kichevo - Preseka).
- Alternative 2: 0.000 to 29.987 km from the previous section (Gorna Gjonovica - Bukojchani) and 12.73 to 0.000 from the next section (Gostivar - Kichevo).

4.6.5. Public consultation on the chosen alternative is undertaken as part of the national ESIA process. The public consultation process is expected to commence in Summer / Autumn 2020. The public consultation will be used to inform the Ministry of Environment and Physical Planning's decision on the Project.

4.6.6. Alternative 1 – Road alignment prepared by ADG Mavrovo EE Mavrovoproekt (grey in Figure 4-1)

4.6.7. This road alignment on the Bukojchani – Kichevo section lies parallel to the western side of the Gostivar – Kichevo railway. The alignment crosses to the east side of the railway via a viaduct, which is 192 m in height. This viaduct also bridges the Zajaska River. The road would pass through a mixture of hilly and more level terrain. The alignment is crisscrossed by many ravines and gullies of different depth and width. This option was not selected based on the considerations set out in Section 4.10.

4.7 ALTERNATIVE 2 (THE PROJECT)

4.7.1. The details of the selected alignment (the Project) are explained in detail in Chapter 2 – Description of the Project.

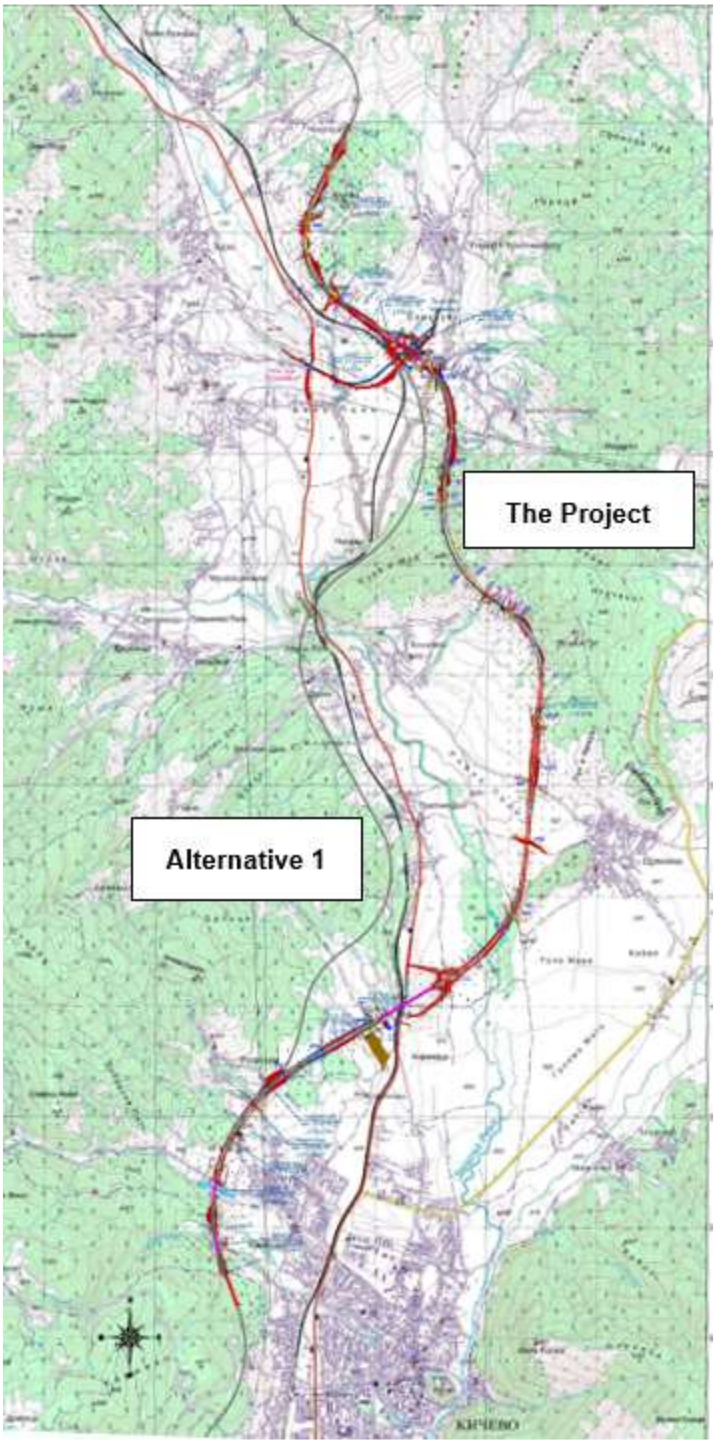

Figure 4-1 - Alternative Alignment

4.8 TECHNICAL COMPARISON

4.8.1. The technical aspects of the two alternatives are set out in Table 4-1 and further considerations for the selection of the preferred alternative are set out in Section 4.10.

Table 4-1 - Comparison between the technical parameters of Alternative 1 and Alternative 2

Technical parameters	Alternative 1	Alternative 2
Length of the alignment	11.99 km	12.73 km
Design speed	100 km/h	100 km/h
List of structures	4 bridges - 6 viaducts; 2 overpasses; 9 underpasses; 47 culverts.	3 bridges: - 3 viaducts; 1 overpass; 11 underpasses; 2 overpasses; 51 culverts; Tunnel, L= 532m 2 interchanges (interchange Strogomishta and interchange Kichevo)

4.9 CONSIDERATION OF THE TWO ALTERNATIVE ALIGNMENTS

4.9.1. The alignment for the Project was selected following the consideration of the two alternative alignments. The following section outlines the key environmental impacts associated with the alternatives.

4.9.2. The impacts of the two options are comparable for air quality as the operational traffic volumes are likely to be similar. The impacts on geology and soil are likely to be comparable as the amount of soil impacted is likely to be similar and the underlying geology is likely to be largely the same. The landscape and visual impacts of both alignments will be similar as both alignments will create a notable feature on the landscape. As Alternative 1 does not include a tunnel, it will result in a greater level of vegetation removal and therefore will have a greater landscape character impact. Due to the topography along Alternative 1, there is a greater risk of erosion and landslides associated with it.

4.9.3. The effects of Alternative 1 are expected to be greater with regard to water quality as there are more river crossings associated with it. Impacts on biodiversity are also likely be greater as there is a larger amount of habitat loss. The social and waste impacts are likely to be more significant due to the larger number of buildings that are likely to be demolished. Alternative 1 runs in closer proximity to the school at Zajas so the noise impacts on this receptor are likely to be greater. Alternative 2 includes landscaped tunnel spoil sites which will mean that issues with spoil are addressed by the design of the Project itself.

4.9.4. The effects of Alternative 2 (the Project) are expected to be greater with regard to climate due to the greater length of the design and consequent larger volume of material required.

4.10 SUMMARY OF ALTERNATIVE ALIGNMENT ASSESSMENT

4.10.1. The two alternative alignments have been compared from a technical, economic, environmental and social point of view, as summarised in the following table as part of development of this ESIA:

Table 4-2 - Comparison of Alternatives

Criteria	Alternative 1	Alternative 2
Technical parameters	-	+
Economic viability	*	*
Safety	0	0
Operating costs	-	+
Traffic	-	+
Air Quality	0	0
Climate (Greenhouse Gases)	+	-
Groundwater	0	0
Surface water	-	+
Geology and Soils - Contamination	0	0
Geology and Soils – Erosion and Landslides	-	+
Waste Generation and Resource Efficiency	-	+
Noise and Vibration	-	+
Biodiversity	-	+

Criteria	**Alternative 1**	**Alternative 2**
Landscape and Visual	-	+
Cultural Heritage	0	0
Expropriation	0	0
Land conversion	*	*
Property-legal relations	*	*
Distance from the sensitive receptors	0	0
Compatibility with planning documentation	-	+

+ (Better); - (Worse); 0 (Comparable); * (insufficient information to compare)

4.10.2. Alternative 2 was chosen due to the potentially lower environmental, social, technical and economic impacts.

4.11 ALTERNATIVE DESIGNS FOR THE STROGOMISHTE INTERCHANGE

4.11.1. During the design process, three designs for the viaduct component of the Strogomishte Interchange were considered, with a view to investigating whether it would be possible to relocate the viaduct piers outside the graveyard, and thereby avoid the need for the temporary or permanent relocation of graves. The design of the Strogomishte Interchange is constrained by various factors, including the need to avoid residential properties, pass over existing railway line, achieve the increase in elevation to the tunnel, and meet the required design standards.

The first design option for the viaduct, Variant 0, is shown in Figure 4-2. This design would require the construction of the foundation for the viaduct piers within the cemetery at Dolno Strogomishte, which would potentially require the relocation of graves. This has the potential to have a negative effect on the local community which would be managed though engagement with the local community and the development and implementation of a graveyard relocation plan.

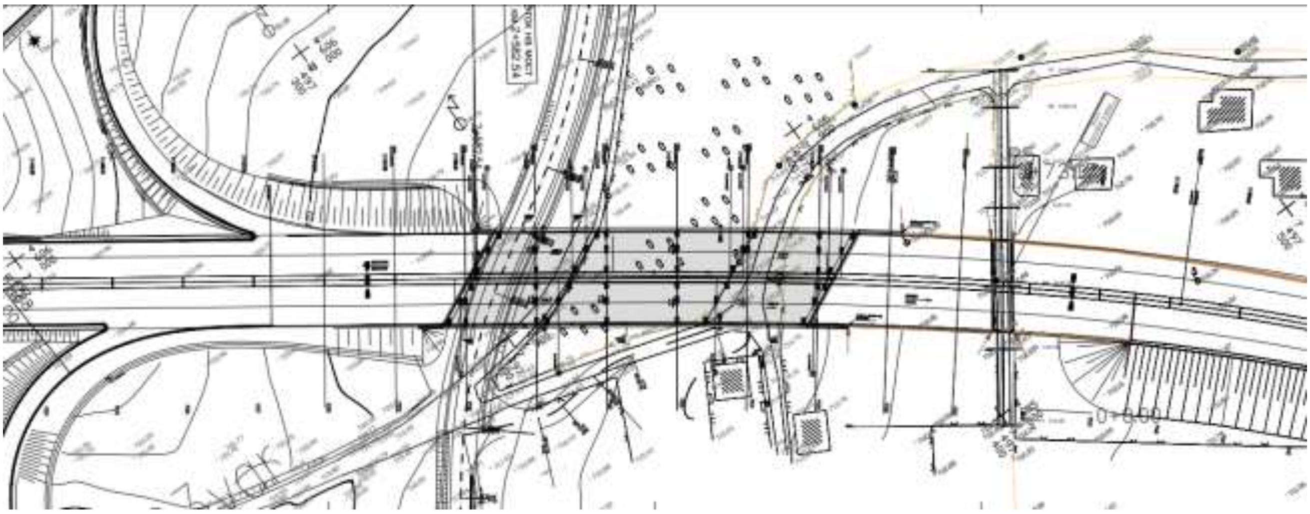

Figure 4-2 - Strogomishte Interchange viaduct design: Variant 0

4.11.2. Two further design options (Variant 1 and 2) have been prepared which have the piers of the viaduct located entirely outside of the cemetery. The design for Variant 1 and Variant 2 are shown in Figure 4-3 and Figure 4-4 respectively.

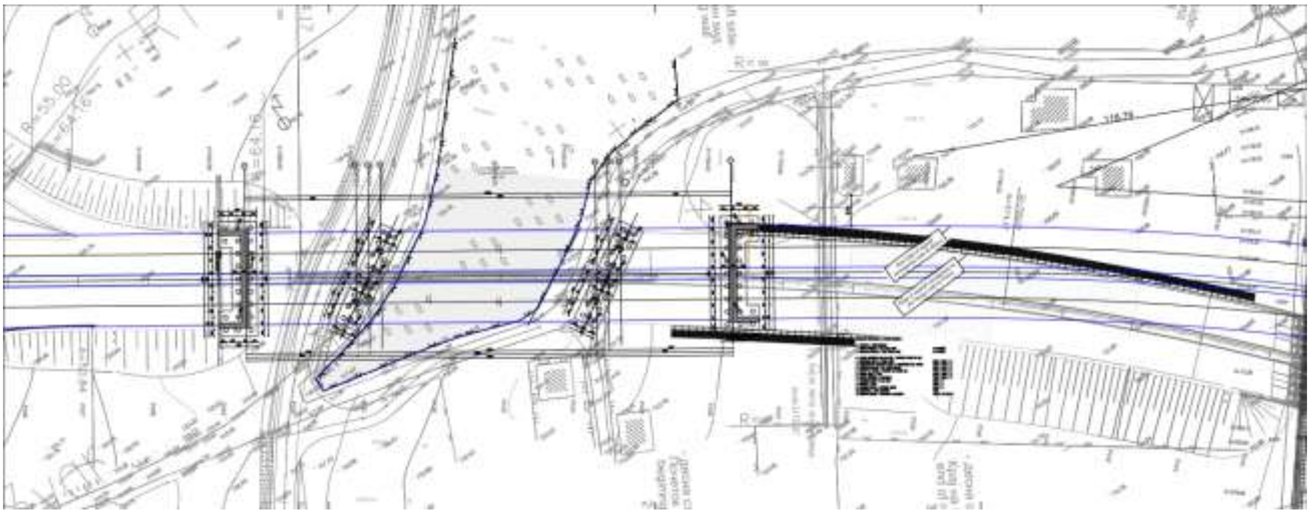

Figure 4-3 – Strogomishte Interchange viaduct design: Variant 1

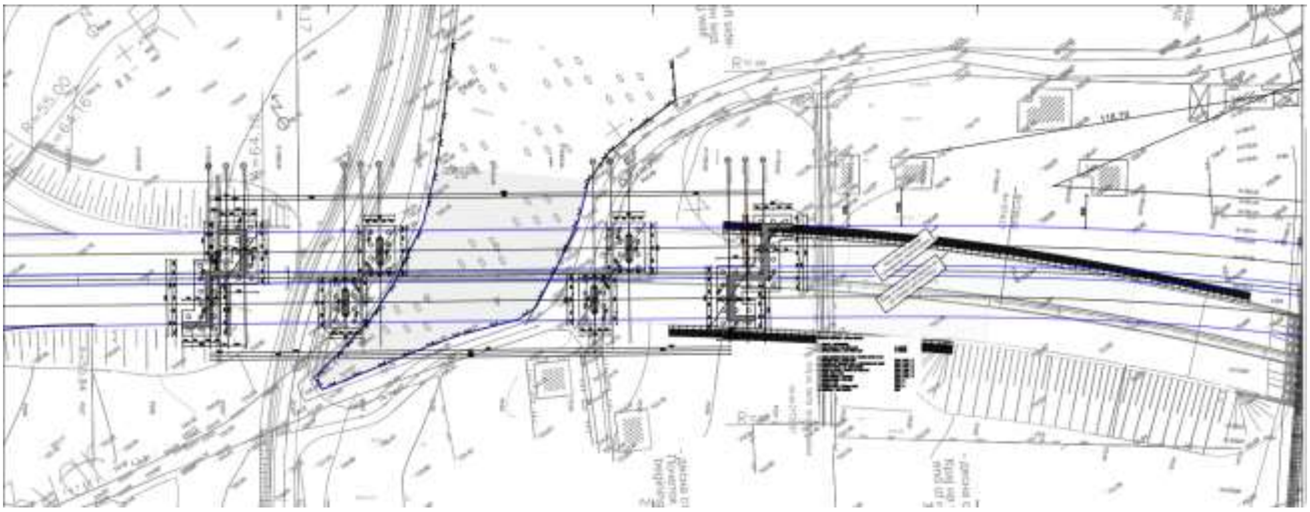

Figure 4-4 - Strogomishte Interchange viaduct design: Variant 2

4.11.3. The key difference between the three viaduct design option / variants are outlined in Table 4-3.

Table 4-3 – Comparison of Strogomishte Interchange design options

	Variant 0: Reinforced Concrete Girder Superstructure	**Variant 1:** Composite Structure	**Variant 2:** Reinforced concrete Hollow Box Superstructure
Length	27.75 + 44.75 + 27.75 = 100.25 m	35.65 + 68.00 + 35.65 = 139.30 m	38.50 + 71.00 + 38.50 = 148.00 m
Width	13.7 + 0.8 + 13.7 = 28.2m	13.7 + 0.8 + 13.7 = 28.2m	13.7 + 0.8 + 13.7 = 28.2m
Depth of superstructure vs alignment	2.22 m a crossing point of the link road	3.50 m	3.03
Advantages	Single span structure with continuous deck slab, which is resistant to unfavourable geotechnical condition which allows for shallow foundations and does not require piling.	Foundations are located outside of the cemetery area. Shorter retaining walls after the bridge than the original design.	Foundations are located outside of the cemetery area. Shortest retaining walls after the bridge compared to the two other variants.

	Variant 0: Reinforced Concrete Girder Superstructure	**Variant 1: Composite Structure**	**Variant 2: Reinforced concrete Hollow Box Superstructure**
	Allows for vertical clearance for the link road. Does not affect the local road to Strogomishte village. Ease of construction.		
Disadvantages	Foundations enter the cemetery area. Longer retaining walls after the bridge.	Continuous structure, less resistant to the unfavourable geotechnical conditions, piling is required. Insufficient vertical clearance at the link road. Construction is more complicated vs Variant 0	Continuous structure, less resistant to the unfavourable geotechnical conditions, piling is required. Insufficient vertical clearance at the link road. Construction is more complicated vs Variant 0

4.11.4. The interchange option / variant that will be constructed for the Project, will be selected during the development of the detailed design, in consultation with the local community. This assessment has assessed the design parameters with the maximum impacts, from all the options / variants. This approach has ensured that the worst case scenario has been assessed within this ESIA, irrespective of the interchange design option that is selected, and that appropriate mitigation has been identified.

5 ESIA METHODOLOGY

5.1 OBJECTIVES OF THE ESIA

5.1.1. The key objectives of the ESIA are as follows:

- Set the legal framework (Chapter 3 – ESIA Legislation and Requirements);
- Document the consultation process (Chapter 6 – Stakeholder Engagement);
- Consider the alternatives to the Project (Chapter 4 – Consideration of Alternatives);
- Establish baseline environmental conditions at the Project Site and within the surrounding area (Chapters 8 to 21);
- Identify likely significant effects during the design process so that some effects can be avoided, prevented, reduced or, if possible, offset prior to the assessments within the ESIA (Chapters 8 to 21);
- Identify, predict and assess the environmental effects associated with the Project: their temporal and spatial extents, whether they are beneficial or adverse; direct or indirect; significant or not significant (Chapters 8 to 21 and 22 – Summary of Effects);
- Identify, predict and qualitatively assess the cumulative effects of the Project including those associated with the other developments (Chapter 21);
- Identify suitable mitigation measures to prevent, reduce or, if possible, offset likely significant adverse effects on the environment and identify the likely significant residual effects following the implementation of these measures (Chapters 8 to 21 and Chapter 23 – Environmental and Social Management Plan); and
- Identify monitoring measures where likely significant residual effects are identified (Chapters 8 to 21 and Chapter 23 – Environmental and Social Management Plan).

PLANNING DOCUMENTS

5.1.2. The following documents have been used in the preparation of the ESIA:

- Spatial Plan for the Republic of Macedonia (2002-2020);
- Water Strategy for the Republic of Macedonia (2011-2041);
- National Strategy for Sustainable Development in the Republic of Macedonia;
- Waste Management Strategy of the Republic of Macedonia (2008-2020);
- National Strategy for Clean Development Mechanism of Macedonia for the first commitment period of the Kyoto Protocol, 2008-2012;
- Biodiversity Strategy and Action Plan of the Republic of Macedonia;
- Environmental Monitoring Strategy, Environmental Communication Strategy, Environmental Awareness Strategy and Environmental Data Management Strategy;
- National Waste Management Plan (2009-2015) of the Republic of Macedonia
- Extract from Spatial Plan of the Republic of Macedonia 2002-2020 for the needs to prepare the Infrastructure Design for state road A2, section Bukojchani - Kichevo (variant with a tunnel);
- Extract from the General Urban Plan for the City of Kichevo;
- General act for Dolno Strogomishte settlement;
- Extract from the General Urban Plan for the village of Zajas;
- Other applicable documents for this projects.

5.1.3. The plan for the construction of the A2 Motorway, Gostivar to Kichevo, is closely aligned with the following plans/strategies for the region:

- The National Transportation Strategy (2007-2017 and NTS 2018-2030);
- The Spatial Plan of Republic of Macedonia (2002-2020);
- The Strategy for Development of the Polog Region (2009-2013); and
- The Strategy for Development of the Southwestern Region (2010-2015).

DESIGN DOCUMENTATION

5.1.4. This ESIA was carried out based on design documentation completed by Balkan Consulting, Geing Ltd – Skopje, DIWI Macedonia Ltd Skopje, Chakar & Partners, this included the Main Design and Infrastructure Design and planning documents received from the Public Enterprise for State Roads

5.1.5. The Project description is provided in Chapter 2: Description of the Project.

5.2 APPROACH TO THE ASSESSMENT OF THE PROJECT

5.2.1. This section outlines the phases of the Project that have been assessed, together with the approach to the baseline conditions and cumulative effects. It also sets out the overarching approach to the ESIA, together with project specific requirements for the assessment of effects. This ESIA has a slightly different structure to the structure followed for national Macedonian EIAs, but it contains the same content, level of information and assessment.

BASELINE SCENARIO

5.2.2. Baseline information (environmental characteristics and conditions) has been collated, based upon site visits undertaken and desk-based information available at the time of the assessment. Technical chapters 8 – 20 provide details of the baseline information.

TEMPORARAL SCOPE

5.2.3. This ESIA has assessed the effects that are anticipated to arise during the construction of the Project (the construction phase) and following its completion (commonly referred to as the 'operational phase'). The decommissioning phase has not been considered, due to the particularly long duration of the operational phase of strategic highways.

5.2.4. The construction period is assumed to start in 2021 and last until 2025. The operation phase will commence once traffic begins to use the Project. The effects can broadly be summarised as follows:

- Construction
  - Any effects during the construction period that may arise as a result of construction activities such as demolition / rehabilitation, temporary use of land (such as for site compounds), construction of new road and structures changes in traffic movements and temporary closures or diversions to roads; and
- Operation
  - Any effects during the operational period that may arise as a result of operational activities, such as increased vehicle movements.

5.2.5. Consideration has been given to impacts (changes in the environment) associated with the Project in comparison to the baseline conditions identified in the baseline assessments (conditions that would exist without the presence of the Project).

SPATIAL SCOPE

5.2.6. The spatial scope of the ESIA varies in accordance to the assessment requirements for individual ESIA topics. The study areas for each topic are outlined in Chapters 8 to 20.

SENSTIVITY/ VALUE OF THE RECEPTOR

5.2.7. The sensitivity of receptors to change is defined within technical Chapters 8 – 20 and has been determined where available and appropriate by quantifiable data, the consideration of existing designations and professional judgement. The categories used (very high, high, medium, low, and negligible), unless otherwise stated, are shown in Table 5-1. Where topic specific methodology deviates from this approach, for example as a result of using topic specific guidance, this is set out in the assessment methodology section of the technical chapter.

Table 5-1 - Environmental / Social Value (or Sensitivity)[22]

Value (Sensitivity)	Typical descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or Lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Magnitude of Impact

5.2.8. The magnitude of impact for each identified receptor is predicted as a deviation from the established baseline conditions, as a result of the Project (Table 5-2).

Table 5-2 - Magnitude of Impact and Typical Criteria Descriptors

Magnitude of impact	Typical criteria descriptors
Major	*Adverse:* Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements

[22] Based upon DMRB Volume 11 Section 2 part 5 Table 2.1; August 2008 (dft.gov.uk).

Magnitude of impact	Typical criteria descriptors
	Beneficial: Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality
Moderate	*Adverse:* Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements *Beneficial:* Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	*Adverse:* Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. *Beneficial:* Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	*Adverse:* Very minor loss or detrimental alteration to one or more characteristics, features or elements. *1.* *Beneficial:* Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	*2.* No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Type of Impact

5.2.9. The impacts of the Project are classified according to the following criteria:

Table 5-3 - Types of Impact

Criteria	Further Description of criteria	Indicative Assessment Thresholds used for each Rating Criteria:	
		Threshold	**Typical Descriptions**
Characterisation of Impact	Direction of the impact	Positive	Impact is an improvement on the current situation or is desirable
		Negative	Impact is a worsening of the current situation or is not desirable
Type of Impact		Direct	Project results in a direct impact upon aspect/receptor/resource (i.e. generally within the Project footprint with a relevant study area)

Criteria	Further Description of criteria	Indicative Assessment Thresholds used for each Rating Criteria:	
		Threshold	**Typical Descriptions**
		Indirect	Indirect effect upon aspect/receptor/resource
		Cumulative	Cumulative effect upon aspect/receptor/resource
Reversibility	Reversibility is the ability for a physical parameter, biological or social community to return to the conditions that existed prior to the impact.	Reversible	The effect is reversible
		Irreversible	The effect is potentially permanent and not reversible
Geographic Extent	Describes the area over which the particular impact will occur and is related to the spatial boundaries of the assessment.	Local	Impact is limited to specific individuals or population groups/communities or environmental receptors at or close to the Project
		Regional	Impact extends across municipality of Kichevo
		National or Transboundary	Impact extends through much or all of Macedonia or in transboundary context
		Global	Effect extends globally
Time when the impact occurs	Associated with when the impact will occur.	Immediate	Effect occurs immediately following project activity/action
		Delayed	Effect delayed and occurs sometime after project activity/action
Duration	Refers to how long an impact will occur and is closely related to the project phase or activity that could cause the impact.	Short-term	Impact is expected to last in the short-term (e.g. less than two years)
		Medium-term	Impact is expected to last in the medium-term (e.g. between two and ten years)
		Long-term	Impact extends throughout operation of highway and/or beyond 10 years

Criteria	Further Description of criteria	Indicative Assessment Thresholds used for each Rating Criteria:	
		Threshold	**Typical Descriptions**
Likelihood of occurance	The likelihood that the impact will occur.	Unlikely	The impact can be considered to be unlikely to occur
		Probable	The impact can be considered to have a medium likelihood of occurring
		Certain	The impact can be considered to have a high likelihood of occurring

SIGNIFICANCE OF EFFECT

5.2.10. The classification of the significance of effects has been undertaken using professional judgements (assumptions and value systems) that underpin the attribution of significance. Each effect has been assessed based on the sensitivity / value of the receptor and the magnitude of impact as shown in Table 5-4.).

Table 5-4 - Arriving at the Significance of Effect Categories

		MAGNITUDE OF IMPACT (DEGREE OF CHANGE)				
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
ENVIRONMENTAL VALUE (SENSITIVITY)	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight or Moderate	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

5.2.11. Five significance categories (very large, large, moderate, slight and neutral) have been used to assess significance of each impact (Table 5-5).

Table 5-5 - Descriptors of the Significance of Effect Categories

Significance category	Typical descriptors of effect
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.2.12. Effects of moderate and above are considered ‘Significant’ while effects of slight and below are considered as ‘Not Significant’.

5.2.13. The initial assessment is made without considering the application of preventive and corrective measures (mitigation) that could reduce the magnitude of the impact.

5.2.14. The effects, following the application of mitigation and enhancement measures are the residual effects.

5.2.15. Chapter 22 - Summary of Effects outlines any potential significant effects due to the scheme, and any residual effects following the application of mitigation measures for all topics.

5.3 CUMULATIVE EFFECTS

5.3.1. As per the EIA Directive, Annex I(C), Paragraph 5, the ESIA has assessed the cumulative effects of the Project. Cumulative effects are categorised as follows:

- In-combination Effects: Those arising from the Project in-combination with other projects; and
- Effect Interactions: Those arising from inter-relationships within the Project.

There is no widely accepted methodology or best practice for assessing cumulative effects although various guidance documents exist. The approach used has been adopted based on: previous experience, the types of receptors being assessed, the nature of the Project, the other developments under consideration and the information available to inform the assessment. The assessment of cumulative effects is set out in Chapter 21 – Cumulative Effects.

6 STAKEHOLDER ENGAGEMENT

6.1 STAKEHOLDER ENGAGEMENT AND PUBLIC PARTICIPATION REQUIREMENTS

6.1.1. EBRD Performance Requirements (PR1 and PR10) require stakeholder engagement in order to build strong, constructive and responsive relationships between the Company, the Construction Contractor and the local community.

6.1.2. The EIA Directive outlines the need for public participation as part of the decision-making procedures and the role EIA has in informing the public of the effects associated with the Project. As per the requirements of the EIA Directive, this ESIA is accompanied by a Non-Technical Summary (NTS) which summarises the findings of the assessment.

6.2 STAKEHOLDER ENGAGEMENT PLAN

6.2.1. A Stakeholder Engagement Plan (SEP) has been developed for the Project, as required under PR 1 and PR 10. It will be publicly disclosed and available for questions, comments and suggestions together with this ESIA, after which it will be regularly updated throughout the life of the Project. As per the requirements of PR 10, the SEP includes a Grievance Mechanism to allow affected individuals to raise grievances, concerns and queries to the PESR, Contractor or maintenance operator.

6.2.2. Gender considerations have been incorporated into the SEP, together with the future engagement methods. Engagement activities are designed to allow women to participate, i.e. focus groups and workshops. There are multiple methods for women to get involved in consultations and provide feedback on different aspects of the Project.

6.2.3. A copy of the Grievance Mechanism form is also included in the NTS.

6.2.4. A Supplementary SEP has been prepared to take into account the Covid-19 restrictions (which will be appended to the SEP). This includes alternatives measures for disclosure in line with EBRD's Stakeholder Engagement (PR10) – Covid-19 Briefing Note.

6.3 CONSULTATION UNDERTAKEN DURING SITE VISIT

6.3.1. The following consultation was undertaken during the Geing / PESR / Balkan / WSP site undertaken in July 2019:

- Local community meeting – in the village of Dolno Strogomishte.
- Sinohydro co, Ltd, KO Motorway Project – the Chinese contractors – for the adjacent section of the A2 Kichevo – Ohrid, which is currently under construction to the south of the Project.
- Meeting between PESR, EBRD, GEING (ESIA authors) WSP (Due Diligence) and Balkan (lead designers).
- Meeting with all stakeholders in the Municipality of Kichevo June-July 2019.

6.4 FURTHER MEETINGS AND CONSULTATIONS

PRE-DISCLOSURE CONSULTATION

6.4.1. The PESR intends to undertake pre-disclosure consultation ahead of the formal disclosure events. This consultation will focus on engaging the communities closest to the alignment and will: provide them with information on the nature of the Project, enable them to raise and discuss any concerns or opportunities they may have in relation to the Project, and provide them with advice on the further opportunities that will be available to obtain information on the Project.

DISCLOSURE CONSULTATIONS

6.4.2. In according with EBRD PR 10, for Category A Projects, public hearings will be conducted at in Kichevo and Zajas. The ESIA will be disclosed for a period of 120 days prior to EBRD board approval. The ESIA will remain publicly accessible throughout the duration of the Project.

6.4.3. In accordance with national requirements, the Ministry of Environment and Physical Planning will publish environmental impact assessment information in daily newspapers (at least one that goes out to the entire territory of the state), local TV and radio stations, as well as on the website of the ministry. The Ministry of Environment and Physical Planning will perform the following activities:

1. Announce the Notice of intent for implementation of the project in at least one daily newspaper on the territory of the Republic of North Macedonia and the website of the Ministry of Environment and Physical Planning;

2. Announce the Decision for the need of implementing the procedure for environmental impact assessment in at least one daily newspaper on the territory of the Republic of North Macedonia, as well as on the website and notice board of the Ministry of Environment and Physical Planning;

3. Announce that the ESIA for the project is prepared and available to the public in at least one daily newspaper on the territory of the Republic of Macedonia, local radio / TV station, while the non-technical report of the study will be published on the website of the Ministry of Environment and Physical Planning;

4. Announce the report on compliance of the ESIA for the project in at least one daily newspaper on the territory of the Republic of Macedonia and the website of the Ministry of Environment and Physical Planning;

5. Announcement of the decision to approve or reject the application for project implementation in at least one daily newspaper in the Republic of Macedonia, as well as on the website and notice board of the Ministry of Environment and Physical Planning;

6. Inform the public and stakeholders about the time and venue of the public hearing in at least one daily newspaper on the territory of the Republic of Macedonia, local radio / TV station.

6.4.4. The period required for public disclosure of the ESIA Study, according to the Law on Environment, is 30 days and the EBRD requirement for disclosure is 120 days.

7 LIMITATIONS AND ASSUMPTIONS

7.1.1. The technical limitations and assumptions made during the preparation of the ESIA are summarised as follows:

- As outlined in **Chapter 2 – Project Description**, the location of the construction camps has not been finalised and the Contractor will be responsible for the final locations. As outlined in the Construction Workers' Accommodation Management Plan (see Chapter 23 – ESMP), there will be a set of restrictions to ensure the Contractor selects suitable locations for each camp. The camps will be located in the City of Kichevo, and also in Zajas, as suitable utilities and services are available in these locations. The Contractor will be responsible for gaining all necessary permits and licenses. The local community will be consulted on the final location of each construction camp. The Contractor will be responsible for returning the compound sites to their pre-construction condition.
- Consultation with governmental bodies and technical institutions has been undertaken as outlined in Chapter 19: Consideration of Alternatives.
- There has been limited public consultation undertaken during the route selection process and Covid-19 has restricted consultation following the design fix. A worst case scenario has therefore been assumed in Chapter 20: Property and Livelihood. A remote disclosure process which takes into account Covid-19 safeguards and best practice will be applied as outlined in the SEP and Supplementary SEP.
- No information on the tunnel construction methodology is available at this stage in the design process as this will form part of the detailed design and/or Contractor's methodology. As a robust worst case it has therefore been assumed that blasting will be required which is likely to be the most impactful method of construction (with regard to noise and vibration and safety). This is a sound approach to the ESIA for this aspect of the Project.
- The Contractor will be responsible for the location of construction access roads. All mitigation required for the Project will apply for the access roads including, but not limited to, land acquisition and livelihood restoration, community health and safety, noise and vibration, dust and air quality emissions, biodiversity and landscape and visual impact. The local community will be consulted on the access road locations and the Contractor will be responsible for returning the land to pre-construction condition unless they form part of the Project. Effects on local roads will be mitigated through the implementation of a Community Access and Infrastructure Plan (see Chapter 23 – ESMP);
- There is no strategic noise map available for the region where Project will be located. Therefore, noise measurements were performed at 5 points along the Project;
- A simple traffic model has been used for the air quality, climate – greenhouse gas emissions and noise and vibration assessments. Baseline traffic flows (validated using traffic counts) have had a growth factor of 5% per year applied for the future baseline / with Project scenario. It has been assumed that all traffic on the existing A2 will move onto the Project. This data has also been used for the feasibility and economics reporting for the Project;
- Regional and national Red books and Red lists, with data on the Macedonian flora and fauna have not yet been prepared. As a result, the assignment of sensitivity of habitat types and species along the Project alignment has been made based on the most relevant international conventions (such as the Berne Convention, IUCN Red List, Habitats Directive, Birds Directive etc).

- A full census and detailed study of land ownership has not been undertaken. Prior to the construction, the PESR (or specialist appointed by PESR) will undertake a full census of all properties and land parcels along the alignment. This information will feed into the Land Acquisition Plan. The implementation of the Land Acquisition Plan will align with national and international (EBRD and EU) best practice.
- No consultation has been undertaken to date with the families that may be affected by the grave relocations at Dolno Strogomishte. Full consultation will be undertaken as part of the Grave Relocation Plan (to be completed during the detailed design stage and ahead of the appointment of the Contractor).
- Water samples were taken from Zajaska River and Strogomishka to inform the assessment, as there is no regular water quality monitoring undertaken at the locations where the construction of bridges is proposed, namely: the Zajaska River (which flows into river Treska and river Sushica which has temporary flow); the Strogomishka River (where regulation is proposed). The following parameters were analysed: turbidity, chemical oxygen demand, biological oxygen demand, nitrates, phosphates, dissolved oxygen, oxygen surfeit, zinc, lead, greases and oils and suspended solids.

7.1.2. The River Vadar, which the river Zajaska River eventually forms part of via the River Treska, does not have a separate River Basin Management Plan (RBMP). The RBMP would be expected to provide information on sensitive locations within the basin which require protecting and could affect the sensitivity of the receptor. The assessment of sensitivity of the Zajaska has been based on the local morphology.

8 AIR QUALITY

8.1.1. This Chapter reports the outcome of the assessment of likely significant effects arising from the Project on local air quality.

8.1.2. The Chapter describes the baseline conditions and relevant assessment methodology. The potential air quality impacts of the Project during both the construction and operational phases have been assessed. For both phases, the type, source and a summary of the likely significant effects are identified, together with a description of the mitigation measures required to avoid, prevent, reduce or, if possible, offset any likely significant adverse effect. The likely residual effects are also provided.

8.2 BASELINE CONDITIONS

8.2.1. The Ministry of Environment and Physical Planning undertake air quality monitoring across the Republic of North Macedonia[23]. The automatic ambient air quality monitoring station located closest to the Project is situated in Kichevo.

8.2.2. This automatic monitor is located in a residential area close to the city centre (approximately 1.2km from the Project alignment) and records data for several pollutants (ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulphur dioxide (SO2) and particulate matter (PM10)). With the exception of PM10, concentrations of all the measured pollutants are below the Air Quality Limit Values (AQLVs), however some of the data is missing but this is not considered to have affected the baseline results[24]. CO and PM10 concentrations are much higher during the colder months of the year, suggesting that these pollutants are predominantly emitted from household heating units (Figure 8-1). 77 exceedances of the PM10 daily limit value were registered in 2018 and almost all of these were during the colder months. Further monitoring was undertaken in 2019 to confirm the previous measurements. Additional air quality monitoring will be undertaken prior to the start of construction to set baseline levels for construction monitoring along the alignment, in close proximity to sensitive receptors as outlined in Chapter 23 – Environmental and Social Management Plan.

[23] http://air.moepp.gov.mk/?page_id=175&parameter=SO2&station=Kicevo
[24] In order to minimize the impact of missing values, a five-year dataset covering the period from 2014 through 2018 was examined

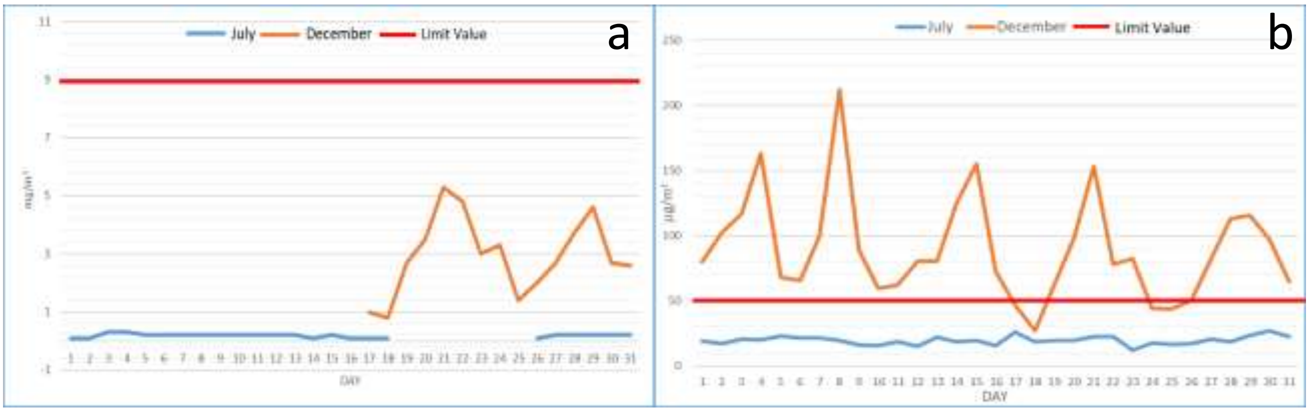

Figure 8-1 - Daily concentrations of CO (a) and PM10 (b) at the monitoring station in Kichevo in July and December 2018 (Source: MOEPP Monthly Reports)

8.2.3. PM_{10}, NO_2 and CO concentrations, covering the period from 2014 through 2018, measured at the Kichevo automatic monitoring site are presented in Table 8-1, Table 8-2 and Table 8-3.

Table 8-1 - Monthly averages of ambient PM_{10} concentrations ($\mu g/m^3$)

	2014	2015	2016	2017	2018	Average
Jan	142.2	214.3	116.5	115.0	73.5	132.3
Feb	107.6	125.6	68.5	87.2	57.0	89.2
Mar	76.0	87.3	53.4	48.7	43.3	61.7
Apr	56.5	59.3	40.7	36.1	29.9	44.5
May	35.7	42.8	28.4	22.6	23.0	30.5
Jun	41.6	30.4	29.9	24.2	17.5	28.7
Jul	40.1	38.0	36.0	27.1	20.0	32.2
Aug	45.6	36.1	35.8	31.2	26.0	34.9
Sep	40.2	33.9	40.9	20.4	22.7	31.6
Oct	65.3	49.0	51.6	34.7	38.4	47.8
Nov	127.9	83.2	90.3	63.7	65.5	86.1
Dec	136.5	152.3	137.1	61.8	90.5	115.6
Annual Average	**76.3**	**79.3**	**60.8**	**47.7**	**42.3**	

Notes:
Source: MOEPP database
Missing data has not been taken into account

Table 8-2 - Monthly averages of ambient NO_2 concentrations (μg/m^3)

	2014	2015	2016	2017	2018
Jan				42.7	
Feb				34.8	
Mar				32.6	
Apr				29.6	
May			8.6		14.6
Jun			8.3		18.2
Jul			11.9		15.6
Aug			14.0		17.0
Sep			16.0		19.2
Oct			14.2		24.6
Nov			21.4		
Dec			43.4		21.7
Annual Average			**17.2**	**34.9**	**18.7**

Notes:
Source: MOEPP database

Missing data has not been taken into account

Table 8-3 - Monthly averages of ambient CO concentrations (mg/m^3)

	2014	2015	2016	2017	2018	Average
Jan	2400	2137.0	2327	2388		2313.0
Feb	1900	1426.8	1162	1467	1081	1407.4
Mar	458	957.3	759	752	1108	807.1
Apr	458	968.2	757	642	1121	789.2
May	909	407.4	781	802	205	575.7
Jun		384.5	550	448	125	353.2
Jul		468.9	426		130	341.6
Aug		374.6	264		142	260.4
Sep		374.8	273		172	273.1
Oct		746.6	616			681.5
Nov		1281.9	1185			1233.3
Dec	1498	1763.2	2033		1550	1710.9
Annual Average	**1376.7**	**1023.5**	**1011.6**	**1453.4**	**765.1**	

Notes:
Source: MOEPP database

Missing data has not been taken into account

8.2.4. The PM_{10} measuring device was out of operation for the summer months of 2019. The results obtained for 2019 during its operation until October suggest higher level of ambient PM_{10} than the two previous years (around 52 μg/m^3). Based on the available data, a forecast has been made of the likely PM10 concentrations for 2020 (the year when the construction activities are expected to take place) and 2023 (the expected starting service year).

8.2.5. Since PM_{10} emissions originate mostly from household heating units in the colder months, the community is focused on reducing emissions from such sources. There is currently a government programme aimed at substituting wood burning stoves with pellets and gas[25]. A substantial number of households were expected to switch to pellets during the winter 2019/2020. Therefore, it is reasonable to expect a reduction of PM_{10} down to an annual average concentration of 20 µg/m^3 in 2040.

8.3 POTENTIAL IMPACTS AND EFFECTS

ASSESSMENT METHODOLOGY

8.3.1. The construction and operational phase impacts of the Project have been assessed utilising the AERMOD[26] modelling software. This model is used extensively to assess pollution concentration and deposition from a wide variety of sources. For the purpose of this exercise emissions from transport in both the construction and exploitation phases were dealt with as line area sources. Emissions from excess soil dump sites were dealt with as area sources.

8.3.2. For the purposes of this assessment, construction activities are anticipated to start in 2020, with the operational phase of the Project planned to begin in 2023, while 2040 has been reviewed as a future year. For the purpose of this assessment the following scenarios have been considered:

- Base Year – 2018;
- Construction Year – 2020;
- Start year – 2023 with and without the motorway being constructed; and,
- Future year – 2040 with and without the motorway being constructed.

8.3.3. The start date for construction of the Project has been delayed until 2021 with operation starting in 2024. This change in year is not considered to have a material effect on the air quality modelling and therefore the results in this chapter are considered to be robust.

8.3.4. The construction phase assessment has considered the emissions of PM_{10} from construction activities, and the operational phase assessment includes the assessment of NO_2, PM_{10}, $PM_{2.5}$ and CO.

8.3.5. The guidance 'Air dispersion modelling report requirements'[27] (for detailed air dispersion modelling) was followed in preparing this report and the recommendations were met as far as possible.

8.3.6. Macedonian environmental legislation does not have a definition of "significant impact," therefore the model results, added to the background concentrations, have been compared with the national and the European air quality standards, with the exception of $PM_{2.5}$, as no background data was available for it.

[25] The government programme, which is currently being implemented, is titled 'Program for reducing the air pollution in the Republic of Macedonia' and includes a plan for air quality monitoring, inspections, public campaigns and amendments to national laws. Further details are available at: https://vlada.mk/node/15965?ln=en-gb.
[26] version 18081 software package of the USEPA (United States Environmental Protection Agency) with its Windows interface (AERMOD VIEW release 9.6) from LAKES ENVIRONMENTAL Co
[27] http://www.theairshed.com/wp-content/uploads/2018/03/EA-requirements-for-dispersion-modelling.pdf

8.3.7. Relevant meteorological data for use in the modelling was obtained from Lakes Environmental[28]. A three-year data set covering the period from 2016 through 2018 was examined.

CONSTRUCTION PHASE

8.3.8. It has been assumed that the motorway construction activities will take place in 2020, for the purposes of the assessment, although this is now likely to be delayed until 2021.

8.3.9. Construction activities are unlikely to take place on the whole route simultaneously. However, as a worst-case scenario for construction air quality it was assumed that the construction works will take place throughout the year 2021 along the entire motorway section.

8.3.10. The model predicts ground level concentrations due to emissions of polluting substances. Annual mean, daily mean and the 98th percentiles of the latter were calculated.

8.3.11. The following data was required to perform modelling:

- Emission Sources (type, characteristics, emission rate);
- Terrain data (topography);
- Data on nearby buildings;
- Receptor coordinates and heights; and
- Meteorological data.

8.3.12. The following emission sources generated by construction phase activities were considered:

- Blasting and excavating;
- Material loading and unloading;
- Transportation of earth and other materials along the haul roads and the motorway alignment (including movement of empty dumpers);
- Wind erosion; and
- Emissions of exhaust gas from vehicles and other machinery.

OPERATIONAL PHASE

8.3.13. For the operational phase of this assessment the following scenarios have been assessed:

- 2018 Base year air quality assessment;
- 2023 [29]Opening year air quality assessment (with and without the motorway being constructed); and,
- 2040 Future year air quality assessment (with and without the motorway being constructed).

8.3.14. The emissions associated with the operational phase are associated with:

- Vehicle engines exhaust gases;
- Tyre wear;
- Brake wear; and

[28] as MM5 Met Data (Regional Mesoscale Model for Creating Weather Forecast and Climate Projections).
[29] The original assessment was based on an assumed opening year of 2023. The modelling was not updated following delays in the start of the Project but the change in emissions are not likely to affect the assessment.

- Fuel evaporation.

8.3.15. Vehicle related pollutant emission rates are determined by factors such as number and kind of vehicles, power of the engines, traveling velocity, type of fuel and conditions of the road.

8.3.16. Macedonia does not have national emission factors, developed for different categories of vehicles under different road conditions. Therefore, German emission factors published in the Handbook Emission Factors for Road Transport – HBEFA[30] were applied. As tyre, asphalt and brakes abrasions are not taken into account in the German emission factors presented in HBEFA, the corresponding NAEI (National Air Emissions Inventory) values were added to PM_{10} and $PM_{2.5}$ emission factors.

8.3.17. Benzene emissions are minor and are only assigned to passenger cars and light commercial vehicles exhaust gases (0.001g/km). Evaporative emissions are even lower (in the order of 10-6g/km). Emissions data on benzene is unavailable, as it has not been monitored at the air quality monitoring station. Therefore, benzene concentrations have not been included in the assessment. Traffic emissions of SO_2 are too small for detailed modelling to be undertaken, therefore SO_2 has not been included in the assessment.

8.3.18. Further detail on the methodology, the source of the traffic data and model inputs is provided in the Air quality modelling report contained within Appendix 8-1.

SENSITIVE RECEPTORS

8.3.19. Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Project. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure as a result of construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the exhausts of construction and operational traffic associated with the Project.

8.3.20. Five receptors sensitive to construction phase impacts have been identified within the modelling area. In addition to the construction phase receptors, a further seven additional receptors were identified for the operational phase assessment. These receptors are applicable to the 'without Project' scenario only, comprising residential dwellings and a Mosque. The sensitive receptors considered within this assessment are presented in Table 8-4 below.

8.3.21. A uniform Cartesian receptor network was also created in the model covering an area of 12 X 12 km with a density of 250 X 250 m.

[30] German emission factors were used as they were considered to be comparable to the vehicle types which will be using the Project. Further information on the emissions factors are available at: https://www.hbefa.net.

Table 8-4 - Sensitive Receptors

Receptor Name	Settlement	UTM Coordinates		Assessment Phase
		X (m E)	Y (m N)	
Primary School	Kichevo	496450	4596350	Construction & Operational
Mosque	Kichevo	495921	4596534	Construction & Operational
University	Kichevo	496790	4596510	Construction & Operational
Military Barracks	Kichevo	496320	4596910	Construction & Operational
Sports Centre	Kichevo	497320	4597330	Construction & Operational
House	Zajas	495852	4605509	Operational
House	Zajas	495797	4605571	Operational
Mosque	Kolibari	496428	4601896	Operational
House	Trapchin Dil	496608	4601490	Operational
House	Trapchin Dol	496637	4601465	Operational
House	Kichevo	496784	4601039	Operational
House	Kichevo	496886	4600879	Operational

ENVIRONMENTAL AIR QUALITY STANDARDS

8.3.22. AQLVs for concentrations of PM_{10}, SO_2, NO_2 and CO in the ambient air, according to the Decree on the limit values of concentrations and types of polluting substances in the ambient air and alarm thresholds, deadlines for complying with the limit values, tolerance margins for the limit values, target values and long term goals (O.G.RM No.50/05), are shown in Table 8-5.

Table 8-5 - Ambient air quality limit values for SO_2, PM_{10}, NO_2, SO_2 and CO

Substance	Unit	AQLV	Allowed exceedance per year
Sulphur Dioxide (SO_2) 1 Hour 24 Hour mean Year (protected areas)	μg/m³	350 125 20	24 times 3 times
Particulate Matter PM_{10} 24 Hour mean Annual	μg/m³	50 40	35 times
Nitrogen Dioxide (NO_2) 1 hour Annual (human health protection) Annual (vegetation protection)	μg/m³	200 40 30	18 times
Carbon Monoxide (CO) Daily (8 hourly mean)	mg/m³	10	-

8.3.23. These national air quality standards follow the air quality standards set in Annex 11 to the Directive 2008/50/EC on ambient air. Table 8-6 is an extract from Table B of the Directive.

Table 8-6 - Limit Values (μg/m³) for relevant air quality pollutants as determined in Directive 2008/50/EC

Pollutant	Hourly	24 hourly	Annual
NO_2	200 (18 exceedances permitted per year)	-	40
PM_{10}	-	50 (35 exceedances permitted per year)	40
$PM_{2.5}$	-	-	25
SO_2	350 (24 exceedances permitted per year)	125 (3 exceedances permitted per year)	-
CO	-	10000 (8 hourly mean)	-
Benzene	-	-	5

CONSTRUCTION PHASE

8.3.24. Dispersion modelling was undertaken for the assessment of the construction phase of the Project. The maximum 24 hour (Figure 8-2) and annual concentrations of PM_{10} due to construction activities were calculated. Contours of the 90.4th percentile of PM_{10} concentrations are shown in Figure 8-3. These indicate that concentrations exceed the AQLV 2% of the time (14 days in two years).

8.3.25. A summary of the maximum gridded results is shown in Table 8-7. It should be highlighted that maximum 24 hour concentrations are only reached once in the studied period. The concentrations shown in the figures are not simultaneous.

Table 8-7 - Expected peak concentrations of PM_{10} during construction period (construction activities only)

Average period	Background ($\mu g/m^3$) – based on averages (Table 8.1)	AQLV ($\mu g/m^3$)	Peak concentration Construction activities only ($\mu g/m^3$)	UTM coordinates	
				X	Y
24 h	40	50	294.7	497250	4605500
Annual (2020)	40	40	70.9	497250	4604500

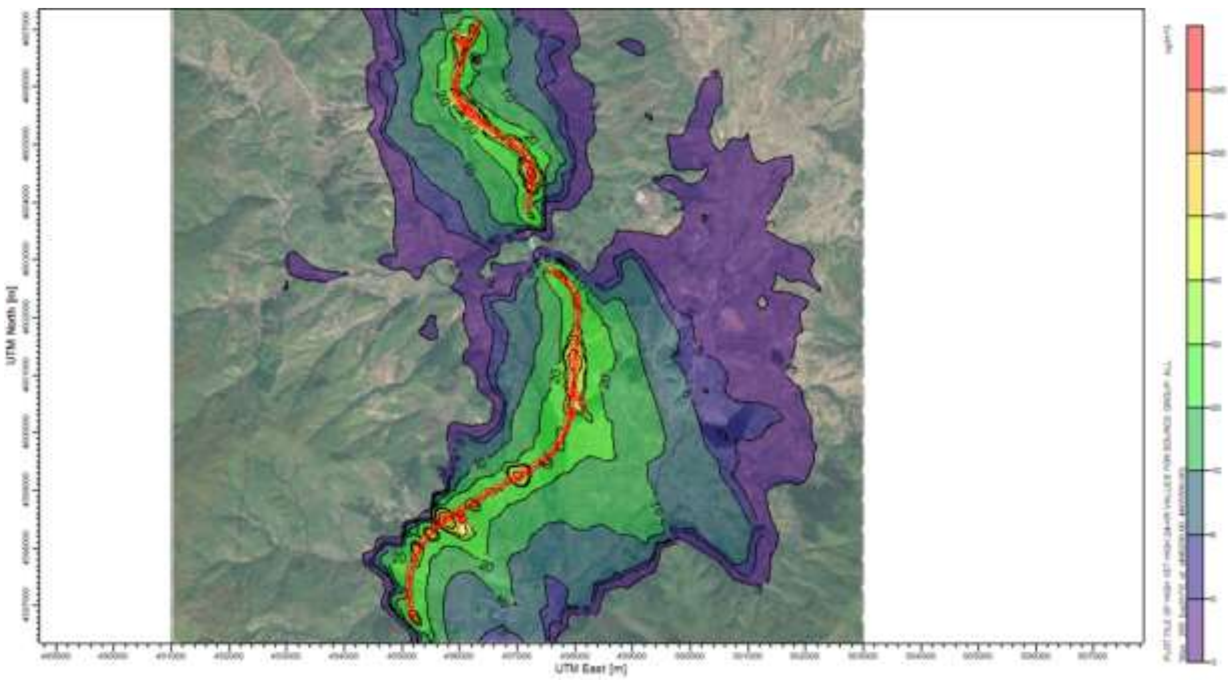

Figure 8-2 - Maximum 24 hour concentrations of PM_{10} associated with the construction phase activities

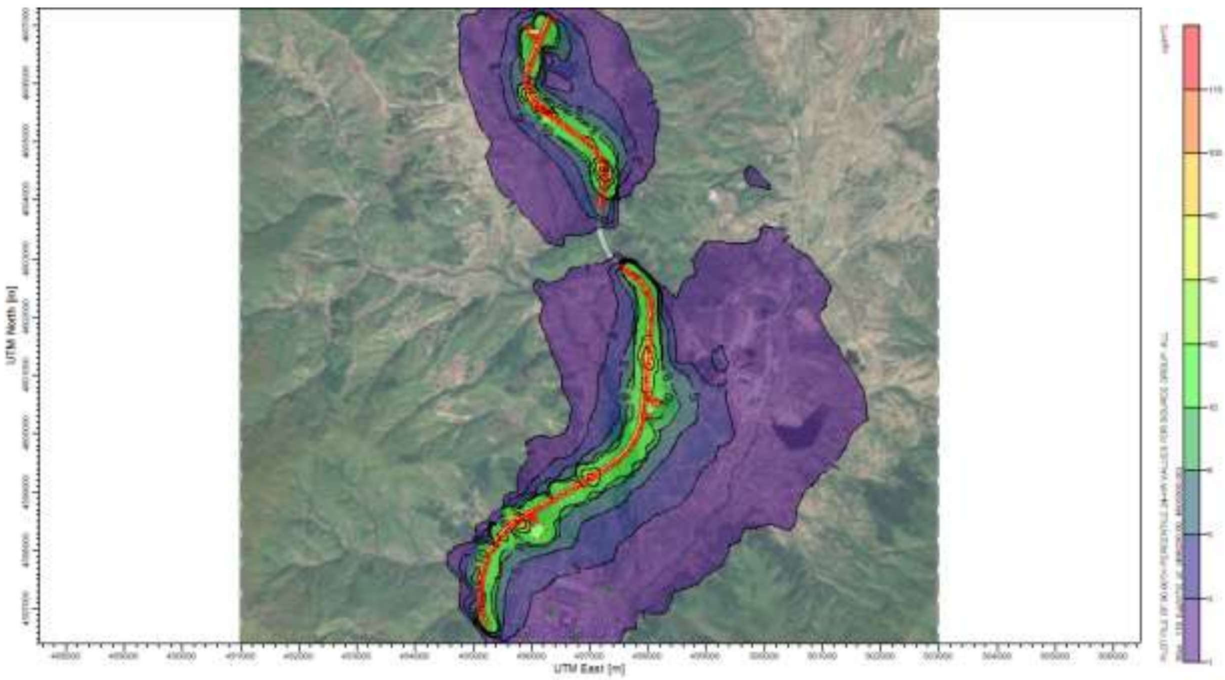

Figure 8-3 - Contours of 90th percentile of PM_{10} concentration due to the motorway construction (construction activities only)

8.3.26. Table 8-8 below presents the predicted 24 hour and annual mean PM_{10} concentrations at the five sensitive receptor locations. The predicted concentrations remain below the 24 hour AQLV at all five receptors, with the greatest 24 hour mean PM_{10} concentrations predicted at the Mosque. Due to the high background concentration, the annual mean PM_{10} AQVL is marginally exceeded at all considered receptors. The Military Barracks is predicted to experience the greatest increase in annual mean PM_{10} concentrations.

Table 8-8 - Expected peak concentrations of PM_{10} during construction period at sensitive locations

Averaging Period	ID	Settlement	Concentrations (µg/m³)			UTM Coordinates (m)	
			Background – based on averages (Table 8.1)	AQLV	Peak (Construction only)	X	Y
24 HR	Primary School	Kichevo	40	50	5.50	496450	4596350
24 HR	Mosque	Kichevo	40	50	7.98	495921	4596534
24 HR	University	Kichevo	40	50	5.56	496790	4596510
24 HR	Military barracks	Kichevo	40	50	7.03	496320	4596910
24 HR	Sports Centre	Kichevo	40	50	6.60	497320	4597330
ANNUAL	Primary School	Kichevo	40	40	0.65	496450	4596350
ANNUAL	Mosque	Kichevo	40	40	0.92	495921	4596534
ANNUAL	University	Kichevo	40	40	0.66	496790	4596510
ANNUAL	Military barracks	Kichevo	40	40	0.93	496320	4596910
ANNUAL	Sports Centre	Kichevo	40	40	0.84	497320	4597330
24 HR 90^{th} Percentile	Primary School	Kichevo	40	50	1.84	496450	4596350
24 HR 90^{th} Percentile	Mosque	Kichevo	40	50	2.29	495921	4596534
24 HR 90^{th} Percentile	University	Kichevo	40	50	1.77	496790	4596510
24 HR 90^{th} Percentile	Military barracks	Kichevo	40	50	2.39	496320	4596910
24 HR 90^{th} Percentile	Sports Centre	Kichevo	40	50	2.13	497320	4597330

8.3.27. The results indicate that significant increase of PM_{10} concentration in the air will be limited to the construction site only during the construction phase. Table 8.8 shows minor increase of PM_{10} at the sensitive receptors with a highest value of less than 8 $\mu g/m^3$.

8.3.28. Given the high background concentration for the pollutant and potential uncertainties in meteorological data, emission factors and variability of emission rates, the AQLVs may be breached occasionally, especially during autumn and winter.

MAGNITUDE AND SEVERITY OF IMPACTS

8.3.29. Based on the above, the magnitude of the impact is assessed as minor (see Table 8-9).

Table 8-9 - Estimation of the magnitude of the impact – Construction Phase

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Adverse	Air quality limit values may be breached. However, impacts will be local and short-term. Highest concentrations are anticipated to be within the construction site.
Type of Impact	Direct/Cumulative	Particulate matter and combustion gases are generated by the construction activities (engaged machinery and vehicles)
Reversibility	Reversible	Air pollutant concentrations will reduce when construction works are complete
Geographic Extent	Local	This impact will be localised within the motorway construction footprint, and adjacent areas. Maximum 24 hour PM_{10} levels above 50mg/m^3 are limited to 70m from the centerline of the Project.
Time when the impact occurs	Immediate	Once construction commences, emissions of particulate matter and those associated with construction machinery and vehicles will be generated
Duration	Short-term	These emissions will stop with the completion of the construction works
Likelihood of appearance	Certain	Emission of combustion gases and particulate matter are inevitable due to the construction machinery and the construction activities
Magnitude	**Minor**	Explained in the text above

SIGNIFICANCE OF EFFECT

8.3.30. The magnitude of the impact will be Minor adverse, and receptors are considered to be up to High sensitivity. The significance of the effect, in the absence of mitigation will be Moderate (significant). Construction phase mitigation in the form of an Air Quality Management Plan (as outlined in Chapter 23 – ESMP) will be applied to manage effects to acceptable levels.

OPERATION PHASE

8.3.31. During the operational phase, there is the potential for air pollutants to arise due to the changes in vehicle emissions associated with the Project. The pollutants considered in the operational phase assessment are particulate matter (PM_{10} and $PM_{2.5}$), CO and NO_2. Details of the inputs to the model are provided in Appendix 8-1.

8.3.32. For particulate matter (PM_{10} and $PM_{2.5}$) the 24 hour and annual average concentrations were modelled for both ‘without the Project’ and ‘with the Project’ scenarios (2023 and 2040). The results show that in the ‘without Project’ scenario PM_{10} and $PM_{2.5}$ concentrations are higher compared to the ‘with Project’ scenario. This is in part due to the Project moving the motorway alignment away from most of the dwellings.

8.3.33. The predicted concentrations remain below the 24 hour AQLV at all considered receptors, with the greatest 24 hour mean PM_{10} concentrations predicted at an existing residential dwelling in the ‘without Project’ 2040 scenario. Due to the high 2023 background concentration, the annual mean PM_{10} AQVL is marginally exceeded at all considered receptors within both the 2023 scenarios. Again, an existing residential dwelling is predicted to experience the highest annual mean PM_{10} concentration in the 2023 ‘without Project’ scenario.

8.3.34. The greatest change in 24 hour (90th Percentile) and annual mean PM_{10} concentrations associated with the Project is predicted at the Military Barracks in both the 2024 and 2040 scenarios. Whilst the Mosque at Kichevo is anticipated to experience the greatest change in maximum 24 hour mean PM_{10} concentrations.

8.3.35. Figure 8-4 and Figure 8-5 show the predicted annual mean PM_{10} concentrations in the 2023 ‘without’ and ‘with’ project scenarios.

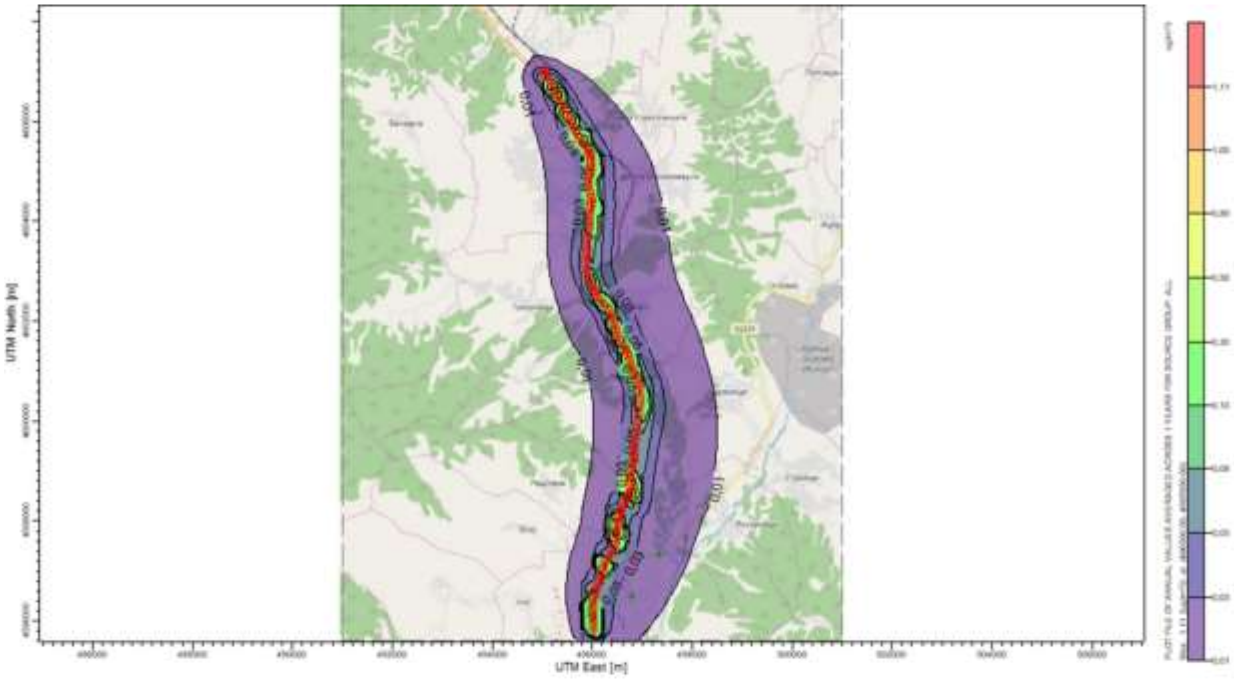

Figure 8-4 - Contours of average annual PM10 concentrations in 2023 – Without Project (Traffic only)

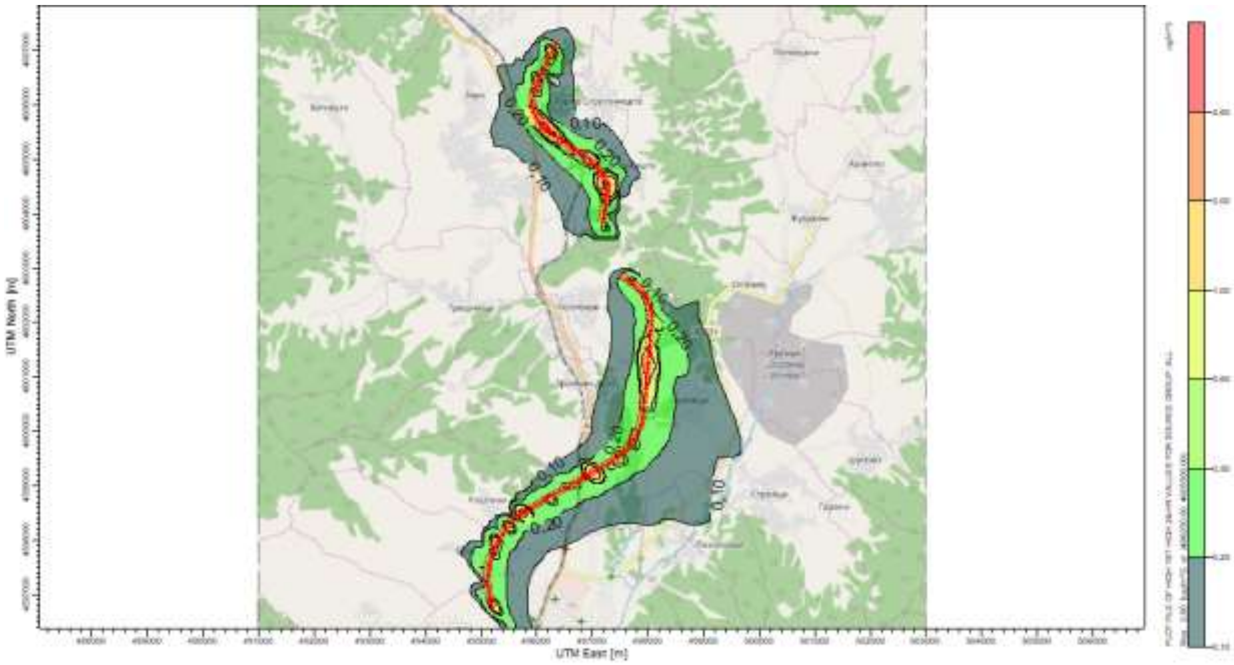

Figure 8-5 - Contours of average annual PM10 concentrations in 2023 – With Project (Traffic only)

8.3.36. Predicted concentrations of CO also show a decrease at sensitive receptor locations in the 'with Project' scenario compared to the 'without Project' scenario. Moreover, the calculated ground level concentrations of CO are well below AQLV for this pollutant and therefore impacts are considered to be negligible.

8.3.37. Similarly, to the pollutants discussed above, the NO_2 results indicate a decrease in concentrations at all existing sensitive receptors in the 'with Project' scenarios compared to the 'without Project' scenarios (Figure 8-6, Figure 8-7 and Table 8-10). The predicted 1 hour and annual mean NO_2 concentrations both in the 'without' and 'with Project' scenarios are below the relevant air quality limit values at all modelled receptors. However, hourly mean NO_2 concentrations are close to the AQLV at two existing residential dwellings in the 'without Project' scenario.

8.3.38. Figure 8-6, Figure 8-7 illustrate the predicted annual mean NO_2 concentrations in the 2023 'without' and 'with' scheme scenarios. Table 8-10 shows the hourly and annual mean NO_2 concentrations at the considered sensitive receptors for the 2023 opening year scenario.

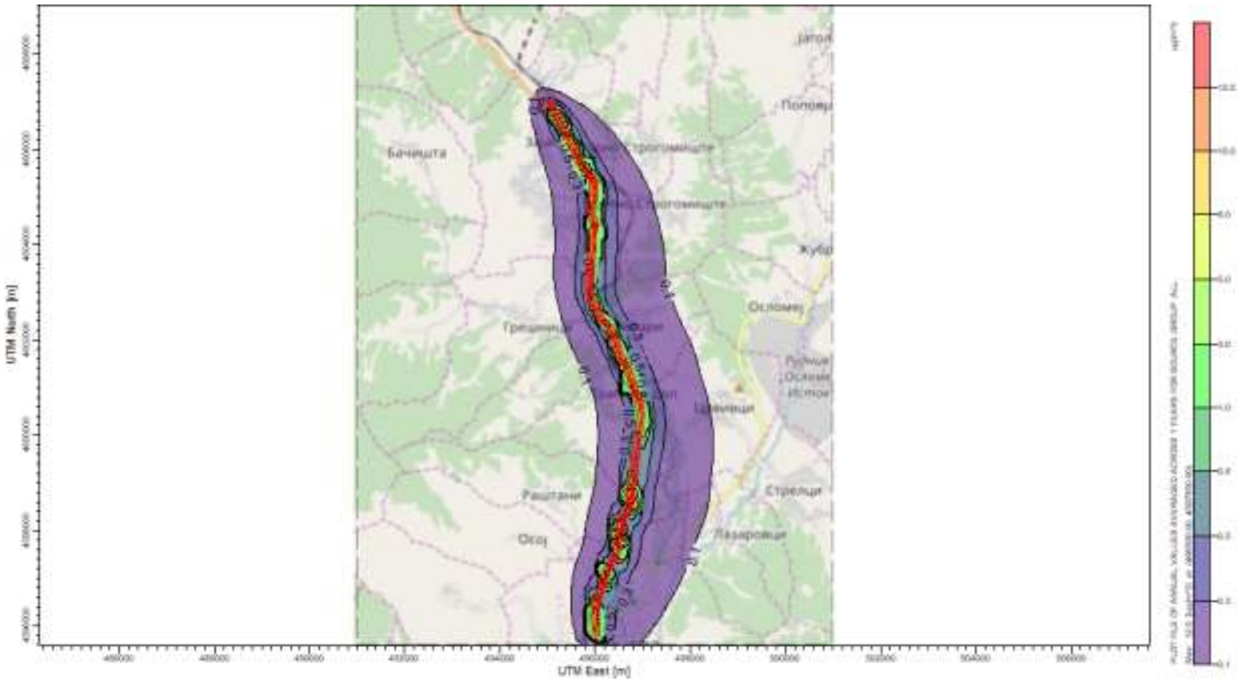

Figure 8-6 - Contours of average annual concentrations of NO2 for 2023 - Without Project scenario (Traffic only)

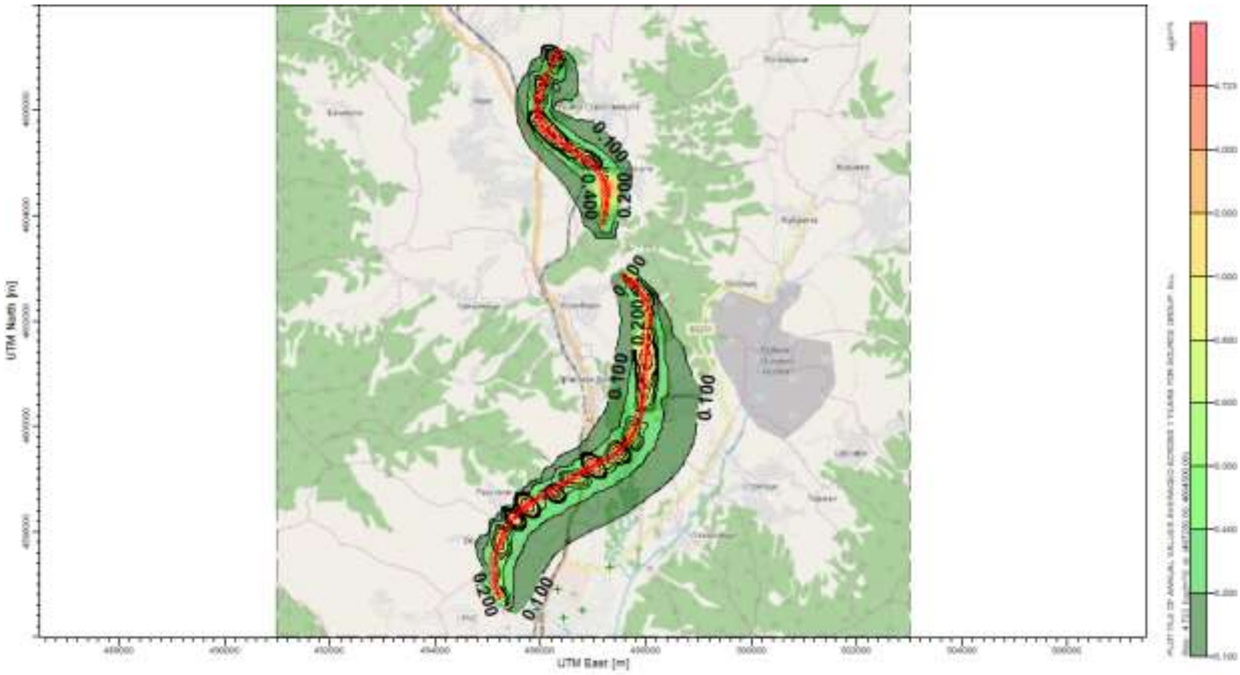

Figure 8-7 - Contours of average annual concentrations of NO2 for 2023 - With Project scenario (Traffic only)

Table 8-10 - NO_2 sensitive receptor summary for the opening year (2023)

Averaging Period	ID	Location	Concentrations (µg/m³)				UTM Coordinates (m)	
			Background – based on averages (Table 8.1)	AQLV	Peak (Traffic only) Without Project	Peak (Traffic Only) With Project	X	Y
1 h (Max)	School	Kichevo	23.6	200	10.48	4.67	496450	4596350
1 h (Max)	Mosque	Kichevo	23.6	200	26.88	4.70	495921	4596534
1 h (Max)	University	Kichevo	23.6	200	6.51	5.47	496790	4596510
1 h (Max)	Military Barracks	Kichevo	23.6	200	41.74	5.47	496320	4596910
1 h (Max)	Sports Centre	Kichevo	23.6	200	11.49	6.49	497320	4597330
1 h (Max)	House	Zajas	23.6	200	147.36	-	495852	4605509
1 h (Max)	House	Zajas	23.6	200	114.20	-	495797	4605571
1 h (Max)	Mosque	Kolibari	23.6	200	108.95	-	496428	4601896
1 h (Max)	House	Trapchin Dol	23.6	200	176.01	-	496608	4601490
1 h (Max)	House	Trapchin Dol	23.6	200	192.88	-	496637	4601465
1 h (Max)	House	Kichevo	23.6	200	117.66	-	496784	4601039
1 h (Max)	House	Kichevo	23.6	200	151.74	-	496886	4600879
Annual	School	Kichevo	23.6	40	0.22	0.05	496450	4596350
Annual	Mosque	Kichevo	23.6	40	0.37	0.08	495921	4596534
Annual	University	Kichevo	23.6	40	0.15	0.05	496790	4596510
Annual	Military Barracks	Kichevo	23.6	40	0.55	0.08	496320	4596910
Annual	Sports Centre	Kichevo	23.6	40	0.13	0.06	497320	4597330
Annual	House	Zajas	23.6	40	4.82	-	495852	4605509

Averaging Period	ID	Location	Concentrations (µg/m^3)				UTM Coordinates (m)	
			Background – based on averages (Table 8.1)	AQLV	Peak (Traffic only) Without Project	Peak (Traffic Only) With Project	X	Y
Annual	House	Zajas	23.6	40	4.05	-	495797	4605571
Annual	Mosque	Kolibari	23.6	40	2.53	-	496428	4601896
Annual	House	Trapchin Dol	23.6	40	2.40	-	496608	4601490
Annual	House	Trapchin Dol	23.6	40	2.85	-	496637	4601465
Annual	House	Kichevo	23.6	40	2.59	-	496784	4601039
Annual	House	Kichevo	23.6	40	3.67	-	496886	4600879
1 h (99.8th percentile)	School	Kichevo	23.6	200	5.12	2.34	496450	4596350
1 h (99.8th percentile)	Mosque	Kichevo	23.6	200	96.85	3.09	495921	4596534
1 h (99.8th percentile)	University	Kichevo	23.6	200	88.89	2.11	496790	4596510
1 h (99.8th percentile)	Military Barracks	Kichevo	23.6	200	50.24	2.75	496320	4596910
1 h (99.8th percentile)	Sports Centre	Kichevo	23.6	200	52.07	2.11	497320	4597330
1 h (99.8th percentile)	House	Zajas	23.6	200	67.32	-	495852	4605509
1 h (99.8th percentile)	House	Zajas	23.6	200	53.49	-	495797	4605571
1 h (99.8th percentile)	Mosque	Kolibari	23.6	200	82.02	-	496428	4601896
1 h (99.8th percentile)	House	Trapchin Dol	23.6	200	5.12	-	496608	4601490
1 h (99.8th percentile)	House	Trapchin Dol	23.6	200	96.85	-	496637	4601465
1 h (99.8th percentile)	House	Kichevo	23.6	200	88.89	-	496784	4601039
1 h (99.8th percentile)	House	Kichevo	23.6	200	50.24	-	496886	4600879

MAGNITUDE AND SEVERITY OF IMPACTS

8.3.39. The greatest change in hourly mean NO_2 concentrations is predicted at the Military Barracks, in both the 2023 and 2040 scenarios. However, the Mosque is anticipated to experience the largest change in hourly mean NO^2 concentrations in the 2023 scenario.

8.3.40. A small number of receptors near Zajas and in Dolno Strogomishte are expected to experience an increased 24 hour NO_2 concentration in the air due to the vicinity of the Project. Predicted hourly concentrations, however, are within the range of 0.4 to 6μg/m^3.The increase of 6μg/m^3 against a predicted background concentration of 23.6μg/m^3 will be within the Macedonian thresholds (set out in O.G.RM No.50/05) of the 200μg/m^3.

8.3.41. With the changes in road alignment due to the Project, the most affected sensitive receptors close to the existing road will no longer be exposed to high concentrations of pollutants.

8.3.42. Based on the above, the magnitude of impact and likely significant effects is estimated in Table 8-11 below.

Table 8-11 - Estimation of the magnitude of the impact – Operational Traffic Emissions

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Beneficial	Due to the change in motorway alignment, the road source will be further from the sensitive receptors and therefore pollutant concentrations are anticipated to decrease.
Type of Impact	Direct	Combustion gases are generated by the use of fuel powered vehicles for transportation
Reversibility	Irreversible	Air pollution, if not severe, can be managed towards the natural conditions along the motorway section.
Geographic Extent	Local	This impact will be localised along the motorway footprint. More details given in the dispersion model (see Appendix 8-1)
Time when the impact occurs	Immediate	The emission of combustion air pollutants is initiated with the use of vehicles for transportation
Duration	Long-term	These emissions will be present during the operation of the motorway.
Likelihood of appearance	Certain	Emission of combustion gasses are an inevitable result of the work of fuel powered vehicles
Magnitude	**Minor**	Explained in the text above

SIGNIFICANCE OF EFFECTS

8.3.43. The magnitude of the impact is minor, and the sensitivity of the receptor is considered to be high. The effect, in the absence of mitigation is assessed as Slight Beneficial. For a small number of dwellings in Dolno Strogomishte, that are close to the Project, the effects may be considered as Slight Adverse. As outlined in Chapter 23 – ESMP, an Operational Air Quality Management Plan will be implemented to manage air quality effects to acceptable levels.

8.3.44. Further detail of the predicted results and figures are given in the Air Dispersion Modelling Report in the Appendix 8-1.

8.4 SUMMARY OF EFFECTS

8.4.1. The summary of the impacts (the significance of effects) on air quality are given below.

- Construction phase
  - **Minor adverse** impact due to increases of PM10 associated with construction phase activities and vehicle emissions associated with construction plant and traffic. This effect is anticipated to be direct, short-term and reversible. The effects will be immediate and localised, with the greatest effects experienced closest to the construction site – the effect will be **Moderate adverse** (**significant**) ;
- Operational phase
  - **Minor beneficial** impact due to reduction in pollutant concentrations (PM_{10}, $PM_{2.5}$, CO and NO_2) as a result of the operational phase of the Project. This effect is anticipated to be direct, irreversible and long-term in nature. The effects will be **Slight beneficial (not significant)**. Receptors that are currently far from the existing A2 and will be in close proximity to the Project are **anticipated** to be subject to a **Slight Adverse (not significant)** effect.

8.5 MITIGATION

CONSTRUCTION PHASE

8.5.1. Mitigation will be considered during the preliminary stage and project design preparation to maximise effectiveness.

8.5.2. The following plans will be prepared by the Contractor before the start of the construction activity:

- Air Quality Management Plan (including Air Quality Control plan for the tunnel); and
- Construction Traffic Management Plan.

8.5.3. The Air Quality Management Plan will address but not be limited to the following:

- Hoarding/temporary fencing to be constructed around the construction sites to reduce the spread of dust and particulate matter, where sensitive receptors are located nearby;
- Accesses and construction sites should be kept moist to reduce dust formation. Water sprays to be implemented during drilling and excavation activities. It is recommended that water spraying is undertaken a minimum of three times per day;
- During dry weather conditions, water spraying will be increased;
- Dust-generating activities to be slowed down or ceased on days of strong wind;
- In windy and dry conditions, earth stock piles to be moistened to prevent the distribution of dust particles;

- As soon as a surface is no longer in use or is finished it should be vegetated to prevent dust emissions;
- Particular care should be paid to watering after the vegetation is replanted to ensure that it does not die-off,'
- The surface should be moistened during loading and unloading of aggregates in trucks;
- Intense spraying should be carefully monitored to avoid land erosion;
- Truck dumpers carrying dusty materials to be covered with tarpaulin cloth;
- Work areas should be large enough to allow storage of the excavated tunnel material, access of trucks and truck loading operations; and
- The tunnel should be ventilated during the excavation works, using particulate filters, which need to be regularly maintained.

8.5.4. The Construction Traffic Management Plan should include, but not be limited to the following mitigation measures:

- Vehicles and construction machinery must be properly maintained and strictly comply with relevant emission standards;
- No unnecessary idling and no excess numbers of construction vehicles at the construction sites;
- Construction truck traffic will be optimised so as to get a minimum number of trucks carrying the maximum volume of materials;
- The truck routes should be planned to avoid peak traffic hours or routes with heavy traffic; and,
- Delivery and removal of material (regarding time and routes) at the construction site should be defined before the start of the construction activities or planned ahead, records of which should be kept.

8.5.5. The mitigation measures during the Construction phase include the full implementation of the Dust Management Plan and the Construction Traffic Management Plan.

OPERATIONAL PHASE

8.5.6. An Operational Air Quality Management Plan will be prepared and implemented during the operation of the Project. Regular monitoring will take place at sensitive receptors and in response to grievances raised as part of the Operational Stakeholder Engagement Plan.

8.5.7. Air quality will be a key consideration in the Tunnel Operational Management Plan which will be prepared prior to the start of operation. The plan will include measures for the following:

- Maintain ventilation.
- Provide firefighting equipment and other facilities.
- Ensure tunnel staff are adequately trained in case of emergencies, including rescue, recovery and prevention of access to additional vehicles.
- Ensure the tunnel is cleaned regularly.
- Ensure that exit doors to the gallery and the passages are not blocked.

8.6 RESIDUAL EFFECTS

CONSTRUCTION PHASE

8.6.1. The likely significance of effects for construction phase impacts without mitigation measures was estimated to be Minor adverse. Following the implementation of the mitigation measures outlined above, the magnitude of the residual effect is estimated to be Slight adverse to Neutral (not significant).

OPERATIONAL PHASE

8.6.2. The significance of this impact without mitigation measures was estimated to be Minor beneficial for the majority of receptors but Slight Adverse for a small number of receptors in close proximity to the Project. Mitigation in the form of Operational Air Quality Management Plan, the Operational Stakeholder Engagement Plan and Tunnel Operational Management Plan will mitigate the effects to Slight beneficial to Neutral (not significant).

8.7 SUMMARY

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Air Quality	Construction	Construction Emissions	Moderate adverse (significant)	Construction Air Quality Management Plan Construction Traffic Management Plan	Slight adverse (not significant)
	Operation	Traffic Emissions	Slight beneficial (not significant) and Slight adverse (not significant)	Operational Air Quality Management Plan Tunnel Operational Management Plan Operational Stakeholder Engagement Plan	Slight beneficial (not significant) to Neutral

9 CLIMATE

9.1.1. This chapter assesses the greenhouse gas emissions as a result of the construction and operation of the Project; this is covered in Sections 9.1 to 9.5. The resilience of the Project to changes in climate are addressed in Sections 9.6 to 9.8.

9.2 GREENHOUSE GASES

BASELINE CONDITIONS

9.2.1. The 'Do Minimum' (baseline) scenario involves no construction activities and therefore the construction baseline is zero emissions.

9.2.2. Total end-user baseline GHG emissions are presented in Table 9.1 for the year 2025 (the first operational year of the Project) and the latest future modelled year 2040. In addition, the average annual and total GHG emissions from 2025 to 2084 are presented for comparison with the 60-year operational period of the Project.

Table 9-1 - Baseline GHG Emissions Data for End-User Traffic covering the existing A2 as well as local road networks in the surrounding area of the Project

Scenario	Total GHG emissions for traffic (Thousand tonnes of carbon dioxide; tCO_2)			
	2025 (operational year)	2040 (future year)	Average per year (2025-2084)	Total (2025-2084)
Baseline ('Do Minimum')	2,934	5,332	4,970	298,215

9.2.3. The operation and management of the existing assets under the baseline scenario are likely to require a small number of components (for example signage) as well as some bulk materials (asphalt and concrete) for minor works and routine repairs. These materials will have embodied emissions associated with them, and the installation of these materials will result in emissions due to the transport of these materials and plant use. These baseline emissions are expected to be small, and as such are not quantified.

9.3 POTENTIAL IMPACTS AND EFFECTS

SCOPE OF ASSESSMENT

9.3.1. This assessment has taken into account relevant current legislation, policy and guidance, including the EIA Directive 2014/52/EU[31], the EBRD Protocol for Assessment of Greenhouse Gas Emissions[32] and the EBRD Green Economy Transition Handbook[33]. The assessment of significance of GHG emissions has been established through professional judgement informed by guidance from IEMA[34].

9.3.2. Elements shown in Table 9.2 are not considered to give rise to a large magnitude of emissions as a result of the Project and have therefore not been included in this assessment.

Table 9-2 - Elements Scoped Out of the Assessment

Element Scoped out	Justification
Construction	
Disposal of waste	Emissions from the disposal of waste are unlikely to be large and material waste is expected to largely be inert.
Operation	
Maintenance, repair, replacement, refurbishment	Maintenance, repair, replacement and refurbishment associated with the Project are not expected to be large emissions sources
Ventilation	Emissions from power consumption for tunnel ventilation is not expected to be large emissions source
Land Use Change	Minimal emissions from the net loss of forested areas is expected due to the Project
End of Life	
Decommissioning process	Expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of

[31] Directive 2014/52/EU ;https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052
[32] EBRD (2017) https://www.ebrd.com/documents/admin/ebrd-protocol-for-assessment-of-greenhouse-gas-emissions.pdf
[33] EBRD (2019). Green Economy Transition Handbook.
[34] Institute of Environmental Management and Assessment (2017) EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance https://www.iema.net/assets/newbuild/documents/IEMA%20GHG%20in%20EIA%20Guidance%20Document%20V4.pdf (Accessed 30/09/19).

Element Scoped out	Justification
Transport and disposal of materials	emissions activity to determine their likely magnitude, even if they take place at all. As such these emissions sources will not be considered.

9.3.3. The elements shown in Table9-3 are considered to have the potential to give rise to significant effects during the construction and operation of the Project and have therefore been considered within this chapter.

Table 9-3 - Elements Scoped into the Assessment

Lifecycle Stage	Potential Sources of Emissions
Construction	
Product stage; including raw material supply, transport and manufacture	Embodied emissions associated with extraction and manufacturing of the required raw materials.
Construction process stage; including transport to/from works site and construction/installation processes.	Activities of organisations conducting construction and landscaping work, including fuel/energy consumption by delivery of materials, transportation of waste and construction plant emissions.
Operation	
Use of the infrastructure by the end-user	End-user emissions from using of the road
Lighting	Emissions from lighting the Project

EXTENT OF THE STUDY AREA

9.3.4. The GHG assessment is not restricted by geographical area, but instead includes any increase or decrease in emissions as a result of the Project, wherever that may be. This includes:

- Construction emissions from the Project footprint, together with emissions related to the transport of materials to and from the site and their manufacture (this may be distant from the Project location (for example emissions for manufacture of steel); and
- Operational emissions (increase or reduction in emissions) which result from the end-use of the Project and any shifts in transport modes/patterns which may occur. Such emissions include those for traffic using the Project as well as the surrounding regional road network to gain access.

ASSUMPTIONS AND LIMITATIONS

- Type and quantities of material and transport information provided at this stage are indicative and will be refined as the design of the Project is finalised. Data have been provided by the Design Team, based on the current design for the Project.
- For the construction assessment, an industry average emission rate has been used to estimate the construction plant emissions, due to a lack of information on the construction activities (vehicles types, run hours, generator use, electricity consumption etc.).
- There is currently no specific guidance or carbon emissions thresholds, which, if exceeded, are considered significant.
- It has been assumed that all road lighting will operate for 20 hours per day
- The lifespan of the Project is assumed to be 60 years
- In order to estimate emissions from end-user traffic assumed speeds were applied (70kph for the Do Minimum and 100kph for the Do Something)
- End-user traffic emissions are based on traffic moving to the road from the replaced road. Impacts to the rest of the network or new vehicles being incentivised onto the road were not considered in the assessment.
- The construction phase is over 4 years

SIGNIFICANCE CRITERIA

9.3.5. There are currently no agreed thresholds for what level of GHG emissions is considered significant for ESIA. The significance of GHG emissions is assigned with reference to the magnitude of emissions, their context, guidance from IEMA[35], and the use of professional judgement. The criteria used is consistent with the EBRD Protocol for Assessment of Greenhouse Gas Emissions.

9.3.6. As climate change impacts are global in nature, it is not possible to link a specific project, with a specific environmental impact. As such, significance of GHG emissions have been put into context using North Macedonia regional emissions data.

9.3.7. The most up to date annual national GHG emissions inventory for North Macedonia is presented in Table 9.4 for context[36].

Table 9-4 - National Emissions Context

North Macedonia Emissions	KtCO2e/year
Total National Emissions	12204.3
Transport Emissions (8.2% of Total National Emissions)	976.344

[35] IEMA (2017) EIA Guide to Assessing GHG Emissions and Evaluating Their Significance https://www.iema.net/assets/newbuild/documents/IEMA%20GHG%20in%20EIA%20Guidance%20Document%20V4.pdf
[36] Second Biannual Report on Climate Changes of the Republic of Macedonia (2017), Ministry of Environment & Physical Planning https://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/application/pdf/macedonian_sbur_eng_%5B_preview_%5D.pdf

CALCULATION METHODOLOGY

9.3.8. The assessment approach considers the likely magnitude of anticipated GHG emissions (or avoided emissions) due to the Project, in comparison with the baseline scenario without the Project.

9.3.9. To quantify the embodied emissions, materials data (for example the type and quantity of materials) was sourced from the design team. The quantity of materials were multiplied by emissions factor data, sourced from publicly available sources, including CESMM4[37], and ICEv3[38]. Emissions for transport of construction material were calculated using a GHG Protocol[39] global emissions factor.

9.3.10. To estimate the emissions as a result of transporting materials to site, the expected mass of materials was multiplied by transport distance assumptions provided by RICS (Royal Institution of Chartered Surveyors, 2017)[40], resulting in tonne kilometres (a unit representing a tonne travelling one kilometre). The tonne kilometres were then multiplied by an appropriate GHG Protocol[41] global emissions factors.

9.3.11. In the absence of information about the construction plant, such as the types of machinery and fuels to be used, the construction plant emissions have been estimated using best practice methods from RICS (2017).

9.3.12. The emissions from the clearance of forest and roots were calculated by multiplying the cleared area (ha) by a CESMM4 emissions factor.

9.3.13. End-user vehicle emissions were quantified using the Greenhouse Gas Protocol global emission factors for on-road diesel and petrol and the Association of Issuing Bodies (AIB) European Residual Mixes42 emission factor for electricity as there are no country-specific emission factors for North Macedonia. The calculation took into account the fuel type of vehicles and fuel consumption parameters using UK WebTAG data[43] from the Department of Transport, as there is no forecast fuel consumption parameters data publicly available for North Macedonia. The calculation includes the ‘do-minimum’ and ‘do-something’ total GHG emissions for all vehicles covered by the traffic model.

9.3.14. The construction and operational phase emissions were compared with the North Macedonia national and transport emissions.

9.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

9.4.1. Construction emissions due to the Project are presented in Table 9.5.

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[37] CESMM4: Civil Engineering Standard Method of Measurement
[38] http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#.XalxuihKhPY
[39] GHG Protocol (2015) https://ghgprotocol.org/calculation-tools#country_specific_tools_id
[40] RICS (2017) https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf
[41] GHG Protocol (2015) https://ghgprotocol.org/calculation-tools#country_specific_tools_id
[42]AIB (2018) European Residual Mixes
[43] HM Government (2019) Tag Data Book [Link]

Table 9-5 - Construction Phase Emissions

Material	Embodied Emissions (tCO_2e)	Transport to Site (tCO_2)	Total (tCO_2e)
Aggregate (Excavation)	9,196	-	9,196
Earthworks	713	3,960	4,673
Concrete	1,429	625	2,054
PVC	117	2	119
Soil	2	10	12
Geotextiles	48	2,099	2,146
Aggregate (Construction)	16,176	1,563	17,339
Emulsion (for bitumen)	982	2	984
Asphalt	6,375	5,197	11,572
Tree Clearance	30	-	33
Total (tCO_2e)	35,069	13,458	**48,529**

9.4.2. Due to the limited information currently available on the Project's construction plant, the GHG emissions arising from the construction activities have been estimated using an average construction site emission factor taken from the RICS (2017). The emission factor is an average emission rate relative to the value of a construction project and it has been applied to the total estimated value of the Project. Total emissions from the construction plant are estimated to be 232 tCO2e.

SIGNIFICANCE OF EFFECT – CONSTRUCTION PHASE

9.4.3. The emissions reported in Tables 9.6 have been placed into the context of North Macedonia's national emissions and the quantity of those national emissions that are attributed to transport.

Table 9-6 - Construction Phase Emissions Context

Emissions Sector	Macedonian Emissions (KtCO2e/ 4 years)	Project Construction Emissions (KtCO2e/ 4 years)
Total National Emissions	48,817	44.8 (+0.09%)
Transport Emissions (8.2% of Total National Emissions)	3,905	44.8 (+1.24%)

9.4.4. The Pre-mitigation effect of the construction of the Project on climate change is minor significant.

OPERATIONAL PHASE

9.4.5. Total anticipated end-user GHG emissions are presented in Table 9.7 for the opening year, the latest forecast year and the lifespan of the Project.

Table 9-7 - End-User Emissions

Scenario	Total GHG emissions for traffic (Thousand tonnes of carbon dioxide equivalent; tCO_2)			
	2025 (operational year)	2040 (future year)	Average per year (2025-2084)	Total (2025-2084)
Baseline ('Do Minimum')	2,934	5,332	4,970	298,215
Project ('Do Something')	3,253	5,867	5,473	328,384
Difference	319	536	456	30,169

9.4.6. The anticipated emissions from operational lighting are presented in Table 9.8.

Table 9-8 - Operational Lighting Emissions

Annual Lighting Emissions (tCO_2)	Total Lifespan Lighting Emissions (tCO_2)
195	11,685

SIGNIFICANCE OF EFFECT – OPERATIONAL PHASE

9.4.7. The emissions reported in Tables 9.9 have been placed into the context of North Macedonia’s national emissions and North Macedonia emissions that are attributed to transport

Table 9-9 - Operational Phase Emissions Context

Emissions Sector	Macedonia Emissions (KtCO2e/ year)	Project Operational Emissions (KtCO2e/ year)
Total National Emissions	12,204	0.7 (+0.01%)
Transport Emissions (8.2% of Total National Emissions)	976	0.7 (+0.07%)

9.4.8. Based on the design and transport information that was made available, the pre-mitigation effect of the Project on climate change is Minor significant.

9.5 MITIGATION

CONSTRUCTION

9.5.1. It is recommended that the following measures are considered:

- Design optimisation to reflect the carbon reduction hierarchy;
  - Reduce the elements required for the Project;
  - Reduce the requirement for construction materials;
  - Substitute construction materials for lower-carbon alternatives (e.g. low temperature asphalt/ with a lower bitumen content)
  - Use efficient construction processes, such as design for manufacture and assembly.
- As far as possible, incorporating material resource efficiency and waste minimisation best practice into design.
- Select and engage with material suppliers and construction contractors taking into account their policies and commitments to reduction of GHG emissions, including embodied emission in materials.
- Prepare and implement a Materials and Waste Management Plan (MWMP).
- Minimise energy consumption including fuel usage by, for example, minimising plant use, idling and specifying efficient plant (or hybrid or electric plant).
- Maximise the local sourcing of materials and the use of local waste management facilities.

OPERATION

- Operate, maintain and refurbish the Project using best-practice efficient approaches and equipment
- Lighting with be optimized (energy-efficient lighting) will be specified at the detailed design stage.

9.6 RESIDUAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

9.6.1. The mitigation outlined above is expected to reduce GHG emissions due to construction of the Project. The Pre-mitigation effect of the Project is minor significant, and the residual effect of construction is also minor significant.

OPERATIONAL PHASE

9.6.2. The mitigation outlined above is expected to reduce GHG emissions due to operation of the Project. Based on the design and transport information that was made available, the pre-mitigation effect of the Project is minor significant, and the residual effect of operation is also minor significant.

9.7 CLIMATE RESILIENCE

BASELINE CONDITIONS

Current Conditions

9.7.1. Information on the current climate of North Macedonia has been obtained from the World Bank Climate Change Knowledge Portal and the Climate Resilience Design Guidelines for the PESR[44.] The Republic of North Macedonia has a diverse climate with a number of climatic regions (see Figure 9.1). The region of Kichevo is influenced by the continental and mountain climate (see Figure 9.2).

[44] http://www.roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads

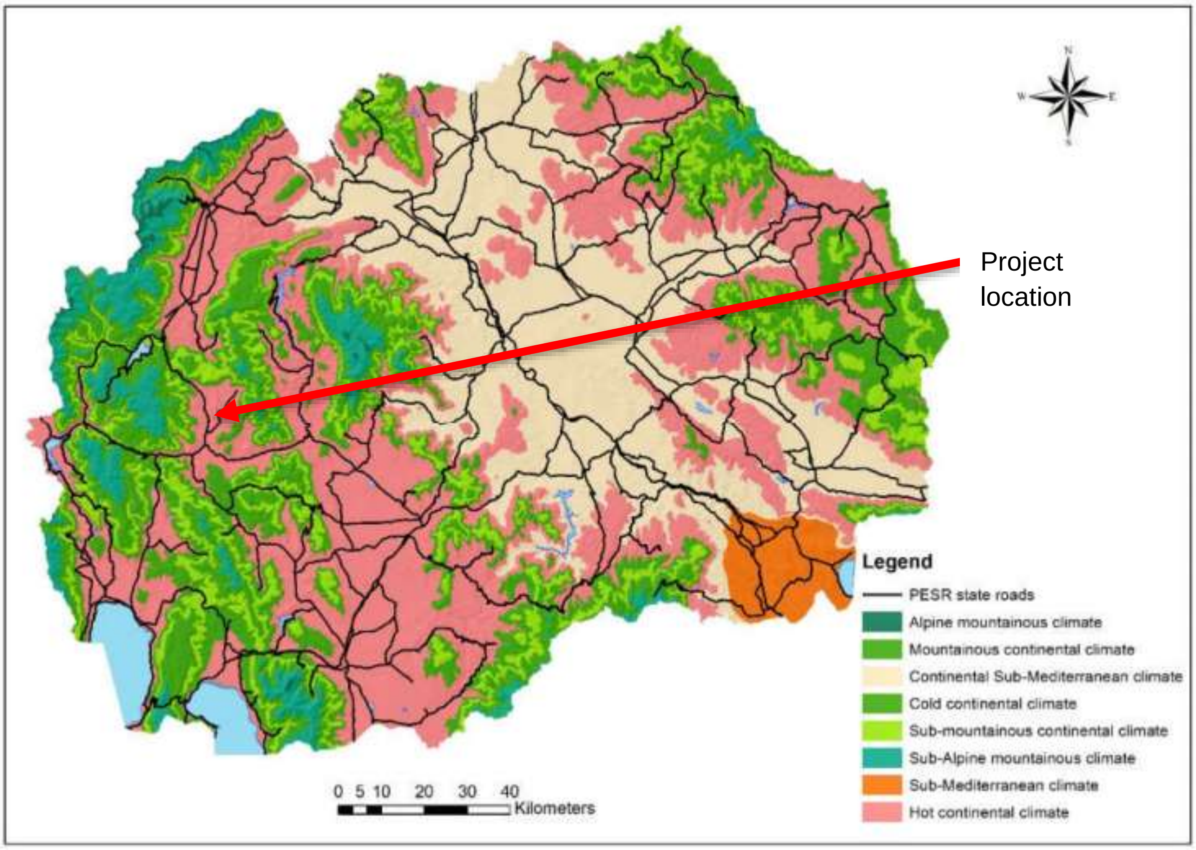

Figure 9-1 - Climatic regions in republic of North Macedonia. Source: PESR

9.7.2. Average monthly temperatures in Kichevo are slightly cooler in comparison to North Macedonia as presented in Figure 9.2. Historical data shows that the coldest month is January, with July and August being the warmest months.

9.7.3. Records from 1961-2012[45] indicate that there have been trends in temperature changes suggesting the occurrence of effects from climate change. For example:

- During 1994-2012, the mean annual temperature has been 0.2°C to 0.5°C higher than the average for 1961-1990.
- The number of summer days has increased significantly in recent years compared to the number within the 1960s. There has also been an increase in the number of tropical nights46 in recent years.
- Cold waves have occurred much less frequently than heatwaves. The greatest frequency of heatwaves has occurred in the most recent ten years of the recording period (1961-2012). It is

[45]World Bank Climate Change Knowledge Portal, Macedonia, Historical climate data. Available at: https://climateknowledgeportal.worldbank.org/country/macedonia/climate-data-historical [last accessed 03/03/2020]
46 A tropical night is when the temperature does not fall below 20° C during the night-time

estimated that the intensity, length and number of heatwaves regionally have increased by a factor of six to eight since the 1960s.

9.7.4. There has also been a general trend of decline in the number of ice days per year. However, no general change in the number of annual frost days has been observed.

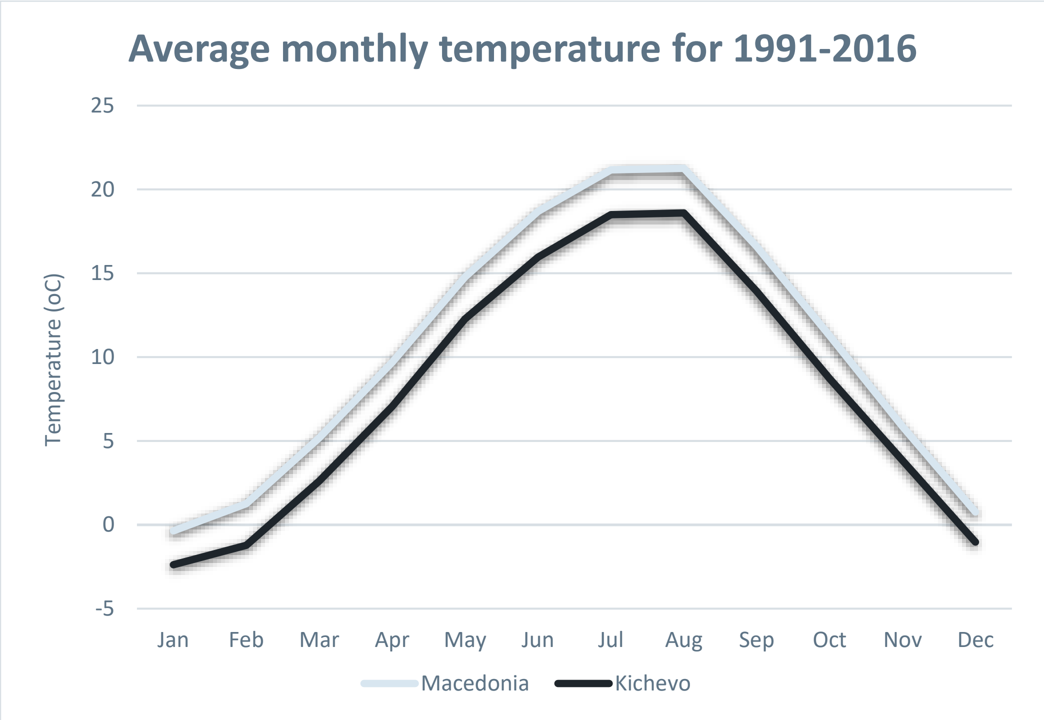

Figure 9-2 - Average monthly temperature for Macedonia and Kichevo for 1991-2016[47]

Precipitation

9.7.5. The Kichevo region experiences higher monthly rainfall in comparison to the average for North Macedonia, as presented in Figure 9.3

[47] World Bank Climate Change Knowledge Portal https://climateknowledgeportal.worldbank.org/, last accessed 27/02/2020

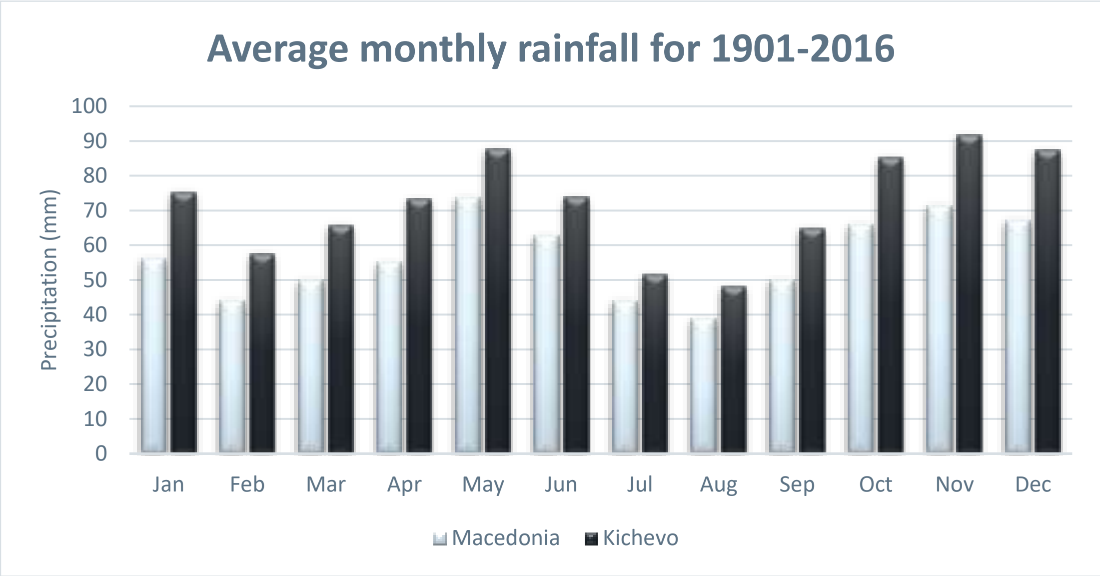

Figure 9-3 - Average Monthly Precipitation for North Macedonia and Kichevo for 1991-2016[48]

9.7.6. Precipitation trends for North Macedonia include:

- A general decrease in rainfall in May and November (the months with the most rainfall) for the period of 1961-2010[49];
- There is a strong discrepancy between the rainfall experienced in the central and western part of the country for the period of 1961 to 2017. The centre of the country experiences approximately 400 mm/year whereas over a 100 mm/ year is experienced in the western part of the country[50].
- In the hilly areas of the western half of the country, precipitation reaches approximately over 150 mm/day, while the eastern part is experiences less with approximately 40-70 mm/day. This reflects the occurrence of extreme events, which are generally expected and historically experienced in the western hilly areas[51.]

Wind

9.7.7. According to the data provided by the meteorological station in Kichevo, the prevailing wind direction in the Project area is from north to south. In Kichevo, the northern continental wind is the most common. The average wind speeds during the year are between 1 m/s and 3 m/s.

Sea Level

9.7.8. As North Macedonia is a landlocked country, sea level is not considered relevant to this assessment and has not been considered further.

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[48] World Bank Climate Change Knowledge Portal https://climateknowledgeportal.worldbank.org/
[49] World Bank Climate Change Knowledge Portal https://climateknowledgeportal.worldbank.org/
[50] http://www.roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads
[51] http://www.roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads

9.8 FUTURE BASELINE (CLIMATE PROJECTIONS)

9.8.1. Climate projections have been derived from the World Bank Climate Change Knowledge Portal[52]. Projection for a 'high' emissions' scenario (Representative Concentration Pathway (RCP) 8.5[53]) for the time period of 2080-2099 (assuming a 60-year project design life) have been used to develop the baseline against which resilience has been assessed. A high emissions scenario has been used to provide a 'worst-case' scenario against which to assess the resilience of the Project and following the precautionary principle.

Temperature

9.8.2. The projected change in monthly temperature for Kichevo for 2080-2099 under RCP 8.5, compared to a baseline of 1986-2005 is presented in Figure 9.4 This projects an increase in temperature in the range of 3.5°C to 7°C for the 50% percentile 'central estimate', where as much evidence points to a lower outcome as a higher one and is therefore taken as the median value of predicted change.

9.8.3. Compared with the period 1961-1990, the projections for temperature rise are greatest in summer. During winter, air temperatures are also expected to increase, though with less intensity.

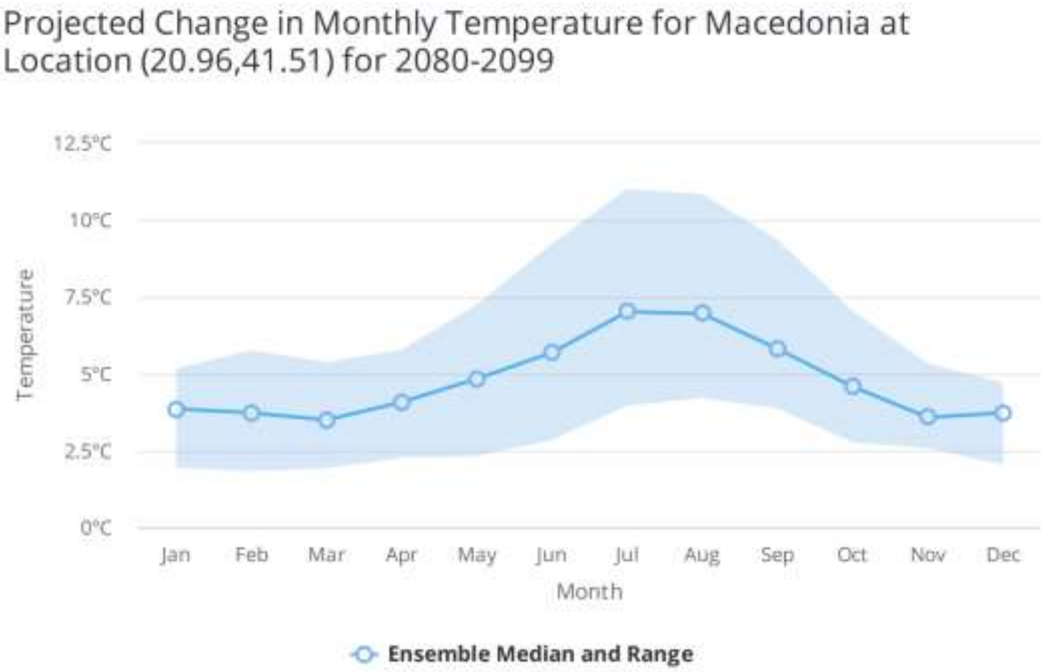


Figure 9-4 - Projected change in monthly temperature of Kichevo in 2080-2099 under RCP8.5 (compared to 1986-2005 baseline)

[52] World Bank (2020) Macedonia Climate Data - Projections
53 Representative Concentration Pathways specify the concentrations of greenhouse gases that would result in target amounts of radiative forcing at the top of the atmosphere by 2100, relative to preindustrial levels. Four forcing levels have been set: 2.6, 4.5, 6.0 and 8.5 W/m2. These create four RCPs; RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5.

9.8.4. As well as an increase in average temperatures, projections indicate an increase in extreme temperatures (i.e. the temperature experienced during heatwaves). Figure 9.5 shows the change in the warmest daily maximum temperature in each month relative to the reference period (1986-2005) for North Macedonia.

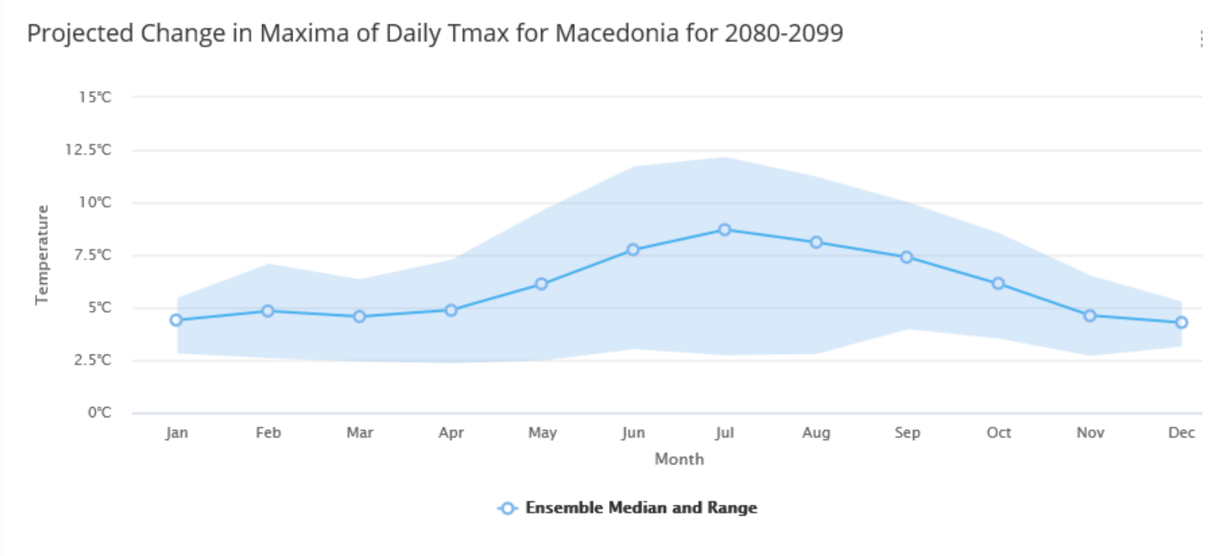


Figure 9-5 - Projected Change in warmest daily maximum temperature in 2080-2099 under RCP8.5 (compared to 1986-2005 baseline)

Precipitation

9.8.5. A decrease in annual precipitation is predicted in North Macedonia for the period 2080-2099. Precipitation reductions are forecast for all four seasons, with the maximum decrease in summer (June, July and August). The projected change in monthly precipitation for Kichevo for 2080-2099 under RCP8.5 compared to the baseline of 1986-2005, is presented in Figure 9.6 This projects a decrease in precipitation in the range of 5mm to 19mm (50th centile value).

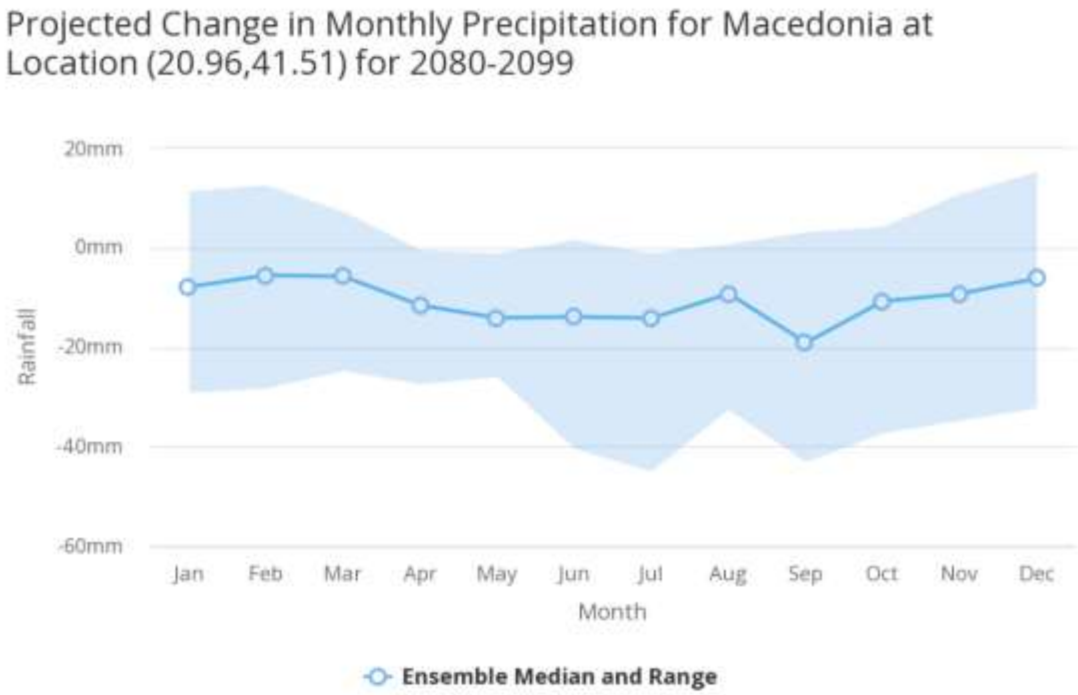


Figure 9-6 - Projected change in monthly precipitation of Kichevo in 2080-2099 under RCP8.5 (compared to 1986-2005 baseline)

9.8.6. In terms of extreme rainfall events, projections for North Macedonia show little change in the amount of rainfall falling during intense rainfall events – see Figure 9.7 This indicator captures how much of the precipitation sum in an area comes primarily from extreme rainfall events, as opposed to more evenly distributed events. The larger the number, the more the location is dominated by a few heavy rainfall events. Conversely, the smaller the number, the more evenly distributed is precipitation, and the largest rainfall events are not that exceptional overall. Figure 9.7shows that in the period 2080-2099, rainfall will be fairly evenly distributed in North Macedonia.

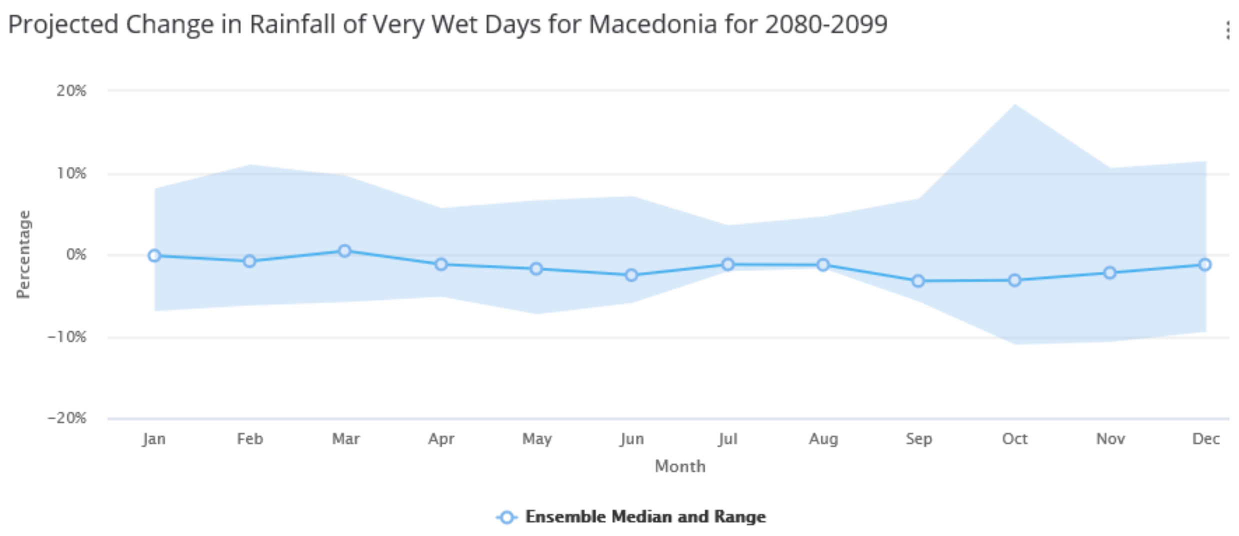


Figure 9-7 - Projected Change in rainfall of very wet days for North Macedonia in 2080-2099 under RCP8.5 (compared to 1986-2005 baseline)

9.8.7. The Climate Resilience Report[54] hypothesises that overall North Macedonia is facing decades of decreasing annual rainfall, but more frequent moderate and extreme rainfall surges.

Wind

9.8.8. There is low confidence in existing models of future storm conditions under climate change. Tropical storms originate over warm tropical oceans however, based on current knowledge and the proximity of the project to the Adriatic Sea, it is considered likely that the frequency of tropical storms will decrease or stay the same, but that maximum wind speed and precipitation will increase[55].

9.9 ASSESSMENT METHODOLOGY

9.9.1. The assessment of risk and vulnerability associated with the climate variables identified above comprises of the following:

- Identification of climate variables to which the Project is vulnerable to, based on sensitivity and exposure;
- Identification of mitigation measures already incorporated into the Project design and construction plans;
- Assessment of impacts associated with climate variables the Project is vulnerable to, and identification of their significance; and
- Identification of additional mitigation measures to address any residual climate effects.

[54] http://www.roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads
[55] https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_all_final.pdf [Accessed 4/11/2019]

CLIMATE CHANGE VULNERABILITY ASSESSMENT

9.9.2. Vulnerability of the Project to climate change depends on the sensitivity of the Project to a climate variable and exposure of the Project to change in that variable (as described in 9.3.3 Future Baseline).

9.9.3. The sensitivity and exposure of each element of the Project (i.e. road, bridges, viaducts, tunnel) to climate variables have been assessed using the following ratings scale:

- High: high climate sensitivity or exposure.
- Moderate: moderate climate sensitivity or exposure.
- Low: no significant climate sensitivity or exposure.

9.9.4. This is a qualitative assessment informed by supporting literature, and expert opinion. The sensitivity and exposure ratings have been combined to determine vulnerability of the Project elements to climate variables, using the matrix shown in Table 9-10.

9.9.5. The outcome of this stage of the assessment is a list of climate variables for each Project element to take forward for further assessment. ‘Low’ vulnerabilities will not be considered further. ‘High’ and ‘Moderate’ vulnerabilities will be assessed further.

Table 9-10 - Vulnerability matrix

Sensitivity	**Exposure**		
	Low	**Medium**	**High**
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

Assessment of Impacts and their Significance

9.9.6. For each Project element (i.e. road, bridges, viaducts, tunnel), the significance of effects associated with the climate variables it is vulnerable to will be assessed. This is carried out by considering the likelihood and consequence of potential impacts occurring taking account of design measures which mitigate the impacts. These design measures are identified through consultation with the Project’s design team and review of project documentation.

9.9.7. Likelihood and consequence are qualitatively assessed using the descriptions in Table 9-11 and Table 9-12. These descriptions have been developed using experience and professional judgement, informed by relevant guidance[56], including the cost implications identified in Table 24 of the Climate Resilience Design Guidance for Roads in Macedonia.

Table 9-11 - Definitions of likelihood

Measure of likelihood	Description
Very high	The event occurs multiple times during the lifetime of the project, e.g., usually annually.
High	The event occurs several times during the lifetime of the project, e.g., approximately once every five years.
Medium	The event occurs limited times during the lifetime of the project, e.g., approximately once every 15 years.
Low	The event occurs occasionally during the lifetime of the project, e.g., once in 60 years.
Very low	The event may occur once during the lifetime of the project.

Table 9-12 - Definitions of consequence

Measure of consequence	Description
Negligible	No infrastructure damage, minimal adverse effects on health, safety and the environment. No road closure. No financial loss.
Minor adverse	Localised infrastructure disruption or loss of service. No permanent damage, minor restoration work required: road closure lasting less than one day. Slight adverse health or environmental effects. Repairs cost 2% of road reconstruction cost.
Moderate adverse	Limited infrastructure damage and loss of service with damage recoverable by maintenance or minor repair. Disruption lasting more than one but less than three days. Adverse effects on health and/or the environment. Repairs cost 25% of road reconstruction cost.
Large adverse	Extensive infrastructure damage and severe loss of service. Disruption lasting more than three but less than ten days. Early renewal of 50-90% of

[56] Design Manual for Roads and Bridges LA114 Climate http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20114%20Climate-web.pdf and cclimate Resilience Design Guidance for roads in Macedonia (http://roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads)

Measure of consequence	Description
	infrastructure. Permanent physical injuries and/or fatalities. Significant effect on the environment, requiring remediation. Repairs cost 50% of road reconstruction cost.
Very large adverse	Permanent damage and complete loss of service. Disruption lasting more than ten days but less than 20 days. Early renewal of infrastructure >90%. Severe health effects and/or fatalities. Very significant loss to the environment requiring remediation and restoration. Repairs cost 100% of road reconstruction cost.

9.9.8. The likelihood and consequence are combined to assess the significance of effects on receptors, as shown in Table 9.13. The assessment is qualitative and based on expert judgment and knowledge of similar schemes. It also includes engagement with the wider Project Team and a review of Project documentation.

Table 9-13 - Significance rating matrix

Likelihood	Consequence of Hazard Occurring				
	Negligible	**Minor adverse**	**Moderate adverse**	**Large adverse**	**Very large adverse**
Very High	Not significant	Significant	Significant	Significant	Significant
High	Not significant	Significant	Significant	Significant	Significant
Medium	Not significant	Not significant	Significant	Significant	Significant
Low	Not significant	Not significant	Not significant	Significant	Significant
Very Low	Not significant	Not significant	Not significant	Significant	Significant

ASSUMPTIONS AND LIMITATIONS OF THE METHOD

9.9.9. There are inherent uncertainties associated with using climate projections and they are not predictions of the future. It is possible that future climate will differ from the future baseline climate against which the resilience of the Project has been assessed, depending on the extent of global emissions released into the atmosphere over the next century. A worst-case scenario has been used to assess the resilience of the road over its lifetime.

9.9.10. Data on projected climate has been taken from the World Bank Knowledge Climate Change Knowledge Portal which summarises output of the Coupled Model Intercomparison Project, Phase 5

(CMIP5) models included in the IPCC's Fifth Assessment Report (AR5). There are some climate variables which are not available from the Knowledge Portal, including wind and fog, and as such, the assessment does not include detailed information on projections in these variables.

9.9.11. The assessment of impacts and their likely significance takes into account design measures which mitigate impacts. These measures have been identified through engagement with the wider Project Team and a review of Project documentation. The assessment assumes that the measures which have been identified at this stage are incorporated into the final design and that the road is designed in accordance with the following documents:

- Guidelines for the Public Enterprise for State Roads in North Macedonia: Part B Climate Resilience Design Guidelines[57]. Analysis of Climate Risks in Transport Infrastructure in the Western Balkans – Macedonia[58].

DESIGN MEASURES WHICH MITIGATE IMPACTS

9.9.12. The assessment of significance takes into account design measures which mitigate climate impacts. The design measures have been identified through engagement with the project team and from the existing project information. It is appropriate to adopt a precautionary approach in future-proofing designs, so that the key assets will perform satisfactorily throughout their design life in the event of climactic changes towards the extreme predictions[59]. These measures are summarised in **Table 9.14**.

Table 9-14 - Measures within the project design which will mitigate impacts of climate change

Project Element	Design measures
Structures	Proper hydroisolation is proposed for all bridges. Polymerised bituminous strips will be used which will provide resistance to ice and other aggressive substances such as greases and oils. These add waterproofing and consistency during heat. In order to improve the slope stability, to prevent landslides and rockslides, gabions are proposed for bridge no.1 and bridge no.3. When the bridges become operational, the authority responsible for the maintenance of the road is obliged to maintain the structures. This obligation consists of regular and controlled inspection checks of the structures at intervals which are compliant with legislation. During the initial period of operation, any structural irregularities must be identified for correction and/or removed in a timely

[57] Climate Resilience Design Guidance for roads in Macedonia (http://roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads)
58 Analysis of Climate Risks in Transport Infrastructure in the Western Balkans – Macedonia. August 2017.
[59] Climate Resilience Design Guidance for roads in Macedonia (http://roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads)

Project Element	Design measures
	manner. During the first two years, at four-month intervals, geodetic surveys of the structure are to be performed in order to register any possible vertical and horizontal displacements.
Earthworks	For excavations in soils with slopes of 1:1.5, protection measures such as those below will be made: ▪ Sprayed concrete and anchors. ▪ Protective rockfall barrier with local anchoring. ▪ Vegetation to protect from erosion. ▪ Terracing of terrain (3-4 m terraces).
Drainage	The Drainage Design Report (Section 9 – part 2 Hydraulic Calculation – Stormwater Drainage) states that drainage design for the carriage way drainage allows for the 1-in-10-year event and for the structures (bridges and culverts), the 1-in-100-year event. This is accordance with Macedonian standards. The Project includes all necessary drainage elements, including box and pipe culverts. All pipe culverts will have Ø1000 openings, except for one in the area of the tunnel which will have an Ø1900 opening. Drainage, sewage, oil and grease traps are planned to be placed at various locations along the motorway. An integral part of the drainage system is located on either side of the tunnel, constructed from drainage semi-perforated pipes, which collect the underground or storm water that has penetrated the soil. In addition to the drainage system, the channel along the lower edge of the carriageway would serve to collect liquid pollutants that would flow onto the carriageway.

POTENTIAL IMPACT AND EFFECTS

Vulnerability Assessment

9.9.13. During construction, the Project is sensitive to the climate variables as shown in Table 9.15.

Table 9-15 - Sensitivity to weather and climate during construction

	Climate variable	Description of sensitivity	Sensitivity rating
Site compound (including access)	Average precipitation	Increase in dust	Medium
	Drought	Drying out and cracking of site compound during drought	Medium
	Extreme precipitation	Waterlogging of flooding of site compound and access	High
	Average temperature	Site compound relatively insensitive to higher temperature	Low
	Extreme temperature	Drying out and cracking of site compound during drought	Medium
	Wind	Increase in dust and windblown material	Medium
Storage of materials	Average precipitation	Material/stockpiles of spoil can dry out leading to emissions of dust Drying times can be reduced	Medium
	Drought	Material/stockpiles of spoil can dry out leading to dust Drying times can be reduced	Medium
	Extreme precipitation	Run-off from material/stockpiles of spoil	Medium
	Average temperature	Combustion of flammable materials	High
	Extreme temperature	Increased risk of combustion of flammable materials	High
	Wind	Increase in dust and windblown material	Medium
Plant and equipment	Average precipitation	Plant and equipment is relatively insensitive to reduced rainfall	Low
	Drought	Plant and equipment is relatively insensitive to drought	Low

	Climate variable	Description of sensitivity	Sensitivity rating
	Extreme precipitation	Plant may not be able to operate on waterlogged or flooded site	Medium
	Average temperature	Machinery may overheat in high temperatures	Medium
	Extreme temperature	Machinery may overheat in high temperatures Risk to storage of fuels (e.g. fuel tanks) and storage areas of hazardous substances and materials (e.g. solvents)	Medium
	Wind	Working at height is sensitive to increased wind speed	High
	Fog	Reduced visibility may restrict construction activities	High
Workforce	Average precipitation	Workforce is relatively insensitive to drier average conditions	Low
	Drought	Site workers can suffer heatstroke during drought	Medium
	Extreme precipitation	Site workers may not be able to access the site or work if the site is flooded	Medium
	Average temperature	Site workers can suffer heatstroke	Medium
	Extreme temperature	Site workers can suffer heatstroke	Medium
	Wind	Potential for injury	Medium

9.9.14. During operation, the Project is sensitive to change in climate variables as shown in Table 9.16.

Table 9-16 - Sensitivity to climate change during operation

	Climate variable	Projected change	Description of sensitivity	Sensitivity rating
Road	Average precipitation	Reduction in average rainfall	Drier average conditions may lead to more dust on the road.	Low
	Drought	Increase in drought conditions	Prolonged dry periods may lead to drying out and cracking of earthworks and soils.	Medium
	Extreme rainfall	Little change in extreme rainfall	Flooding of road and damage to surface[60].	High
	Average temperature	Increase in average temperature	Warmer average temperatures may cause damage to paved surfaces. An increase in solar radiation can also cause more rapid deterioration of materials and associated infrastructure such as signage.	Medium
	Extreme temperature	More heatwave events	Extreme temperature may cause damage to paved surfaces, including potential melting and deformation.	High
	Wind	Increase in wind speed	More wind-blown debris on the road surface and drainage infrastructure.	Low
Bridges and viaducts	Average precipitation	Reduction in average rainfall	Prolonged dry periods may lead to drying out and cracking of earthworks and soils, leading to instability.	Medium
	Drought	Increase in drought conditions	Prolonged dry periods may lead to drying out and cracking of earthworks and soils, leading to instability.	Medium
	Extreme rainfall	Little change in extreme rainfall	Flooding and scour of supporting structures.	Medium

[60] The Climate Resilience Design Guidance for roads in Macedonia Figure 16 identifies the flood vulnerability of roads for which those in the project location are deemed as 'high'.

	Climate variable	Projected change	Description of sensitivity	Sensitivity rating
	Average temperature	Increase in average temperature	Sensitive to high temperatures which affect thermal expansion joints and increase earth pressures.	High
	Extreme temperature	More heatwave events	Sensitive to high temperatures which affect thermal expansion joints and increase earth pressures.	High
	Wind	Increase in wind speed	Sensitive to increased wind loading. High winds and storms can affect the stability of above-ground infrastructure and hasten material degradation. High winds can also cause wind-driven rain infiltration into materials and surfaces which can increase maintenance costs and operational disruption. High winds also increase risk to bridge users (particularly high sided vehicles) and may lead to temporary closure.	High
Tunnel	Average precipitation	Reduction in average rainfall	Prolonged dry periods may lead to drying out and cracking of soils, leading to instability and damage to materials.	Medium
	Drought	Increase in drought conditions	Prolonged dry periods may lead to drying out and cracking of soils, leading to instability and damage to materials.	Medium
	Extreme rainfall	Little change in extreme rainfall	Waterlogging of soils leading to drainage becoming overwhelmed. Outage in energy infrastructure causing electricity outage in lighting in tunnel.	Medium
	Average temperature	Increase in average temperature	Increase in cooling and ventilation requirements in tunnel.	Medium
	Extreme temperature	More heatwave events	Increase in cooling and ventilation requirements in tunnel.	Medium
	Wind	Increase in wind speed	Tunnels are relatively insensitive to wind.	Low

9.9.15. Exposure of the Project to climate variables during construction is summarised in Table 9.17, based on the current baseline presented in section 9.3.1.

Table 9-17 - Exposure to weather variables during construction

Climate variable	Exposure rating
Average precipitation	Low
Drought	Low
Extreme precipitation	Low
Average temperature	Medium
Extreme temperature	Medium
Wind	Low
Fog	Low

9.9.16. Exposure of the Project to climate variables during operation is summarised in Table 9.18, based on the future baseline presented in section 9.3.2.

Table 9-18 - Exposure to change in climate variables during operation

Climate variable	Projected change	Exposure rating
Average precipitation	Reduction in average rainfall	Medium
Drought	Increase in drought conditions	Medium
Extreme rainfall	Little change in extreme rainfall	Low
Average temperature	Increase in average temperature	High
Extreme temperature	More heatwave events	High
Wind	Increase in wind speed	Medium

9.9.17. The vulnerability of construction elements to climate variables during construction is summarised in Table 9.19.

Table 9-19 - Vulnerability of construction elements to climate variables during construction

	Climate variable	Exposure	Sensitivity	Vulnerability
Site compound (incl. access)	Average precipitation	Low	Medium	Low
	Drought	Low	Medium	Low
	Extreme rainfall	Low	High	Low
	Average temperature	Medium	Low	Low
	Extreme temperature	Medium	Medium	Medium
	Wind	Low	Medium	Low
Storage of materials	Average precipitation	Low	Medium	Low
	Drought	Low	Medium	Low
	Extreme precipitation	Low	Medium	Low
	Average temperature	Medium	High	Medium
	Extreme temperature	Medium	High	Medium
	Wind	Low	Medium	Low
Plant	Average precipitation	Low	Low	Low
	Drought	Low	Low	Low
	Extreme rainfall	Low	Medium	Low
	Average temperature	Medium	Medium	Medium
	Extreme temperature	Medium	Medium	Medium
	Wind	Low	High	Low
	Fog	Low	High	Low

	Climate variable	Exposure	Sensitivity	Vulnerability
Workforce	Average precipitation	Low	Low	Low
	Drought	Low	Medium	Low
	Extreme precipitation	Low	Medium	Low
	Average temperature	Medium	Medium	Medium
	Extreme temperature	Medium	Medium	Medium
	Wind	Low	Medium	Low

9.9.18. The vulnerability of Project elements to climate variables during operation is summarised in Table 9.20.

Table 9-20 - Vulnerability of project elements to change in climate variables during operation

	Climate variable	Exposure	Sensitivity	Vulnerability
Road	Average precipitation	Medium	Low	Low
	Drought	Medium	Medium	Medium
	Extreme precipitation	Low	High	Low
	Average temperature	High	Medium	Medium
	Extreme temperature	High	High	High
	Wind	Medium	Low	Low
Bridges and viaducts	Average precipitation	Medium	Medium	Medium
	Drought	Medium	Medium	Medium
	Extreme precipitation	Low	Medium	Low
	Average temperature	High	High	High

	Extreme temperature	High	High	High
	Wind	Medium	High	Medium
Tunnel	Average precipitation	Medium	Medium	Medium
	Drought	Medium	Medium	Medium
	Extreme precipitation	Low	Medium	Low
	Average temperature	High	Medium	Medium
	Extreme temperature	High	Medium	Medium
	Wind	Medium	Low	Low

9.9.19. The results of the vulnerability assessment are that impacts associated with the following climate variables for the following Project elements have been assessed further are shown in Table 9.21.

Table 9-21 - Vulnerability of project elements to change in climate variables during operation

Stage	Element	Variable has been assessed further
Construction	Site compound (incl. access)	Extreme temperature
	Storage of materials	Average temperature Extreme temperature
	Plant and equipment	Average temperature Extreme temperature
	Workforce	Average temperature Extreme temperature
Operation	Road	Drought Average temperature Extreme temperature
	Bridges and viaducts	Average precipitation Drought

Stage	Element	Variable has been assessed further
		Average temperature Extreme temperature Wind
	Tunnel	Average precipitation Drought Average temperature Extreme temperature

Assessment of Impacts and the Significance of Effect

9.9.20. Table 9.22 shows the assessment of impacts during the construction phase. It shows that there is one likely significant effect during the construction phase:

- Heatstroke affecting the workforce during extreme temperature events (i.e. heatwaves), leading to risks to human health – causing illness or inability to work – and culminating in delays to construction activities and programme.

Table 9-22 - Assessment of impacts and effects during the construction phase

	Climate variable	Potential impact	Likelihood	Consequence	Significance
Site compound (incl. access)	Extreme temperature	Drying out and cracking of compound and access road surfaces leading to slower vehicle movements and repair work, resulting in construction delays	Medium	Minor adverse	Not significant
Storage of materials	Average temperature	Combustion of flammable materials	Low	Moderate adverse	Not significant
	Extreme temperature	Combustion of flammable materials	Low	Moderate adverse	Not Significant
Plant	Average temperature	Overheating of machinery leading to delay	Low	Minor adverse	Not significant

	Climate variable	Potential impact	Likelihood	Consequence	Significance
	Extreme temperature	Overheating of machinery and reduced battery performance leading to delay	Medium	Minor adverse	Not significant
Workforce	Average temperature	Heatstroke leading to delays	Low	Moderate adverse	Not significant
	Extreme temperature	Heatstroke leading to delays	Medium	Moderate adverse	Significant

9.9.21. Table 9.23 shows the potential impacts during the operation phase. It also shows the following likely significant effects, without mitigation:

Road

- Drying out of substrate during droughts, leading to pavement damage.
- Die-off of vegetation during drought, leading to destabilisation of earthworks.
- Deformation of pavements due to warmer conditions.
- Melting of pavement during heatwaves.

Bridges and viaducts

- Drying out and cracking of substrate due to lower average rainfall and, during droughts, leading to the damage of foundations.
- Increase in expansion of materials due to warmer average conditions and, during heatwaves, leading to structural damage.
- Increase in earth pressure due to warmer average conditions and, during heatwaves, leading to structural damage.
- Increase in wind loading due to higher wind speeds, leading to destabilisation.
- High-sided vehicles being blown over due to higher wind speeds.

Tunnel

- Drying out of soils due to drier conditions and drought leading to cracking of tunnel materials.
- Overheating during heatwaves.

Table 9-23 - Assessment of impacts during the operation phase

	Climate variable	Potential impact	Likelihood	Consequence	Significance
Road	Drought	Drying out and cracking of substrate leading to damage to pavement, increased repair costs and slower journey times	Medium	Moderate adverse	Significant
		Increase in dust leading to reduced visibility	Medium	Negligible	Not significant
		Die-off of vegetation leading to slope destabilisation	Low	Large adverse	Significant
	Increase in average temperature	Deformation of pavement leading to increased repair costs and slower journey times	Medium	Moderate adverse	Significant
		Increase in length of growing season leading to increase maintenance requirements	Medium	Minor adverse	Not significant
	Extreme temperature (heatwave)	Melting of pavement leading to increased repair costs and journey delays	Medium	Large adverse	Significant
Bridges and viaducts	Decrease in average precipitation	Drying out and cracking of substrate leading to damage to foundations and destabilisation of structure	Very Low	Large adverse	Significant
	Drought	Drying out and cracking of substrate leading to damage to foundations and destabilisation of structure	Low	Large adverse	Significant
	Average temperature	Increase in expansion leading to structural damage	Very Low	Large adverse	Significant

	Climate variable	Potential impact	Likelihood	Consequence	Significance
		Increase in earth pressure	Low	Large adverse	Significant
	Extreme temperature	Increase in expansion leading to structural damage	Low	Large adverse	Significant
		Increase in earth pressure	Medium	Large adverse	Significant
	Wind	Increase in wind loading leading to destabilisation	Medium	Large adverse	Significant
		High-sided vehicles being blown over	Medium	Minor adverse	Not significant
Tunnel	Average precipitation	Drying out of soils and cracking of materials	Low	Large adverse	Significant
	Drought	Drying out of soils and cracking of materials	Medium	Large adverse	Significant
	Average temperature	Overheating in the tunnel	Medium	Minor adverse	Not significant
	Extreme temperature (heatwave)	Overheating in the tunnel	High	Minor adverse	Significant

MITIGATION

9.9.22. Recommended mitigation measures to address the likely significant effects during the construction phase are shown in Table 9.24.

Table 9-24 - Recommended mitigation measures – construction phase

Construction element	Likely significant effect	Recommended mitigation
Workforce	Heatstroke affecting the workforce during extreme temperature events (heatwaves), leading to delays	The following health and safety measures for the workforce are included in the ESMP:

Construction element	Likely significant effect	Recommended mitigation
		▪ Ensure workforce have appropriate PPE including hats, sunglasses, long sleeved, light clothing, sun cream. ▪ Ensure rest breaks are taken during heatwaves. ▪ Provide suitable rest/welfare areas (e.g. including shade) and drinking water facilities for workforce. ▪ Ensure a first aider trained in recognising and treating the effects of heatstroke is on site.

9.9.23. The Project will be designed in accordance with the PESR's Technical Assistance Preparation of Climate Resilience Design – Guidelines for the Public Enterprise for State Roads in North Macedonia[61]. These guidelines include measures for climate adaptation including drainage and structure specifications, retaining walls and slope stabilisation.

9.9.24. Recommended mitigation measures to address the likely significant effects during the operation phase are shown in Table 9.25. These will be discussed and agreed with designers ahead of the next phase of design work (detailed design).

Table 9-25 - Recommended mitigation measures – operation phase

	Likely significant effect	Recommended mitigation
Road	Drying out of substrate during droughts, leading to pavement damage.	Take the latest projections of future rainfall into account when specifying pavement material and designing drainage.
	Die-off of vegetation during drought, leading to destabilisation of earthworks.	Take projected (reduction in overall) rainfall into account when specifying vegetation for slopes. Ensure native drought-resistant species are chosen.
	Deformation of pavement due to warmer conditions.	Take projections of future rainfall into account when specifying pavement material. Ensure

[61] Web-link : http://www.roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads

	Likely significant effect	Recommended mitigation
		thermal tolerance of specified materials is above projected average temperature.
	Melting of pavement during heatwaves	Take projections of future rainfall into account when specifying pavement material. Ensure thermal tolerance of specified materials is above projected extreme temperature.
Bridges and viaducts	Drying out and cracking of substrate due to lower average rainfall and during droughts, leading to damage of foundations.	Take projections of future rainfall into account when specifying foundation depth.
	Increase in expansion due to warmer average conditions and during heatwaves, leading to structural damage.	Take projections of future average and extreme temperature into account when designing expansion joints.
	Increase in earth pressure due to warmer average conditions and during heatwaves, leading to structural damage.	Take projections of future average and extreme temperature into account when designing foundations.
	Increase in wind loading due to higher wind speeds, leading to destabilisation.	Take projections of future wind speed into account when calculating wind loading.
	High-sided vehicles being blown over due to higher wind speeds.	Take projections of future wind speed into account when designing wind barriers.
Tunnel	Drying out of soils due to drier conditions and drought leading to cracking of tunnel materials.	Take projections of future rainfall into account when specifying tunnel construction materials.
	Overheating during heatwaves.	Take projections of future average and extreme temperature into account when specifying cooling and ventilation systems.

RESIDUAL EFFECTS

9.9.25. Table 9.26 shows the assessment of residual effects during the construction phase, assuming the mitigation measures described in Table 9.24 are adopted and incorporated. The residual significance of effect is not significant.

Table 9-26 - Residual impact assessment – construction phase

Construction element	Climate variable	Potential impact	Likelihood	Consequence	Residual significance
Workforce	Extreme temperature	Heatstroke leading to delays	Low	Moderate adverse	Not significant

9.9.26. Table 9.27 shows the assessment of residual effects during the operation phase, assuming the mitigation measures described in Table 9.25 are incorporated into the design. The residual significance of all effects is not significant.

Table 9-27 - Residual impact assessment – operation phase

	Climate variable	Potential impact	Likelihood	Consequence	Residual significance
Road	Drought	Drying out and cracking of substrate leading to damage to pavement	Low	Moderate adverse	Not significant
Road	Drought	Die-off of vegetation leading to slope destabilisation	Very low	Moderate adverse	Not significant
Road	Increase in average temperature	Deformation of pavement	Low	Moderate adverse	Not significant
Road	Extreme temperature (heatwave)	Melting of pavement	Low	Moderate adverse	Not significant
Bridges and viaducts	Decrease in average precipitation	Drying out and cracking of substrate leading to damage to foundations	Very Low	Moderate adverse	Not significant
Bridges and viaducts	Drought	Drying out and cracking of substrate leading to damage to foundations	Low	Moderate adverse	Not significant
Bridges and viaducts	Average temperature	Increase in expansion leading to structural damage	Very Low	Moderate adverse	Not significant

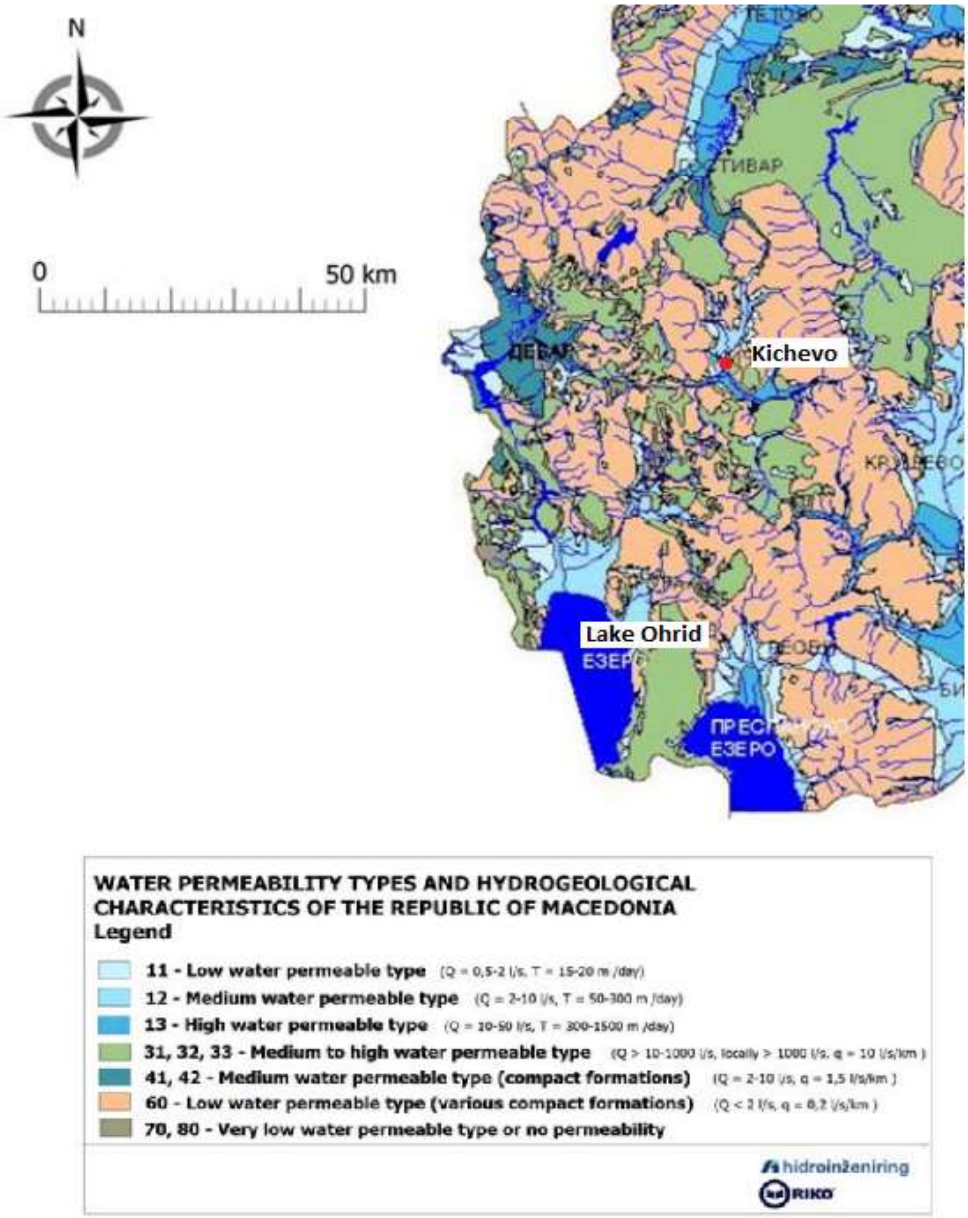
	Climate variable	Potential impact	Likelihood	Consequence	Residual significance
		Increase in earth pressure	Very low	Moderate adverse	Not significant
	Extreme temperature	Increase in expansion leading to structural damage	Low	Moderate adverse	Not significant
		Increase in earth pressure	Low	Moderate adverse	Not significant
	Wind	Increase in wind loading leading to destabilisation	Low	Moderate adverse	Not significant
Tunnel	Average precipitation	Drying out of soils and cracking of materials	Low	Moderate adverse	Not significant
	Drought	Drying out of soils and cracking of materials	Low	Moderate adverse	Not significant
	Extreme temperature (heatwave)	Overheating in the tunnel	Low	Minor adverse	Not significant

10 GROUNDWATER

10.1 BASELINE CONDITIONS

10.1.1. The Project is located within the Western Macedonian Hydrogeological province.

Figure 10.1 - Location of Project and Groundwater Reserves[62]



[62] http://www.moepp.gov.mk/wp-content/uploads/2014/12/MACEDONIAN-WATER-STRATEGY-FINAL-DRAFT-VERSION_10092011_EN.pdf

10.1.2. The hydrogeology of the Kichevo region comprises a mix of aquifers (hydrological collectors/ stores) and aquacludes (hydrological insulators).

10.1.3. The geology in this area consists of low-grade to locally medium-grade metamorphosed Paleozoic sedimentary and igneous rocks and Mesozoic, mostly Triassic with some Jurassic, sedimentary rocks[63].

10.1.4. The solid rock masses that dominate the region, the Phyllites, can be classified as hydrogeological insulators. This group of rocks are characterised by crack porosity and have very low water permeability, particularly where their structure is compact. Other hydrogeological insulators include the Pliocene sediments and the quaternary deposits which are mostly clayey silty sands mixed with debris material, of a variety of grain size, characterised by very poor water permeability.

10.1.5. Hydrogeological collectors are characterised by intergranular porosity and good water permeability. These include the quaternary deposits, which comprise clayey sand and silts, and contain debris, and are characterised as having weak to good water permeability. Hydrogeological collectors also include those Pliocene sediments which are comprised of loose rock masses mostly composed of sandy clayey material, with small amounts of silt.

10.1.6. A number of springs and streams are identified along the Project alignment. 'Wet zones' occur during February-March and can be found in the flat parts of the alignment at Ch 02+940 m to Ch 03+240 m and at Ch 08+140 m to Ch 08+670 m. There is likely to be a hydraulic connection between the groundwater and the registered wet zones. See Figure 10-2.

10.1.7. There is a large floodplain in the vicinity of the River Zajaska (near Bridge No. 1 at Ch 08+315 m), where surface water comes into contact with groundwater. The Project includes bridges and viaducts in areas of floodplain and shallow groundwater (see Chapter 2 – Description of the Project) to ensure that it remains operational during peak rainfall events. Groundwater levels have been identified along the Project alignment. These measurements were undertaken during ground investigations in Spring/ Summer 2017. The data is outlined in Table 10-1.

Table 10-1 - Groundwater Occurrence and Level in the Exploratory Wells and Exploratory Boreholes

Exploratory well / Exploratory borehole	Chainage (km)	Groundwater occurrence (m)	Groundwater level (m)
EW-9	03+000	0.90	0.60
B-1	03+340	/	3.20
EW-18	06+900	2.20	2.00
EW-19	07+440	1.60	1.50
EW-20	07+860	/	1.85
EW-21	08+220	0.60	0.20

[63] https://www.researchgate.net/profile/Milorad_Jovanovski/publication/282612958_Hydrogeological_survey_of_Groundwater_in_Macedonia/links/56141f8908aed47facee15ea/Hydrogeological-survey-of-Groundwater-in-Macedonia.pdf?origin=publication_detail

Exploratory well / Exploratory borehole	Chainage (km)	Groundwater occurrence (m)	Groundwater level (m)
EW-22	08+620	0.90	0.70
EW-23	09+000	2.40	2.15
EW-26	10+350	1.20	0.95
B-1	10+880	/	9.00
B-2	10+880	/	14.10
EW-28	11+289	1.90	1.80
EW-29	11+660	1.80	1.40


Figure 10-1 - Wet Zones

Wet zone at Ch 02+940 m to Ch 03+240 m **Wet zone at Ch 08+140 m to Ch 08+670 m**

10.2 ASSESSMENT METHODOLOGY

10.2.1. The criteria for evaluating the sensitivity of groundwater is given in Table 10-2.

Table 10-2 - Sensitivity of Groundwater[64]

Value/Sensitivity	Descriptor
Very high	Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation
High	Principal aquifer providing locally important resource or supporting river ecosystem
Medium	Aquifer providing water for agricultural or industrial use with limited connection to surface water
Low	Unproductive strata

[64] Based on DMRB Volume 11 Section 3 part 10 Table A4.3; (p.119).

10.2.2. The most affected groundwater sites due to the construction of the Project are set out in Table 10-3.

Table 10-3 - Sensitivity of the Most Affected Groundwater Sites within the Project Area

Location	Hydrogeology features	Motorway location	Sensitivity
Kolibari Tunnel	Delluvial sediments; solid Quartzites and surface Phyllites	Ch 04+116 m – Ch 04+847 m	Medium
Bridge No. 1 over the River Zajaska (wet zone)	Alluvial sediments; Gravel sandstone	Ch 08+135 – Ch 08+670	High

10.3 POTENTIAL IMPACTS AND EFFECTS

10.3.1. The impacts on groundwater caused by the construction of the Project can be expressed as:

- Impacts on the hydrology of the groundwater; and
- Impacts on the quality of the groundwater.

10.3.2. The construction activities have the potential to have significant effects on the hydrology and the quality of the groundwater. The main activities that may have an impact on the groundwater during the pre-construction and construction phase have been identified below.

Impacts on the hydrology of the groundwater, can be caused by:

- Drainage of groundwater;
- Compaction of the soil layers as a result of using heavy construction plant;
- Barrier effect caused by the motorway road base; and
- Construction and drainage of the tunnel.

Impacts on the quality of groundwater, can occur as a result of:

- Infiltration of pollutants present on the surface; and
- Leakage of large amounts of pollutants in case of incident.

10.3.3. During the operational phase of the Project, the following activities may have an impact on the groundwater.

Impacts on the quality of groundwater can occur as a result of:

- Incorrect and irregular maintenance of the oil storage facilities for the storage of grease/oils/fuel originating from motor vehicles using the motorway, such as petrol stations; and
- Incidents and traffic accidents when transporting large amounts of pollutants.

Table 10-4 - Construction Phase Activities that Can Impact Groundwater

Activities that are a source of pollutants	Leakage and/or sudden spillage of fuel, lubricants, grease, oils and other harmful substances from the location of their storage, or from the construction machinery and equipment as well as from the vehicles on the construction site
	Leakage or sudden spillage of harmful substances during the use of concrete, bentonite, cement mortar (injection mass) or other harmful substances (such as paints, solvents, acids, resins, adhesives) during construction activities
	Drainage of potentially polluted localities

Activities through which pollutants can be transmitted	The earthworks such as excavations. Using explosives and tunnel driving, as well as maintaining the plant. If any harmful substances generated during these activities, are disposed of inappropriately, this will transmit pollutants
	Discharge of water that has been drained from a polluted locality
Activities that cause a change in the natural flow of groundwater	Drainage / dewatering during earthworks, excavations and tunnel driving
	Inadequate drainage of groundwater

10.3.4. During the operational phase the activities that could result in pollutants entering surface waters, may have the same impact on groundwater. This is because surface water and soil pollutants can reach groundwater via the infiltration of rainwater through the soil.

10.3.5. During the operational phase, the following activities can lead to pollution of surface waters and/or soils, and therefore of groundwater: the possible leakage of oils and/or fuel from the motor vehicles; inadequate maintenance and irregular discharge of grease traps; inadequate maintenance of motorway structures located over surface watercourses; as well as accidents.

10.3.6. The potential impacts on groundwater during the pre-construction preparation and construction phase of Project are as follows:

- Alteration of groundwater hydrology;
- Alteration of groundwater quality due to input of pollutants;

10.3.7. The potential impacts during the operational phase of the Project are as follows:

- Alteration of groundwater quality due to input of pollutants.

CONSTRUCTION PHASE

Alteration of Groundwater Hydrology

Description

10.3.8. The impact on the groundwater hydrology is expected at areas of construction works where the water table is very shallow, and thus very close to the surface. An impact on groundwater hydrology is also expected at the tunnel location, since the geological features at this site allow water permeability to some extent.

10.3.9. Soil compaction due to the use of heavy machinery is also likely during construction, which can alter the soil's water permeability.

Magnitude and Severity of Impacts

10.3.10. The estimation of the magnitude of impact has been undertaken for the locations where the Project intersects locations with a very shallow water table, and also for locations where construction will be undertaken in materials which allow water permeability.

10.3.11. There are two locations with a shallow water table, (i.e. where the ground water is very close to the surface, also regarded as a wet zone) at Ch 02+940 m – Ch 03+240 m and Ch 08+140 m – Ch 08+670 m. The tunnel construction will also take place in a material that allows water permeability to some extent. Considering this, the magnitude of this impact is assessed as Moderate.

10.3.12. Other factors to be considered in the assessment of the magnitude of this impact are given in Table 10-5.

Table 10-5 - Estimation of the Magnitude of the Impact – Alteration of Groundwater Hydrology

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable. The alteration of the groundwater hydrology may impact river water supply, and thus influence the freshwater habitats and biodiversity
Type of Impact	Direct	The alteration of the groundwater hydrology is a result of the construction activities
Reversibility	Irreversible	The tunnels will be permanent motorway structures
Geographic Extent	Local	This impact will be localised at the motorway structures constructed in water permeable materials
Time when the impact occurs	Delayed	The alteration of the groundwater hydrology is possible after all the motorway objects have been constructed. Since construction activities are planned during dry periods this impact will not be immediate
Duration	Long-term	Some of the potential impacts of the Project on groundwater hydrology are due to permanent structures. Thus, the alteration of groundwater regime due to the construction of these structures will be permanent
Likelihood of appearance	Certain	Some motorway structures are expected to be constructed at locations where the water table is very close to the surface, therefore these structures are likely impact the groundwater regime
Magnitude	Moderate	Explained in the text above

10.3.13. The magnitude of the impact for the affected groundwaters is as follows:

Table 10-6 - Magnitude of the Impact for Groundwater Receptors

Groundwater receptor	Motorway location	Sensitivity	Magnitude of the impact
Tunnel Location	Ch 04+166 m – Ch 04+847 m	Medium	Moderate
Bridge of River Zajaska (wet zone)	Ch 08+140 m – Ch 08+670 m	High	Moderate

Significance of Effects

10.3.14. The sensitivity of the groundwater receptor ranges from medium to high, and the magnitude of the impact is moderate. Therefore, the significance of this effect, in the absence of mitigation measures is **Moderate (significant).**

Alteration of Groundwater Quality due to input of Pollutants

Description

10.3.15. An aquifer's susceptibility to surface pollutants is dependent on the degree of protection which is provided by the geological materials over it. This is dependent on the vertical travel time required for a waterborne contaminant released at or near the surface to enter the groundwater. Vertical travel time is primarily controlled by the permeability of the sediments and their thickness.

10.3.16. The locations along the Project where the water table is near the surface are susceptible to waterborne contaminants from the surface. There are susceptible locations (wet zones) at Ch 02+940 m to Ch 03+240 m and at Ch 08+140 m to Ch 08+670 m, within the Project study area.

Magnitude and Severity of the Impact

10.3.17. The bridge over the River Zajaska at Ch 08+315 m will be constructed in a susceptible location, or wet zone, which is located at Ch 08+140 m to Ch 08+670 m. There is another wet zone within the study area for the Project at Ch 02+940 to Ch 03+240 m.

10.3.18. These sites are both susceptible to waterborne pollutants from the surface.

10.3.19. The pre-construction preparation and construction activities are planned to take place during the dry period of the year, when the water table at these susceptible locations is expected to be lower. This will increase the vertical travel time from the surface to the groundwater receptor. The mitigation measures that will be implemented to prevent soil compaction are set out in Section 10.4 - Mitigation.

10.3.20. Other criteria to be considered in the assessment of the magnitude of this impact are given in the table below.

Table 10-7 - Estimation of the Magnitude of the Impact – Alteration of Groundwater Quality Due to Input of Pollutants

	Assessment Thresholds	
Criteria	**Threshold**	**Descriptions**
Characterisation of Impact	Negative	Not desirable. The alteration of the groundwater quality may also impact a river water quality and thus influence the freshwater habitat ecology and biodiversity
Type of Impact	Indirect	The alteration of the groundwater quality will result from soil contamination
Reversibility	Reversible	If groundwater contamination is noticed and stopped at time In cases of accidents and spillage of large amounts of contaminants a remediation would be necessary
Geographic Extent	Local	This impact will be localised and will occur at the locations where motorway structures are constructed in water permeable materials, and downstream from the source of pollution
Time when the impact occurs	Delayed	The alteration of groundwater quality will occur after soil contamination events
Duration	Medium-term	Self-purification of groundwater may take several years after

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
		the contaminant reaches the receptor, and the source of contamination is removed If the source of pollution is not removed this impact will be long-term
Likelihood of appearance	Likely	This impact occurs due to the accidental spillage and leaks of contaminants into the soil. It occurs when materials are not stored or utilised properly, contaminated soil is not removed and disposed of safely, and leaks and spills are not stopped and cleared up
Magnitude	Moderate	Explained in the text above

10.3.21. The significance of the effect for the affected groundwaters is as follows:

Table 10-8 - Groundwater Receptors and Effects

Groundwater receptor	Motorway location	Sensitivity	Magnitude of the impact
Wet zone	Ch 02+940 m – Ch 03+240 m	High	Moderate
Wet zone (around Bridge of River Zajaska Ch 08+315)	Ch 08+140 m – Ch 08+670 m	High	Moderate

<u>*Significance of Effects*</u>

10.3.22. The sensitivity of the receptor is high, and the magnitude of the impact is moderate. Therefore, the significance of this effect, without mitigation measures, is **Moderate (significant).**

OPERATIONAL PHASE

Alteration of Groundwater Quality due to input of Pollutants

<u>*Description*</u>

10.3.23. During operation, the most vulnerable locations to contaminative substances entering groundwater, are locations where the water table is shallow (wet zones). The wet zones in the study area are composed of gravel sandstone and are located on Alluvial sediments.

Magnitude and Severity of the Impact

10.3.24. The operational sources of contamination which may affect the soil, and therefore the groundwater, include: spills and leakage of oils and/or fuel from vehicles using the Project, as well as the use of substances such as: solvents, paints, acids or herbicides during the maintenance of the Project.

10.3.25. Furthermore, contamination as a result of accidents during the transportation of hazardous substances cannot be excluded.

10.3.26. The alluvial sediments, and areas of high-water permeability, close to the Project alignment, are the most sensitive to the alteration of groundwater quality.

10.3.27. The magnitude of this impact is estimated as **Moderate**.

10.3.28. Other factors to be considered in the assessment of this impact are given in Table 10-9.

Table 10-9 - Estimation of the Magnitude of the Impact – Alteration of Groundwater Quality Due to Input of Pollutants (Operational Phase)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable. The alteration of the groundwater quality may also impact a river water quality and thus influence the freshwater habitat ecology and biodiversity.
Type of Impact	Indirect	The alteration of the groundwater quality will result from possible soil contamination.
Reversibility	Reversible	If groundwater contamination is noticed and stopped at time. In cases of accidents and spillage of large amounts of contaminants, remediation would be necessary.
Geographic Extent	Local	This impact will be localised at the motorway structures constructed in water permeable materials, and downstream the source of pollution.
Time when the impact occurs	Delayed	The alteration of the groundwater quality will occur after soil contamination events.
Duration	Medium-term	Self-purification of groundwater may take several years after the contaminant reaches the receptor, and the source of contamination is removed. If the source of pollution is not removed this impact will be long-term.
Likelihood of appearance	Unlikely	This impact occurs due to the accidental spillage and leaks of contaminants into the soil. It occurs when materials are not stored or utilised properly, contaminated soil is not removed and disposed of safely, and leaks and spills are not stopped and cleared up.
Magnitude	**Moderate**	Explained in the text above

10.3.29. The magnitude of impact for groundwater is shown in Table 10-10.

Table 10-10 - Groundwater Receptors and Effects

Groundwater receptor	Motorway location	Sensitivity	Magnitude of the impact
Wet zone	Ch 02+940 m – Ch 03+240 m	High	Moderate
Wet zone (around Bridge of River Zajaska Ch 08+315)	Ch 08+140 m– Ch 08+670 m	High	Moderate

Significance of Effects

10.3.30. The sensitivity of the receptor is high, and the magnitude of the impact is moderate. Therefore, the significance of this effect, without mitigation measures, is **Moderate (Significant).**

10.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

10.4.1. The detailed design will include measures such as oil interceptors and impermeable surfacing which will reduce the operation impacts to groundwater.

10.4.2. The mitigation measures for the protection of soil contamination (see Chapter 12 - Geology and Soils) are also applicable in protecting groundwater quality.

10.4.3. As outlined in Chapter 23 - Environmental Social Management Plan, the Contractor will prepare and implement a **Water Resources Management Plan**, (including Groundwater Management and Waste Water Management). Measures outlined in the Water Resources Management Plan include measures to:

- Reduce the harmful impacts arising from leakage of grease and oils;
- Reduce the risk of the leakage of harmful substances and chemical preparations; and
- Reduce the risk of changes of the flow and the hydrology of the groundwater.

10.4.4. The Water Resources Management Plan will include monitoring specifications for pre-construction, construction and post-construction. Monitored parameters will include; water level, pH, total dissolved solids, fuels/ oils and metals. Key monitoring locations include locations of cuttings and areas of shallow groundwater.

OPERATIONAL PHASE

10.4.5. As outlined in Chapter 23 - Environmental Social Management Plan, an **Operational Maintenance Plan and Operational Drainage Management Plan** will be prepared and implemented. This plan will include the following measures:

- Regular control and maintenance of the drainage facilities in order to avoid blockages and in order to ensure that their rate of flow is constantly maximum, thus preventing the containment of substances that could cause pollution in these facilities;
- Inspection and maintenance of oil traps / interceptors;
- Monitoring the quality of groundwater at locations where the level of groundwater is very close to the surface, in order to react in a timely manner if the quality of groundwater is disturbed;
- Application of measures for protection of surface waters and soil from pollution.

10.5 RESIDUAL IMPACT

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

Alteration of Groundwater Hydrology

10.5.1. Prior to mitigation, a moderate adverse effect is expected due to the medium to high sensitivity of groundwater receptors. and the moderate magnitude of impact.

10.5.2. The magnitude of the impact with the implementation of mitigation measures, as set out in Chapter 23 - Environmental Social Management Plan is minor. Therefore, the significance of the residual effect is considered to be **Slight (not significant).**

Alteration of Groundwater Quality due to input of Pollutants

10.5.3. Prior to mitigation, a moderate adverse effect is anticipated due to the high sensitivity of the receptor and moderate magnitude of the impact.

10.5.4. The magnitude of the impact with the implementation of mitigation measures, as set out in Chapter 23 - Environmental Social Management Plan, is Low. Therefore, the significance of the residual effect is considered to be **Slight (not significant).**

OPERATIONAL PHASE

Alteration of Groundwater Quality due to input of Pollutants

10.5.5. Prior to mitigation, a moderate adverse effect is anticipated due to the high sensitivity of the receptor and moderate magnitude of the impact.

10.5.6. The magnitude of the impact with the implementation of mitigation measures, as set out in the **Operational Maintenance Plan** and **Operational Drainage Management Plan**, is moderate. Therefore, the significance of the residual effect is considered to be **Slight (not significant).**

10.6 SUMMARY OF EFFECTS

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Groundwater	Construction	Alteration of groundwater hydrology	Moderate adverse (significant)	Water Resources Management Plan (to include monitoring specification)	Slight adverse (not significant)
		Alteration of groundwater quality due to input of pollutants	Moderate adverse (significant)		Slight adverse (not significant)
	Operation	Alteration of groundwater quality due to input of pollutants	Moderate adverse (significant)	Detailed Design measures including oil interceptors and suitable drainage design Operational Maintenance Plan Operational Drainage Management Plan Surface and groundwater monitoring.	Slight adverse (not significant)

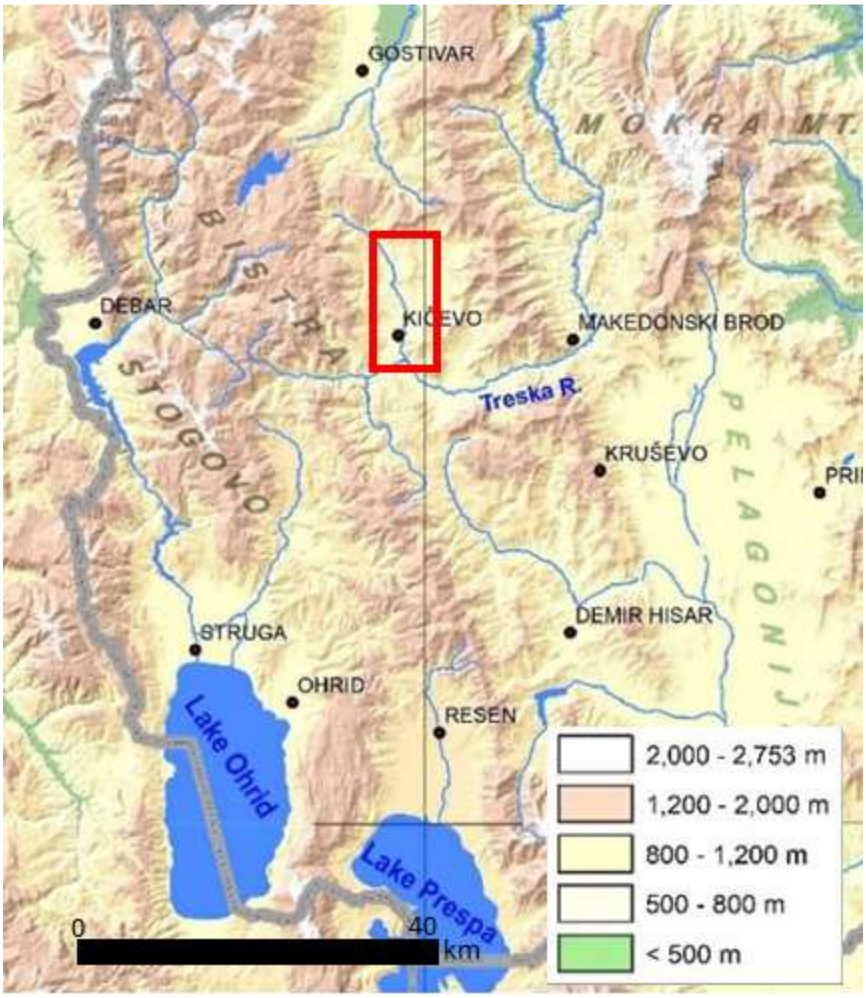
11 SURFACE WATER

11.1 BASELINE CONDITIONS

11.1.1. There are two rivers along the Project alignment, the River Zajaska (crossed in two locations) and the River Sushica (see Figure 11-1, 11-3, 11-4, and 11-5). There are also several intermittent streams and minor water bodies including the River Strogomishka.

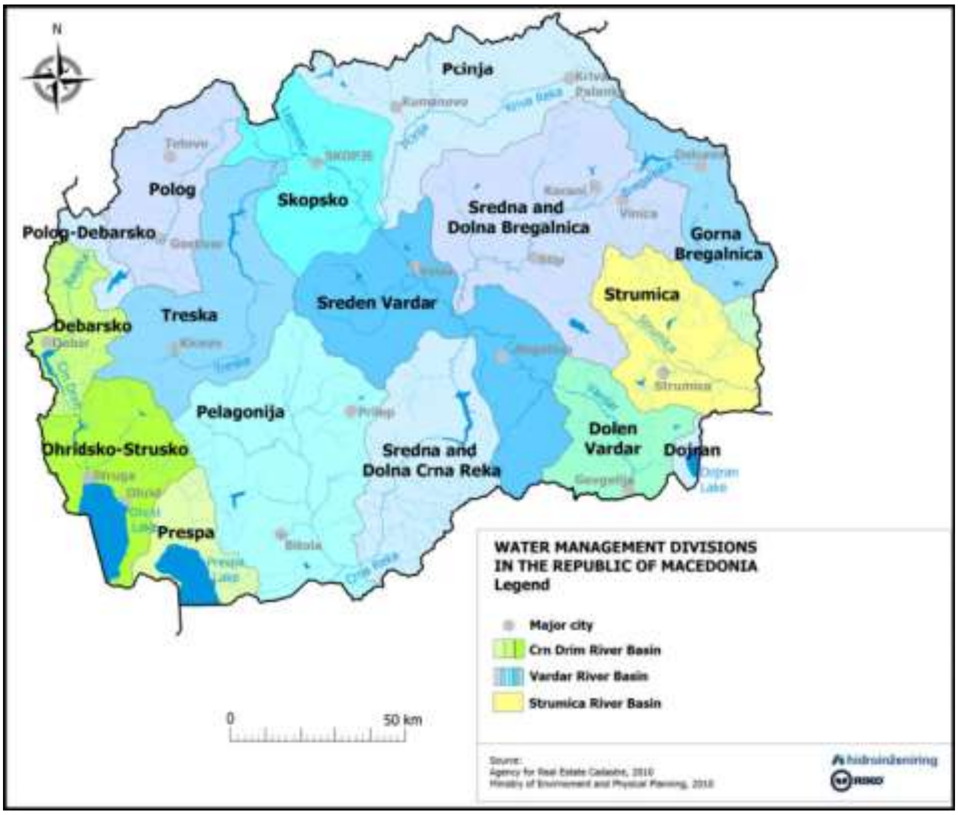
11.1.2. The River Zajaska, also known as the Kichevska River, is a western tributary of the Treska River in the Kichevo area and is the largest of all tributaries of the Treska. It surfaces as a spring on the eastern slope of Bistra, near the village Tajmishte at an altitude of 1.480 m. It flows into the Treska River, approximately one kilometre north-west from the village of Bigor Dolenci, at an altitude of 590 m. The total length, from the spring to the mouth of the river is 25.9 km.

Figure 11-1 - Rivers in North Macedonia (the Project area is indicated by the red boundary) Source: Open Geosciences 11, 1; 10.1515/geo-2019-0059



11.1.3. The river basin for the Zajaska River covers an area of 333.85 km2. The Zajaska River is known as “Tajmishka River”, close to its source, near the village of Midinic. Before it enters the Kichevo area, it passes through the village of Zajas, where it is called the Zajaska River. At the village of Kolari it merges with the river Sateska, as it enters into the Zajaska basin where it flows a length of 8 km.

Figure 11-2 - River basins in North Macedonia[65]



11.1.4. The basin area of the River Sushica is 31,17 km2.

11.1.5. The information for the soil characteristics, and for the land within the basins of the analysed watercourses have been acquired from the Pedological layout of the Republic of North Macedonia and from the CORINE Land Cover database and are summarised in Table 11-1.

Table 11-1 - Soil characteristics in river basins

River basin structure	Chainage	Soil characteristics of the basins (km^2)				Total surface (km^2)
		Loam	Clay loam	Sandy loam	Loam clay	
Bridge No. 1 - Zajaska River	Ch 08+315 km	29.26	16.24	119.06	5.50	167.76

65 https://www.researchgate.net/figure/Geographical-location-of-the-Treska-river-drainage-basin_fig1_288671464

River basin structure	Chainage	Soil characteristics of the basins (km^2)				Total surface (km^2)
		Loam	Clay loam	Sandy loam	Loam clay	
Bridge No. 2 - Sushica River	Ch 11+949 km	0.02	1.76	8.38	0.00	10.16
Bridge No. 3 - Zajaska River	Ch 01+093 km (located on the proposed link road that will connect the Project to the existing A2 highway near Zajas)	17.11	4.74	40.55	5.50	67.89
Viaduct No. 3 - dry Stiborani ravine	Ch 12+460 km	0.01	3.70	0.39	0.00	4.10

11.1.6. Where Bridge No. 1 crosses over the Zajaska River (Ch 08+310), the riverbed is generally clean, with some local debris and has a relatively straight formation, surrounded by dense tree vegetation.

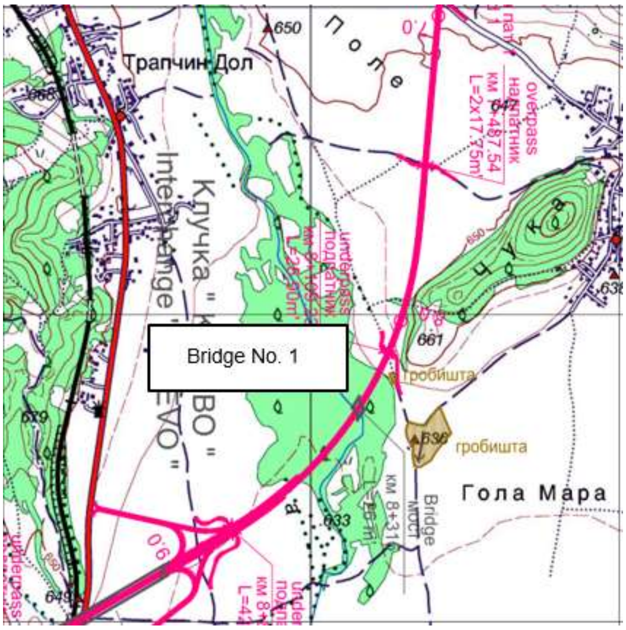


Figure 11-3 - Bridge No. 1

11.1.7. Where Bridge 2 crosses over the Sushica River (Ch 11+ 949) there is a relatively clean riverbed, with low vegetation, which channelizes the flow in the river.

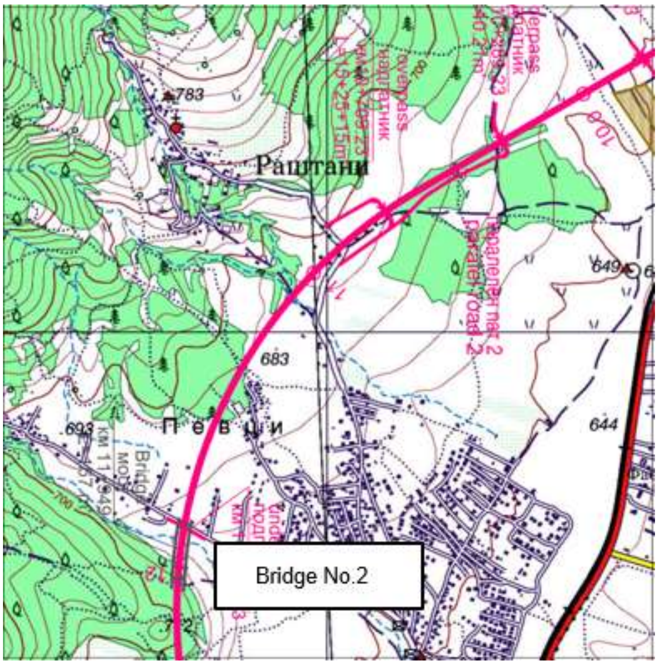


Figure 11-4 - Bridge No. 2

11.1.8. The riverbed of Zajaska River within the area of Bridge No. 3 (Ch 01+092) is relatively clean, with low shrub vegetation along the banks.

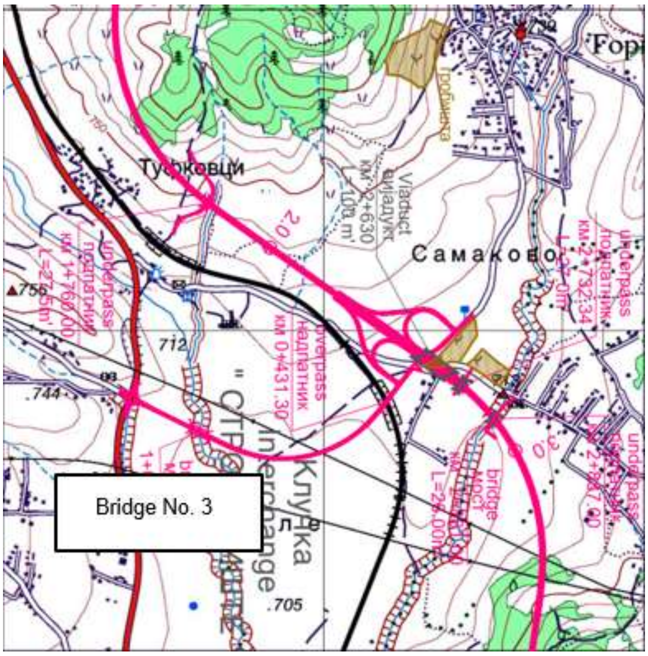


Figure 11-5 - Bridge No. 3

11.1.9. Viaduct no. 3 crosses an occasional watercourse, Stiborani ravine (Ch 12+460) which it is mostly dry. The watercourse is channelized by with shrub vegetation.

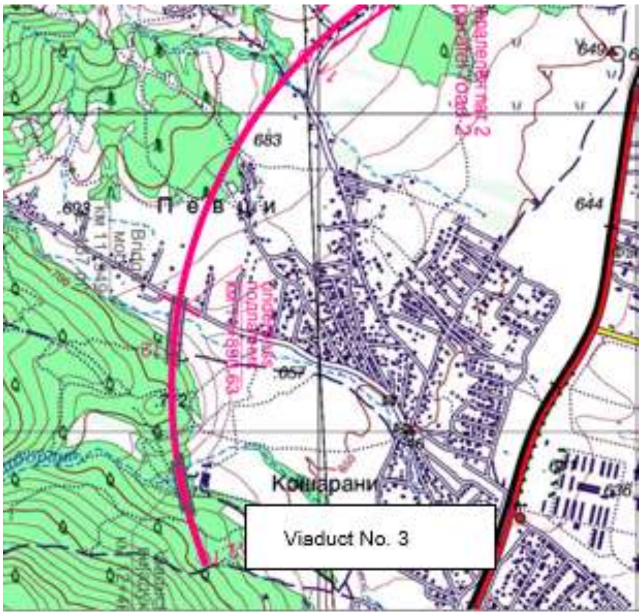


Figure 11-6 - Viaduct No. 3

11.2 WATER SUPPLY IN THE PROJECT AREA

11.2.1. The water supply in the Municipality of Kichevo is managed by the Public Water supply Enterprise "Studenchica", and the water supply is obtained from the River Studenchica.

11.2.2. The source of the River Studenchica is located on the east side of Mountain Bistra, at an altitude of 965 m, 4-5 km upstream of the village of Gorno Dobrenoec. The watershed of River Studenchica has an area of 22.4 km^2, but like other springs in the area the River Studenchica. has many tributaries.

11.2.3. The capacity of the Studenchica spring was measured in January 2020, and its capacity is between 877 l/s as a minimum value to 1156 l/s as a maximum. The average flow in January 2020 was 986 l/s. The water level at the capture was measured as 32.00 cm as a minimum and 36.70 cm as a maximum, with the average being 34.00 cm.

11.2.4. Appendix 14-1 provides the values for the water level and the capacity of the Studenchica

11.3 CATCHMENTS AND NATIONAL MANAGEMENT PLANS

CATCHMENTS AREAS IN THE REPUBLIC OF NORTH MACEDONIA

11.3.1. The territory of the Republic of North Macedonia has three catchment basins: the Aegean basin (comprising 86.9% of the area of North Macedonia), the Adriatic basin(12.9%) and the Black Sea basin (0.2%).

11.3.2. The Project is located in the Aegean basin, which contains the river Vardar and its tributaries (with a catchment basin of 20.535 km^2), the basin of the River Strumica (1.535 km^2), the basin of the river Lebnica (129 km^2) which is a tributary of the Struma, and the basin of the Doiran Lake (120 km^2).

River Basin Management Plan

11.3.3. The Republic of North Macedonia has candidate status for EU membership and is obliged to transpose and implement the regulations outlined in the Water Framework Directive (2000/60/EC). This directive of the European Commission arises from the necessity of unified framework legislation that aims to ensure integrated access to the protection and management of the water bodies on the territory of Europe.

11.3.4. The key elements of the Water Framework Directive are:

- Protection of all waters (surface water and groundwater) in a holistic manner;
- Achieving good water quality ("good status") by 2015;
- Integrated management of surface water and groundwater at river basin level;
- Combined approach of emission limit values and quality standards and elimination of extremely dangerous substances;
- Economic analysis and adequate water prices in order to promote sustainable use of water; and
- Involvement of the citizens and the interested parties.

11.3.5. According to the requirements of this Directive, a River Basin Management Plan shall be prepared for each river basin or district and it shall include the key elements given in the Directive. The Draft River Basin Management Plan for the Vardar River was published in 2019 for the period 2018/ 2019 until entering the WFD-cycle in 2021[66].

11.4 RIVERS IN THE STUDY AREA

11.4.1. The watercourses that are most affected by the Project are the River Zajaska and the River Sushica. The locations where the Project crosses these watercourses and the structures that are going to be constructed are described in Chapter 2: Description of the Project. The Project will cross over Zajaska River at Ch 01+093 m (near to the village of Zajas, Bridge No. 3) and at Ch 08+315.00 m (close to village of Crvici, Bridge No. 1). The bridge over the River Sushica is located at Ch 11+949.00 m (in village Osoj, Bridge No. 2). The Project passes over an intermittent watercourse, the River Strogomishka, at Ch 02+879.40 m, on a reinforced concrete culvert as part of the Dolno Strogomishte interchange structure.

[66] Draft Vardar River Basin Management Plan (VCBMP) Technical Report - 2019

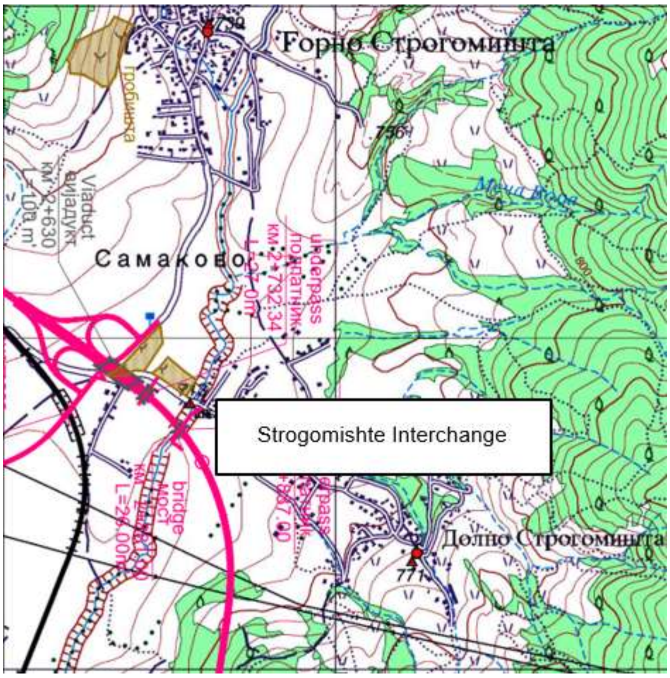


Figure 11-7 - River Strogomishka

11.4.2. The River Zajaska originates on the eastern slope of Bistra, over the village Tajmishte, at 1.480 m Above Sea Level (ASL). It flows into the river Treska, 1 km northwest of Bigor Dolenci, at a height of 590 m. The total length from the spring to the inflow is 25.9 km. The total difference in elevation between the spring and the inflow is 890 m. The basin of the River Zajaska is the largest of the tributaries of the River Treska and occupies 333,85 km2. In the river's mountainous upper reaches it is known as "Tajmishka Reka" all the way to the village Midinci. Before it enters the Kichevo area, it flows through the village of Zajas, and is called the River Zajas in this area

11.4.3. The River Sushica is an intermittent river with low water level. The part that flows through the settlement Osoj has a narrow river channel, that widens in the city of Kichevo. Some of the watercourses that flow into the River Sushica (at 900-1200 m ASL) are of a temporary nature, including those from the localities Osojski Jasak, Kolibishta, Peto Lozje and Shiroka Niva (west of the settlement of Osoj). The river flows through Osoj and Kichevo. In the eastern part of Kichevo the Sushica flows into the Zajaska River at approximately 610 m ASL.

11.4.4. There are approximately 15 intermittent watercourses, with very low water levels, close to the Project area. Most of them flow into River Zajaska, while some of them flow into the River Sushica. The majority are unnamed.

11.4.5. The Zajaska River is a tributary of the River Treska, which itself is the third main tributary (in terms of its length) of the River Vardar. Accordingly, the affected watercourses belong to the Vardar River Basin. The River Basin Management Plan for the River Vardar in accordance with the requirements from the Water Framework Directive (2000/60/EC) has not been finalised yet. The authority in charge of the river is the Vardar River Basin Management Team at the Ministry of Environment and Physical Planning.

11.4.6. The sensitivity of the water receptors is determined on the basis of the criteria given in Table 11-3.

Table 11-2 - Identification of the sensitivity of the surface water bodies

Value (Sensitivity)	Criteria
Very high	Natural rivers with unlimited retention capacity and continuous flow
High	Natural streams with unlimited retention capacity and continuous natural flow
Medium	Natural rivers and streams with unlimited retention capacity and occasional flow Particular natural rivers and streams with or without retention capacity and continuous flow. These are watercourses that have lost their natural state (for example due to rapid urbanization)
Low	Natural smaller rivers with unlimited retention capacity and occasional flow
Negligible	Unnatural water channels with no retention capacity

11.4.7. The Regulation on classification of waterways, lakes, reservoirs and groundwater “Official Gazette of RM” no.18/99 defines river categories in North Macedonia. The section of the River Zajaska, that is close to the Project alignment is Category[67] II. To the north of the Project (where it is known as the Tajmishka River) the river is Category III. To the south of the Project (from the city of Kichevo to the Treska River) it is Category III . The River Sushica is an intermittent river and is not officially classified.

11.4.8. The sensitivity values for the surface water bodies affected by the Project are as follows:

Table 11-3 - Sensitivity of the affected surface water bodies

Name of the watercourse	Watercourse type	Chainage where the motorway crosses the river	Sensitivity
Zajaska River	Small natural river with continuous flow	Bridge No. 3 Ch 01+093 (on the proposed link road between the Project and the existing A2 Highway) Bridge No. 1 Ch 08+315 (at village of Crvivci)	Medium

[67] Category I rivers are largely natural, Category II rivers have been altered and Category III are heavily altered.

Name of the watercourse	Watercourse type	Chainage where the motorway crosses the river	Sensitivity
River Sushica	Small natural river with occasional flow	Bridge No. 2 Ch 11+949 (in village of Osoj)	Low
Intermittent watercourses with very low water level	Very small natural watercourses with occasional flow	Approximately 15 along the alignment including the Stiborani ravine, crossed by Viaduct No. 3 (Ch 12+460 km)	Low
Intermittent watercourse, River Strogomishka	Small natural river with occasional flow	Strogomishte Interchange structure Ch 02+879.40	Negligible

11.4.9. Appendix 11-2 provides lab analysis of water samples of the River Zajaska in close proximity to Bridge 2. The lab analysis for the sample is provided in Table 11-5 and considered against EU Environmental Quality Standards (EQS). The water tested is considered to be of acceptable quality.

Table 11-4 - River Zajaska Water Samples – EQS

Parameter	Measurement Recorded	Indicative Parameter Levels / Thresholds
Chemical Oxygen Demand	<25 mg/l	5 - 50 mg/l
Biological Oxygen Demand	1.3 mg/l	1 - 5 mg/l
Suspended Soils	4 mg/l	2 – 30 mg/l (rainfall dependent)
Dissolved Oxygen	9.6 mg/l	8 – 15 mg/l
Nitrates	3.3 mg/l	0.5 – 10 mg/l

11.5 POTENTIAL IMPACTS AND EFFECTS

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

Table 11-5 - Activities from the construction phase that could impact surface water bodies

Activities that are sources of pollutants	Daily presence of construction workers and construction compounds resulting in wastewater and communal waste generation.
	Leakage and/or sudden release of fuel, lubricants, grease, oil and hazardous materials from storage locations or from the

	construction equipment as well as from the vehicles at the construction site.
	Leakage and/or sudden release of hazardous materials during the use of concrete, bentonite, cement mortar (injection mass) or other hazardous materials (paints, solvents, acids, resins, glues) during the construction activities. Uncontrolled deposition of sediment into the river channels which is possible during the processes of vegetation removal, cleaning of the terrain, excavation of the surface soil layer, breaking the rocks into smaller fractions, as a result of the earthworks.
	Dewatering of potentially polluted sources.
Activities through which pollutants can be transferred	Temporary embankment works in the river channel (if necessary) and potential release of contaminants.
	Earthworks including excavation, removal of vegetation, using explosives as well as the maintenance of the equipment if the hazardous materials generated by these activities are not appropriately disposed.
	Accidental release of pre-existing contaminants.
Activities that cause modification in the natural flow of the watercourse	Increased deposition of sediment into the water body.
	Construction works in the river bed and on the river banks.
	Potential change in drainage of groundwater into watercourses.

Input of Pollutants

Magnitude and Severity of Impacts

11.5.1. The estimation of the magnitude of this impact on the quality of the surface water is given in the following table.

Table 11-6 - Estimation of the magnitude of the impact – Input of pollutants

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable. Pollution of surface water can impact habitats and species related to and/or dependent on river freshwater.
Type of Impact	Direct/ Cumulative	Water pollution is generated from emissions and contaminated effluents which result from the construction activities.
Reversibility	Reversible	Reversible if the pollution pressure is not prolonged. Many pollution incidents, if constrained in a timely

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
		manner, can be easily eliminated since lotic ecosystems have a self-purification capacity.
Geographic Extent	Local	Since most of the length of the River Zajaska is at a sufficient distance from the construction activities, to prevent it being affected. This impact is localised to the points where the motorway section crosses the river.
Time when the impact occurs	Immediate	The quality of surface waters is affected immediately upon the input of polluting substances. The possibility of surface water pollution starts with the start of the construction activities.
Duration	Short-term	Since the most affected locations will be where the motorway intersections with surface waters, the possibility of pollution and alteration of water quality is expected to come to an end with the conclusion of the construction.
Likelihood of appearance	Probable	Construction activities will inevitably result with the possibility of polluting substances being washed off to the nearest surface water.
Magnitude	Moderate	Explained in the text above

11.5.2. The magnitude of the impact for the affected surface waters is as follows:

Table 11-7 - Impact on Surface Water Receptors

River (surface water receptor)	Point of motorway intersection with surface water receptor	Sensitivity	Magnitude of the impact
River Zajaska	Bridge No. 3 Ch 01+092 m (junction near Zajas village) Bridge No. 1 Ch 08 +315 m (near Crvivci village)	Medium	Moderate
River Sushica	Bridge No. 2 - Sushica River Ch 11+949 m (in Osoj village)	Low	Minor
Periodic streams of very low water flow	Approximately 15 along the motorway section	Low	Minor

River **(surface water receptor)**	**Point of motorway intersection with surface water receptor**	**Sensitivity**	**Magnitude of the impact**
River Strogomishka	Strogomishte Interchange Ch 02+879.40 m	Negligible	Negligible or Minor

Significance of Effect

11.5.3. The sensitivity of receptors ranges **from Negligible to Medium** and the magnitude of impact due to the input of pollutants, ranges from **Negligible to Moderate**. Therefore, the significance of this effect, without mitigation measures, is **Moderate (significant)**.

Alteration of River Bed Morphology and/or Physical Water Quality

Description

11.5.4. Physical water quality can deteriorate due to excessive sedimentation. The use of heavy machinery could result in soil compaction near the rivers, and therefore increase the runoff of particulate matter into the rivers.

11.5.5. The morphology of the water flow is also altered when bridge piers are constructed within river beds. Bridge piers, if constructed in the river bed, can prevent particulate matter transportation with the water flow and increase retention of particulate matter behind / upstream of the piers. This can also lead to the retention of larger objects and cause changes in the stream flow.

Magnitude and Severity of Impacts

11.5.6. The Project requires bridges over permanent rivers at two locations, both location cross the River Zajaska.

11.5.7. Bridge No. 1 over the River Zajaska (at Ch 08+315.00) has been designed to have no piers constructed in the river bed however, the toes of the abutments would be below the highest water levels. The piers of the bridge will require piling.

11.5.8. Bridge No. 3 over the River Zajaska at Ch 01+093 km will not require the construction of piers in the river, but the toes of the abutments would be below the highest water levels. This bridge will not require pilling as the foundations will be relatively shallow.

11.5.9. Bridge No. 2 over River Sushica (at Ch 11+949, in the village of Osoj), which is a river with intermittent flows, has two piers which have foundation levels below the riverbed level, but will be located outside of it. This bridge will not require pilling as the foundations will be relatively shallow.

11.5.10. It is likely that during the construction of the bridge foundations, pumps will be required to prevent the ingress of water during construction.

11.5.11. River bank protection works using riprap[68] will be used for all three bridges to prevent scouring of the bridge foundations.

11.5.12. It should be noted that modern bridge piers are quite narrow and thus the effects of particulate matter retention are limited to a very small area, while flow alteration impacts likely to be negligible.

11.5.13. The River Strogomishka is already channelized and heavily modified compared to its natural condition and therefore the concrete culvert to be constructed at this location will not impact the flow of this stream.

11.5.14. Based on these considerations, the magnitude of this impact on the alteration of river bed morphology and/or physical water quality, has been estimated as Minor.

11.5.15. The other criteria to be considered in the assessment of this impact on surface water are given in Table 11-8.

Table 11-8 - Estimation of the magnitude of the impact – Alteration of river bed morphology and/or physical water quality

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	The alteration of the river bed morphology is a result of (and necessary for) the construction activities.
Reversibility	Irreversible	Crossings above rivers and other water flows are permanent motorway structures.
Geographic Extent	Local	This impact will be localised at the motorway intersections with water flows.
Time when the impact occurs	Immediate	The alteration of the morphology of the river bed will start even before the construction stage, at the pre-construction preparation activities. Possible increased sedimentation will occur with the start of the construction.
Duration	Long-term	Crossings above rivers and other water flows are permanent motorway structures. The alteration of river bed morphology due to the construction of these structures is permanent.
Likelihood of appearance	Certain	The basic features of the river bed morphology must be altered and adjusted for the construction

[68] rock or other material used to 'armour' shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour and water, wave, or ice erosion

Criteria	Assessment Thresholds	
	Threshold	Descriptions
		of structures at the motorway intersections with water flows.

11.5.16. The magnitude of the impact for the affected surface waters is as follows:

Table 11-9 - Impacts on Surface Water Receptors

River (surface water receptor)	Point of motorway intersection with surface water receptor	Sensitivity	Magnitude of the impact
River Zajaska	Ch 01+093 m (junction near village of Zajas) Ch 8+315.00 m (near village Crvivci)	Medium	Minor or Moderate
River Sushica	Ch 11+949.00 m (in village of Osoj)	Low	Negligible or Minor
Periodic streams of very low water flow	Approximately 15 along the motorway section	Low	Negligible or Minor
River Strogomishka	Ch 02+879.40 m	Negligible	Negligible or Minor

Significance of Effect

11.5.17. The sensitivity of the receptor is between Negligible and Medium and the magnitude of impact ranges from Negligible to Moderate. Therefore, the significance of this effect, without mitigation measures, on the alteration of river bed morphology and/or physical water quality, is Slight or Moderate (significant).

Alteration of the River Bed and Floodplain Habitat Ecology

Description

11.5.18. The riverbed morphology may be altered at river crossings, if bridge piers or earth structures are to be built in close proximity to the rivers. All three bridges will have riprap bank protection which has the potential to affect the riverbank and floodplain habitat.

11.5.19. Alteration of the riverbed morphology may impact the existing habitat structure at the site and thus influence the ecological features of the area. Many aquatic species such as toads (including Annex II species Bombina Variegata), salamanders and frogs may be dependent on the habitat structure and the physical characteristics of the area (for further information see Chapter 15 – Biodiversity).

Magnitude and Severity of Impacts

11.5.20. The Project intersects the River Zajaska, a permanent river, at two locations. The remaining crossings are over intermittent surface water bodies, which are of Low or Negligible sensitivity.

11.5.21. The construction of the Project may alter the existing physical floodplain habitat features at the crossing over River Zajaska at Ch 08+315.00 m. Although the design does not require the construction of piers in the river at this location, there will be structures adjacent to the river. A well-developed natural floodplain forest exists (including Riparian Alder – as identified in Chapter 15) at this location. A large area is covered during the flooding period leaving many patches of stagnant water during the drainage period. Bridge No. 1 crossing over the River Zajaska is shown in Figure 11-5.

11.5.22. Bridge No. 3, over the River Zajaska at Ch 01+093 km, will not require the construction of piers in the river, but the toes of the abutments would be below the highest water levels which may affect the floodplain.

11.5.23. Modern bridges have a limited potential to retain flood water, and thus are expected to have a minor impact on the floodplain hydrology. The bridge constructed over River Sushica will have the bridge piers constructed out of the river flow, hence the flow alteration will be minimal.

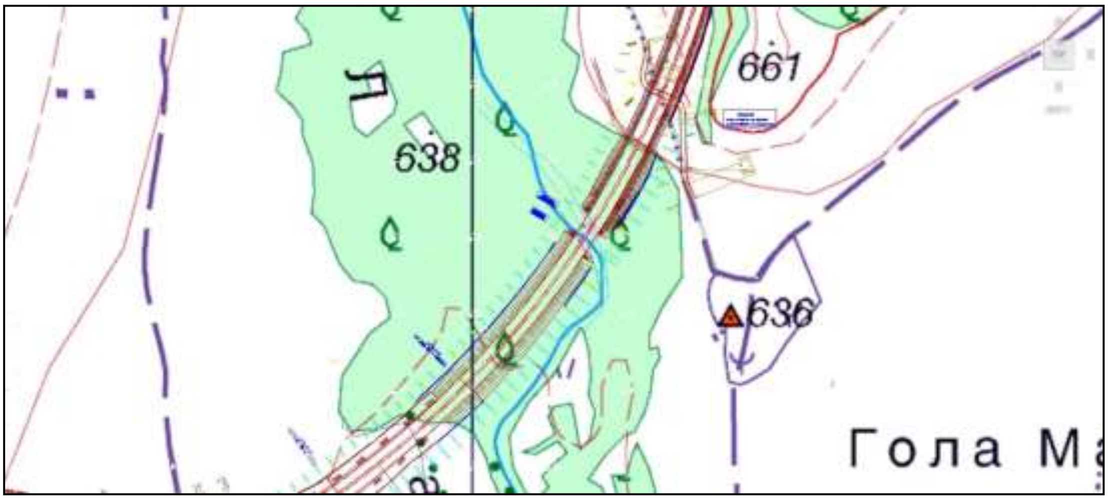


Figure 11-8 - Bridge No. 1 over River Zajaska at Ch 08+315.00

11.5.24. With this in consideration, the magnitude of this impact has been assessed as up to Moderate.

11.5.25. The other criteria to be considered in the assessment of this impact on surface water are given in Table 11-10.

Table 11-10 - Estimation of the magnitude of the impact – Alteration of river bed and floodplain habitat ecology

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable. The alteration of the river bed morphology and excessive sedimentation of particulate matter in water flows may impact the river habitat and the freshwater biodiversity.
Type of Impact	Direct	The habitat structure in most cases is dependent on the physical features of the environment, thus if the physical environment is altered it will directly impact the habitat structure and/or ecology.
Reversibility	Reversible	Considering the extent of the planned activities and area affected we believe that the ecological conditions in the affected habitats can be restored.
Geographic Extent	Local	This impact will be localised at the motorway intersections with water flows.
Time when the impact occurs	Immediate	The alteration of the morphology of the river bed will start even before the construction stage, during the pre-construction preparation activities.
Duration	Short-term	Even though crossings above rivers and other water flows are permanent motorway structures the ecological features of these habitats will not be altered severely.
Likelihood of appearance	Probable	Alteration of the physical features in or adjacent to river flows will inevitably influence the habitat structure.

11.5.26. A riverbed and floodplain habitat that will be most likely affected by this impact is River Zajaska and the floodplain habitat around the proposed bridges. The assessment of the significance of effect is based on this river only (which is estimated to have a Medium sensitivity).

11.6 SIGNIFICANCE OF EFFECTS

11.6.1. The sensitivity of the receptor is Medium, and the magnitude of impacts is considered to be Moderate. Therefore, the significance of this effect, without mitigation measures, is **Moderate (Significant)**. Mitigation outlined in a **Biodiversity Management Plan** and **Land Restoration Plan** will be applied during construction. See Chapter 15 – Biodiversity and Chapter 23 – ESMP for more details.

Abstraction of Water from Surface Water Sources during Construction

Description

11.6.2. The water supply system of "Studenchica" is likely to be used for potable and non-potable uses during the construction of the Project. The Contractor will need to obtain a written agreement with, and a Contract signed by the Public Water Supply Enterprise "Studenchica", prior to commencing construction. This Contract will clearly define the required amount by the Contractor (for the purpose of construction) and the amounts allowed by the Public Water Supply Enterprise “Studenchica”. The amount of water to be used by the Contractor (for the purpose of construction, including supplying construction workers camps) should under no circumstances exceed the capacity of the source “Studenchica”. Based on the large flow rates from the Studenchica spring, it is assumed that it is of Low sensitivity.

11.6.3. Based on comparable motorway infrastructure projects, the water use is likely to be under 140,000 litres per day (including water used for dust mitigation measures).

Estimation of magnitude

11.6.4. The magnitude of impact is outlined in Table 11-11.

Table 11-11 - Estimation of the magnitude of the impact – Abstraction of water from surface water sources during construction

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Water will be taken directly from the river. This will be additional abstraction from an existing source.
Reversibility	Reversible	Once construction stops the need for water will be removed.
Geographic Extent	Local	This impact will be downstream from the point of abstraction.
Time when the impact occurs	Immediate	The impact will occur when abstraction takes place.
Duration	Short-term	During abstraction works.
Likelihood of appearance	Probable	Alteration of the physical features in or adjacent to river flows will inevitably influence the habitat structure.
Magnitude	Negligible	Explained in the text above.

<u>Significance of Effect</u>

The sensitivity of the receptor is Low, and the magnitude of impact is Negligible, Therefore, there will be a **Neutral (not significant)** effect resulting from the abstraction of additional water from an existing source, for construction and potable uses.

11.7 Operational Phase

INPUT OF POLLUTANTS

Description

11.7.1. The release of pollutants during the operational phase, even though less likely when compared to the construction phase, it is not avoidable. The input of pollutants into surface water might result from possible leakage of fuel and/or oil from the vehicles using the motorway. During the regular maintenance of the motorway, there may be a need to use construction and maintenance machinery, with an associated possible impact to surface water. The locations most sensitive to this are those where the motorway intersects with surface water features. Other possible sources of pollution arise from activities including: paint removal, vegetation maintenance and repair works. Accidents may result in the release of pollutants to surface water through spillages and leaks.

Magnitude and Severity of Impacts

11.7.2. The locations most at risk from this impact are those where the Project intersects surface water bodies. Most of these intersections are over surface water features with temporary water flows, which are of Low sensitivity. The River Zajaska is the only permanent watercourse intersected by the Project (in two locations) and is therefore regarded as the most sensitive feature.

11.7.3. The bridge crossings over the River Zajaska are short, and the implementation of proper structures (like grease and oil traps[69]) will greatly reduce or even avoided the risk of pollutants entering the river. The same applies for the bridge crossing over the River Sushica (which has a temporary water flow).

11.7.4. Other factors to be considered together with the estimation of the magnitude are given in the table below:

Table 11-12 - Estimation of the magnitude of the impact – Input of pollutants (Operational phase)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable. Pollution of surface water can impact habitats and species related to and/or dependent on river freshwater.
Type of Impact	Direct/Cumulative	Water pollution is generated from emissions and contaminated effluents which originate from the vehicles using the motorway section.

[69] Grease and oil traps form part of the Project as outlined in Design documentation – Book 9 - Drainage-atmospheric sewage

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Reversibility	Reversible	Reversible if the pollution pressure is not prolonged and proper structures (grease and oil traps) are placed along the alignment. Many pollution incidents, if constrained in a timely manner, can be easily eliminated since lotic ecosystems have a self-purification capacity.
Geographic Extent	Local	Since most of the section length of the affected running water (River Zajaska) is at a relatively safe distance from the motorway, this impact is localised to the points where the motorway section is crossing the river.
Time when the impact occurs	Immediate	The quality of surface waters is affected immediately upon the input of polluting substances.
Duration	Long-term	The possibility of polluting substances entering surface water flows will be present as long as the motorway section is being used.
Likelihood of appearance	Probable	Vehicle transportation is characterized with the possibility of polluting substances being washed off to the nearest surface water.
Magnitude	Moderate	Explained in the text above.

11.7.5. The surface water body, with a permanent surface water flow, that is most likely to be affected by this impact is the River Zajaska, thus the assessment of the impact is based on this river only (which is estimated to have a Medium sensitivity).

Significance of Effect

11.7.6. The sensitivity of the receptor is **Medium,** and the magnitude of the impact is **Moderate**. Therefore, the significance of this effect in the absence of mitigation is **Moderate (significant)**. Mitigation in the form of oil interceptors in the Detailed Design as well as operational procedures including an **Operational Maintenance Plan** and **Operational Drainage Management Plan** will be required to manage this effect to acceptable levels.

Alteration of Flow Patterns and Sediment Deposition during Flooding Periods

Description

11.7.7. The motorway crosses surface water bodies at only a few locations. The impact of alteration of flow patterns and sediment deposition during flooding periods, may start during construction, but may remain throughout the operational phase.

11.7.8. The modifications in the local flow patterns during flooding periods causing a barrier effect have been considered. A critical flooding area is the point where the motorway sections crosses River Zajaska at Ch 08+315.00 (Bridge No. 1). The motorway structure would contribute to the extension of the flooding area upstream, but it is possible that it could also prevent water during flooding periods from reaching the areas downstream, which otherwise would have been flooded.

Magnitude and Severity of Impacts

11.7.9. As the bridges and culverts have been designed for the 1 in 100 year flood event this barrier effect is not likely to be a significant issue.

11.7.10. As for the bridge structures, some water retention could occur if the piers are constructed within the stream bed. An indirect effect would be the accumulation of sediments and larger objects upstream behind the piers, thus causing changes in the stream flow and sedimentation patterns. The magnitude of the effect would depend on the number and size of the piers inside the water bed (the more and wider the piers the greater the water retention potential). All the bridges will include riprap to protect the piers and foundations from erosion, which may affect flow patterns and the deposition during flood periods. The scale of this will be very small as riprap will only be used adjacent to bridges.

11.7.11. Other criteria to be considered are given in the Table 11-13.

Table 11-13 - Estimation of the magnitude of the impact – Alteration of flow patterns and sediment deposition during flooding periods (Operational phase)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct/Cumulative	
Reversibility	Reversible	Reversible if structures at river crossings are designed to avoid water retention.
Geographic Extent	Local	This impact is localised to the points where the motorway section crosses rivers, since most of the alignment is located away from surface water bodies.
Time when the impact occurs	Delayed	Water retention may occur after heavy rain falls only. If structures are designed properly water retention may even be avoided (and reduced only to extreme events).
Duration	Long-term	The possibility is present as long as the motorway section is being used.
Likelihood of appearance	Unlikely	If motorway structures at river crossings are designed properly water retention can be avoided.
Magnitude	Negligible	Explained in the text above.

11.7.12. The surface water body, with a permanent surface water flow, that is most likely to be affected by this impact is the River Zajaska, thus the assessment of the impact is based on this river only (which is estimated to have a **Medium** sensitivity).

Significance of Effect

11.7.13. The sensitivity of the receptor is considered to be **Medium**, and the magnitude of impact is considered to be **Negligible**. Therefore, the significance of this effect, without mitigation is **Slight (not significant)**.

11.8 SUMMARY OF EFFECTS

11.8.1. The following effects are anticipated during the Construction phase, before the implementation of the mitigation in Section 11.4:

- The potential for significant effects as a result of the input of pollutants is **Moderate (significant)**.
- The potential for significant effects as a result of riverbed and floodplain habitat alteration is **Moderate (significant)**.

11.8.2. The following effects are anticipated during the Operational phase, before the implementation of the mitigation in Section 11.4:

- The potential for significant effects as a result of the input of pollutants is **Moderate (significant)**.
- The potential for significant effects as a result of riverbed and floodplain habitat alteration is **Slight (not significant)**.

11.9 Mitigation

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

11.9.1. As outlined in **Chapter 23 – Environmental Social Management Plan**, prior to the start of construction; the Contractor will prepare and implement a **Water Resources Management Plan**, **including Waste Water Management**. It will include measures to:

- Reduce the harmful effects caused by grease and oil leakage;
- Reduce the harmful effects caused by dispersion of solid particles;
- Reduce the harmful effects caused by cement and concrete use;
- Reduce the risk from leakage of harmful materials and chemical substances; and
- Reduce the risk to river ecosystems.
- Monitoring criteria for pre-construction and during construction activities.

11.9.2. The Water Resources Management Plan will include calculations for the water demand for construction including water required for:

- Construction (e.g. concrete mixing);
- Dust suppression;
- Cleaning equipment;
- Potable water for construction workers; and
- Use in construction camps (if these will be used).

11.9.3. The plan will include measures to minimise water usage in the first instance, and also opportunities for reuse of water where possible.

11.9.4. The Water Resources Management Plan will also provide details on predicted waste water (sewage) volumes, disposal scheme, information on capacity and type of waste water treatment facility, location of the discharge point/points with indication of coordinates. A discharge permit will be sought from the MoEPP and Maximum Allowable Discharge Limits (MADLs) will be set which the project must then comply with.

11.9.5. The Plan will ensure that liquid wastes are removed by an authorised company and disposed in an environmentally responsible manner in accordance with the Waste and Materials Management

11.9.6. As outlined in the ESMP, appropriate water monitoring will be undertaken pre construction and during the construction phase. Monitoring will include pH; suspended solids; oils and grease. This will be undertaken weekly during activities near surface water bodies. Water will be monitored up and down stream of construction activities to allow the source of pollutants to be understood. If pollutants are found down stream of construction works during inspections, their source will be tracked up river and additional measures may need to be applied (halting works/ changes in work practices etc).

11.9.7. The detailed design will include suitable drainage design and will include oil interceptors to reduce the potential for contaminants to enter surface water bodies during operation.

11.10 OPERATIONAL PHASE

11.10.1. As outlined in **Chapter 23 – Environmental Social Management Plan**, in order to protect the surface water system against impacts during the operational phase an **Operational Maintenance Plan** and **Operational Drainage Management Plan** will be prepared which will include measures such as:

- Regular control and maintenance of the drainage structures in order to prevent their blockage and to reach their constant maximal throughput;
- Inspection and maintenance of oil capture structures / interceptors (in line with national and international best practice); and
- Monitoring of surface water bodies at discharge locations up and down stream (twice a year).

11.11 Residual Effects

CONSTRUCTION PHASE

Input of Pollutants

Alteration of River Bed morphology and/or physical water quality

11.11.1. Prior to mitigation, a **moderate adverse (significant)** effect is anticipated. The magnitude of the impact with the implementation of mitigation measures in the Water Resources Management Plan (ESMP – Chapter 23) is Low. Therefore, the significance of the residual effect is considered to be **Slight (not significant)**.

Alteration of River Bed and Floodplain Habitat Ecology

11.11.2. Prior to mitigation, a Moderate adverse (not significant) effect is anticipated to flood plain habitats including riparian Black Alder and riparian willow (see section 15.2 of Chapter 15: Biodiversity for further details). The magnitude of the impact with the implementation of mitigation measures in the Water Resources Management Plan (ESMP – Chapter 23) is Minor. Therefore, the significance of the residual effect is considered to be **Slight (not significant)**.

Abstraction of Water from Surface Water Sources during Construction

11.11.3. Prior to mitigation, a **Neutral (not significant)** effect is anticipated. The effects of abstraction of water from surface water bodies will be **Neutral (not significant)**.

11.12 OPERATIONAL PHASE

INPUT OF POLLUTANTS

11.12.1. Prior to mitigation, a **moderate adverse (significant)** effect is anticipated. The probability of the success of mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is minor. Therefore, the significance of the residual effect is considered to be **Slight (not significant)**.

ALTERATION OF FLOW PATTERNS AND SEDIMENT DEPOSITION DURING FLOODING PERIODS

11.12.2. Prior to mitigation, a **slight adverse (not significant)** effect is anticipated. The probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is minor. Therefore, the significance of the residual effect is considered to be **Slight (not significant)**.

Table 11-14 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Surface Water	Construction	Input of Pollutants	Moderate adverse (significant)	Water Resources Management Plan Biodiversity Management Plan	Slight adverse (not significant)
		Alteration of river bed morphology and/or physical water quality	Moderate adverse (significant)		Slight adverse (not significant)
		Alteration of river bed and floodplain habitat ecology	Moderate adverse (not significant)		Slight adverse (not significant)
		Abstraction of water from surface water sources during construction	Neutral (not significant)		Neutral (not significant)
	Operation	Input of Pollutants	Moderate adverse (significant)	Detailed design – oil interceptors	Slight adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Alteration of flow patterns and sediment deposition during flooding periods	Slight adverse (not significant)	Operational Maintenance Plan Operational Drainage Management Plan	Slight adverse (not significant)

12 GEOLOGY AND SOILS

12.1 BASELINE CONDITIONS

12.1.1. The baseline data has been obtained through a combination of observations during a site visit, and the desk-based review of third-party information.

LANDUSE

12.1.2. The Project is located within an area of mountainous / hilly terrain and consists of:

- Agricultural land;
- Woodland areas;
- Areas of residential dwellings, predominately located to the south and north of the Project (Kichevo and Zajas, respectively);
- Sections of existing road;
- A number of cemeteries; and
- A number of rivers and streams, inclusive of **Rivers Zajaska, Sushica, Tiborani and Strogomishka.**

12.1.3. The ground cover surrounding the Project generally comprises: agricultural land (largely grassland); areas of hardstanding associated with residential dwellings; sections of the existing road; and areas of woodland, some of which is partially wetland.

GEOLOGY

12.1.4. Geological mapping of the investigated area (BGM sheet Kicevo K34-90) indicates the bedrock geology beneath the Project is comprised of sedimentary strata of Pliocene deposits (**gravels and clays, changing to clayey sands and clays with depth**), Quartz Metasandstones, Feldpathesized Shales, Green Shales and Phyllites. This is overlain by superficial deposits of Alluvium (including pluvial and diluvial deposits). The Project alignment is largely located on topsoil, with Made Ground[70] present beneath the areas of hardstanding.

12.1.5. The Alluvium deposits are present in the Kichevo valley in particular along the rivers with a maximum thickness of 30-50 m. These sediments are composed of sands, gravels and sandy clays.

12.1.6. A detailed description of geological strata is contained in Appendix 12-1.

12.1.7. A detailed summary of likely geological units encountered along the Project alignment are presented in Table 12.1.

[70] A term used to describe soil which has been subject to human intervention, such as through farming, landscaping or construction activities.

Table 12-1 - Review of the geological field characteristics by chainage

Chainage (km)	Length (m)	Lithological description of the material	Engineering-geological and hydrogeological (geotechnical) characteristics of the rock masses
Ch 00+000 ÷ 01+835	1835	Phyllites schists intensively cracked at the surface, at places covered with diluvial sediments built of silty clay at places with presence of sand and debris	The phyllites schists are bedrock, unproductive strata. They are characterized with expressed shrinkage at chainage Ch 01+020 km, forming of contemporary linear erosion under the influence of exogenic geological processes. The diluvial sediments are registered with maximum depth of 2.0 m, and the same are superficial deposits, weakly compacted, unproductive aquifer.
Ch 01+835 ÷ 02+420	585	Pliocene sediments built of silty clay with small presence of sand	Superficial deposits, medium to well compacted, unproductive aquifer
Ch 02+420 ÷ 02+710	290	Pliocene sediments built of silty sand	Superficial deposits well compacted, potential aquifer
Ch 02+710 ÷ 03+340	750	Alluvial sediments, silty clay with presence of small layers of sand	Superficial deposits, unproductive aquifer, at chainage Ch 02+940 km to Ch 03+240 km is registered wetland as well as high level of groundwater in the trial pits
Ch 03+340 ÷ 03+430	90	Diluvial sediments, silty sandy clays with increased presence of debris	Superficial deposits, weakly to medium compacted, according to the hydrogeological characteristics they are potential aquifers
Ch 03+430 ÷ 04+600	1170	Phyllites schists intensively cracked at the surface at places they can be covered with thin layer of diluvial sediments	Bedrock, unproductive aquifer.
Ch 04+600 ÷ 04+910	310	Diluvial sediments built of silty sand with presence of debris which are covering the phyllites schists with different thickness of the diluvial sediments	Superficial deposits, weakly to medium compacted, according to the hydrogeological characteristics they are potential aquifers
Ch 04+910 ÷ 05+900	990	Phyllites schists intensively cracked at the surface at places they can be covered with thin layer of diluvial sediments	Bedrock, unproductive strata. At chainage Ch 05+230 km and Ch 05+330 km is recorded as having linear erosion under the influence of exogenic geological processes
Ch 05+900 ÷ 06+090	190	Pliocene sediments, silty sand with presence of fragments, the same are with thickness of 1.50 m and are covering the phyllites schists	Superficial deposits, well compacted, potential aquifer. At chainage Ch 06+000 km to Ch 06+080 km is recorded as having contemporary linear erosion under the influence of exogenic geological processes
Ch 06+090 ÷ 06+790	700	Pliocene sediments, silty clay with small presence of sand	Superficial deposits, with medium plasticity in semi-solid consistent state, unproductive aquifer

Chainage (km)	Length (m)	Lithological description of the material	Engineering-geological and hydrogeological (geotechnical) characteristics of the rock masses
Ch 06+790 ÷ 08+160	1370	Alluvial sediments at the surface built of silty clay with small presence of sand, in depth the alluvial sediments are built of sandy gravels with presence of bigger boulders	Alluvial sediments and superficial deposits, the surface layers built of sandy silty clay are classified as unproductive aquifers, the materials built of sandy gravels are typically permeable and are considered aquifers
Ch 08+160 ÷ 08+280	120	Alluvial sediments, muddy silt with layers of sand	Superficial deposits, potential aquifer, at chainage Ch 08+160 to Ch 08+690 km. It is registered as a 'wet zone' and has a high level of groundwater-0.20 m in the trial pit TP-21
Ch 08+280 ÷ 08+690	410	Alluvial sediments built of sandy gravel	Superficial deposits, potential aquifer, at chainage Ch 08+140 to Ch 08+670. It is registered as a 'wet zone' and has high level of groundwater -0.70 m in the trial pit TP-22
Ch 08+690 ÷ 09+300	610	Alluvial sediments, clayey silt with small presence of sand, in the deeper layers are represented sandy clayey materials	Superficial deposits in soft consistent state, potential aquifer
Ch 09+300 ÷ 09+630	330	Alluvial sediments, clayey sand with presence of smaller layers of silt	Superficial deposits, well compacted, potential aquifer
Ch 09+630 ÷ 10+820	1190	Diluvial sediments are built of clayey sand with presence of debris which are covering the Pliocene sediments composed of clayey sand	The diluvial sediments are superficial deposits, well compacted, with small depth of 0.5 m. They represent potential aquifers, the Pliocene sediments are classified as superficial deposits and potential aquifers
Ch 10+820 ÷10+960	140	The Pliocene sediments are built of clayey silt with small presence of fragments	The Pliocene sediments are classified as superficial deposits, medium compacted, unproductive aquifer
Ch 10+960 ÷ 11+080	120	Pliocene sediments, clayey silt with small presence of sand	Superficial deposits, unproductive aquifer
Ch 11+080 ÷11+130	50	Diluvial sediments which are built of clayey sandy gravel with presence of debris and they are covering the Pliocene sediments built of sandy silt weakly clayey and with small presence of fragments	The diluvial sediments are superficial deposits and have a registered thickness of 2.1 m to 3.0 m, They are potential aquifers, the Pliocene sediments are classified as superficial deposits, weakly to well compacted, potential aquifers
Ch 11+130 ÷ 11+410	280	pluvial sediments composed of sandy silty clay in depth occurrence of debris	Superficial deposits, unproductive aquifers

Chainage (km)	Length (m)	Lithological description of the material	Engineering-geological and hydrogeological (geotechnical) characteristics of the rock masses
Ch 11+410 ÷ 11+940	530	pronubial sediments, clayey sand with small presence of gravel in depth with presence of debris	Superficial deposits, well compacted, potential aquifers
Ch 11+940 ÷ 12+080	140	pluvial sediments, clayey sand with presence of debris	Superficial deposits, well compacted, potential aquifers
Ch 12+080 ÷ 12+420	340	Phyllites schists cracked at the surface at places covered with diluvial sediments	Bedrock, unproductive aquifer, with expressed shrinkage
Ch 12+420 ÷ 12+550	130	pluvial sediments, clayey sand with presence of debris	Superficial deposits, potential aquifers
Ch 12+550 ÷ 12+728	178	Phyllites schists cracked at the surface at places covered with diluvial sediments	Bedrock, unproductive aquifer, with expressed shrinkage and forming of crack system

ENGINEERING GEOLOGY CHARACTERISTICS

12.1.8. Based on past research, as well as on the basis of engineering geological mapping of the Project alignment, geological units mapped along the route are defined and classified based on their engineering geological characteristics. These include:

Superficial Deposits

12.1.9. The majority of superficial deposits comprise quaternary deposits of pluvial, diluvial and alluvial origin, comprising sandy silty materials with clayey and gravel material, as debris of local rocks. These deposits are potentially unstable as an engineering medium.

Weathered Bedrock

12.1.10. Representatives of this group are the Pliocene sediments comprising variable quantities of clayey silts.

Bedrock

12.1.11. The bedrock phyllites are observed as being weathered towards the upper boundary along the Project alignment. Due to the pressure strength of the tested samples (< 50 megapascal (MPa)) they are classified as bedrock. They increase in strength and competence with depth.

12.1.12. Weathering of bedrock outcrops were noted along the Project alignment as well as linear erosion and gullying of superficial Alluvium and Pliocene deposits. This is likely a result of erosion from rainfall events and as a result of loss of vegetation at chainage Ch 01+020 km, Ch 05+240 km and at Ch 05+340 to 5+380 km. These sections of the road may require protection measures during the operation of the Project.

Figure 12.1 – Formation of linear erosion

Hydrogeology

12.1.13. Groundwater is likely to be present within the superficial Alluvium deposits. The majority of the sedimentary strata is unlikely to be acting as an aquifer such as would support extraction for potable water supply. These unconfined aquifers are characterised with intergranular porosity and good water permeability. Further details regarding groundwater are provided in Chapter 10 - Groundwater.

Surface Waters

12.1.14. The Project alignment approaches and bridges over two rivers, River Zajaska (at two locations) and River Sushica. Further information on surface water bodies is included in Chapter 11 – Surface Water.

POTENTIAL SOURCES OF CONTAMINATION

12.1.15. The following potential sources of contamination have been identified along the Project alignment and in the surrounding area during a site visit undertaken in February 2020:

- Made Ground associated with the construction of the existing roads. The topsoil surrounding the existing roads is also likely to have a high heavy metal contents within a distance of 5 m to 10 m from the alignments;
- Agricultural machinery, with the potential for oil / fuel spills;
- The potential presence of animal waste and animal carcasses associated with the agricultural land;
- A sewage system which intersects with existing residential dwellings, with the potential for unlined pits to be in use;
- Cemeteries, some of are currently in use; and
- Construction and non-hazardous waste sites and fly-tipped waste (see Figure 12-2).

12.1.16. Oslomej Power Station is located approximately 1 km east of the northern section of the Project alignment, beyond the village of Crvica. A large, partially operational open cast coal mine was noted adjacent to the power station. Although the PowerStation and mine are not directly considered to be sources of contamination (and therefore are scoped out of the assessment), large amounts of construction and domestic waste were noticed along the perimeter roads of the power station and mine.

Figure 12.2 – Existing contamination – fly tipping

SEISMIC CHARACTERISTICS

12.1.17. Several tectonic structures are present in the vicinity of the Project alignment, including the Graben of Kicevo, Syncline of Bukovik and the Anticline of Tajmishte geological features. The Graben of Kicevo, consists of Pliocene and Quaternary sediments. The Syncline of Bukovik, formed in the Cambrian and Ordovician period, has a brachisyncline structure. The Anticline of Tajmishte extends along the valley of the River Tajmiska.

12.1.18. In vicinity of the village Osoj, located to the north of Kichevo, lies the Fault of Osoje which travels in a northwest-southeast direction[71].

12.1.19. According to the existing seismic map of the Republic of North Macedonia (as shown in Figure 12-3), over a timeframe of 500 years[72,] it can be concluded that the Project alignment is in an area of 'very strong' intensity. 'Very Strong' indicates the potential for negligible damage in well-designed structures with regards to seismic movements, slight to moderate damage in ordinary structures (i.e. buildings that do not consider seismic movements) and considerable damage in poorly built or previously damaged structures.

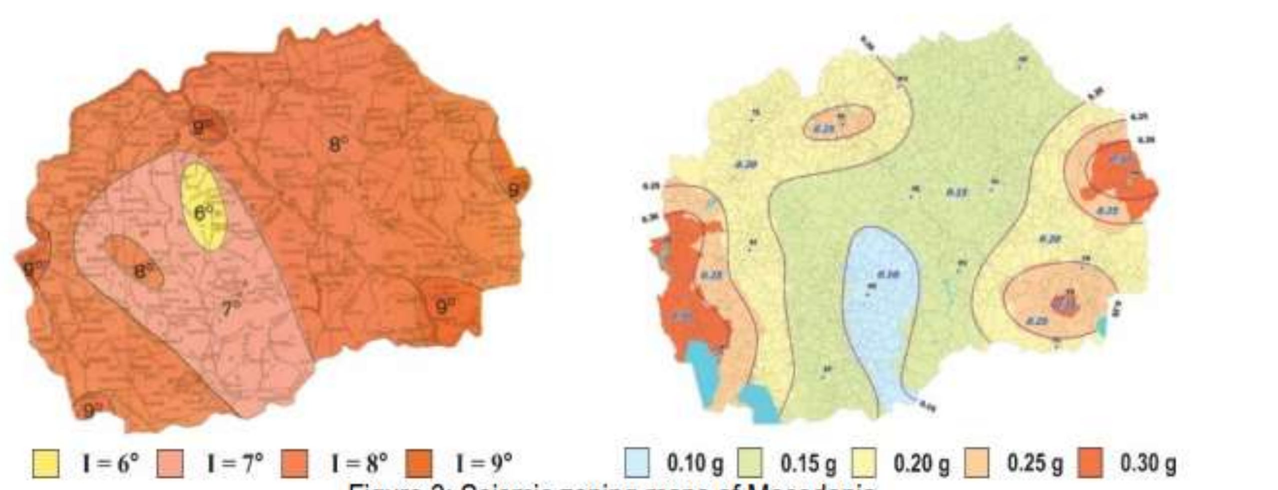


Figure 3: Seismic zoning maps of Macedonia.

a) Currently used map expressed in MSK-64 intensity degrees for a return period of 500 years and moderate soil conditions.

b) New map elaborated in compliance with the requirements of the MKC EN 1998-1:2012 Standard – Eurocode 8, expressed through peak ground acceleration *(PGA)* for a return period of 475 years and soil conditions type A.

Authors: Milutinovic al. 2016

Elaborated by: Seismological Association of SFRY, 1987.

Figure 12.3 – Seismic Intensity of North Macedonia

[71] Interpreter of Basic Geological Map 1:100 000 BGM sheet Kicevo K34-90.

[72] The recommended timeframe for application according to Eurocode 8 until the adoption of a national document for application in the field of seismicity.

EROSION

12.1.20. Figure 12-4 displays the likely risk of erosion in the vicinity of the Project. Most of the Project is in areas of low erosion risk.

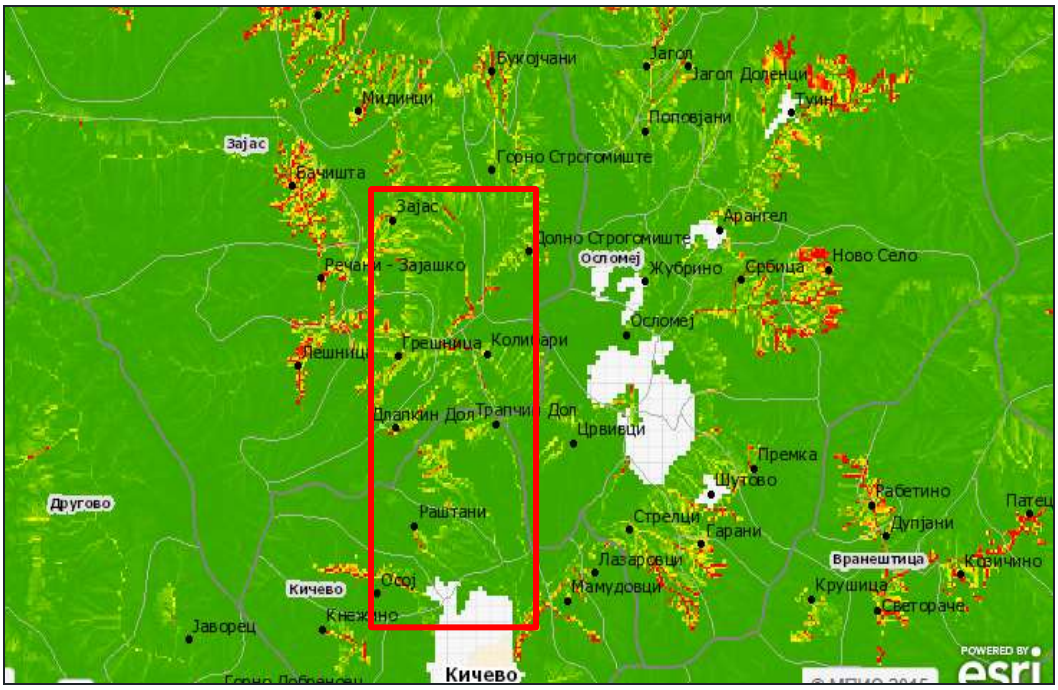


Figure 12.4 – Map of Erosion Risk73 (red is high risk, green is low risk)

12.1.21. In the Republic of North Macedonia, the soil cover is pretty heterogeneous and varies within short distances. Over 30[74] soil types and even more subtypes, varieties and forms have been registered.

12.1.22. The Project alignment passes through hilly and mountainous terrain and is an area with rural characteristics that vary in terms of soil type based on geography, relief, climate, vegetation and anthropogenic impact. The following soil types[75] can be found along the road (more detailed information on these soil types can be found in Appendix 12-1):

- Brown forest soil;
- Colluvial soil;
- Fluvial soil;
- Cinnamon forest soil;
- Wetland gleyed soil and
- Antroposoils

SENSITIVE RECEPTORS

12.1.23. The sensitive receptors that have been incorporated in this assessment are:

- Construction workers;
- Surrounding soils (mainly agricultural) and geology;
- Surface water bodies;

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[73] Source: Macedonian Soil Information System - http://www.maksoil.ukim.mk/masis/
[74] Soils in the Republic of Macedonia, Filipovski, 1995
[75] Source: http://www.maksoil.ukim.mk/masis

- Future site users (including road and pavement users and maintenance workers);
- Off-site users in the immediate vicinity of the Project (including nearby residents);
- Nearby residential dwellings with foundations; and
- Underground utility services (such as drainage, sewerage, potable water supplies and cabling).

12.2 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Degradation of Topsoil and Made Ground Quality (due to Contamination)

Description

12.2.1. Both topsoil and Made Ground are resources which when exposed to influencing factors, such as leaks and contamination, respond in different ways and often result in accelerated resource degradation. Accelerated degradation may lead to a reduction in the quality of the topsoil or Made Ground by reducing the content of organic matter, contamination, salination, acidification, resulting in a loss of biodiversity.

12.2.2. There is the potential for leaks / spills of oil and lubricants from the HGVs and construction machinery to result in ground contamination

12.2.3. The construction phase of the Project will also require the storage of hazardous materials. If these materials are not stored in accordance with guidance and best practice measures there is the potential for leaks to occur, resulting in ground contamination.

Magnitude and Severity of Impacts

12.2.4. The description of the magnitude thresholds is provided in Table 12.2 below.

Table 12-2– Magnitude of Impacts (Topsoil and Made Ground Quality)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct / Cumulative	Contamination occurs from leaks / spills associated with the construction equipment / activities / resources.
Reversibility	Reversible	Soil contamination can be remediated by natural means if contaminants are biodegradable and are in low concentrations. For severe contamination incidents, an active remediation strategy would be required.
Geographic Extent	Local	Limited to the Project alignment and any construction compounds.
Time when the Impact Occurs	Immediate	Soil contamination occurs as the pollutants are released.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Minor	Very minor change in quality.

12.2.5. The sensitivity of the shallow geology is Minor, due to the limited potential for aquifers. The sensitivity of the topsoil and Made Ground is considered to be Medium, as it is likely to be of reasonable quality, with a relatively low likelihood of being contaminated.

12.2.6. The construction activities will be limited in time and physical extent, and therefore the soil function in the area surrounding the Project will not be altered. The magnitude of impact from the potential for leaks from HGVs, machinery, and hazardous material storage is considered to be Minor, and will be managed though the implementation of Best Practice measures in the CEMP.

Significance of Effects

12.2.7. Overall, it is considered that the potential effect on topsoil and Made Ground as a result of the leaks / spills from HGVs, machinery, and hazardous material storage is **Slight Adverse (not significant)** to **Moderate Adverse (significant),** without mitigation. The measures that will be implemented to mitigate this effect are set out in Section 12.4, resulting in a **Neutral (not significant)** residual effect (Section 12.5).

Soil Erosion and Compaction

Description

12.2.8. The construction phase of the Project will result in additional traffic movements, associated with Heavy Good Vehicles (HGVs) and machinery, which have the potential to compact and degrade the topsoil.

12.2.9. During the preparation and clearance works for the Project, including vegetation clearance and the temporary storage of topsoil, there is the potential for changes to the topsoil and Made Ground surfaces. Such changes in the surface layer may change the sensitivity of the surface environment, and it susceptibility to erosion).

12.2.10. Soil erosion may occur as result of exposure to wind and water runoff, removal of topsoil and Made Ground, exposure of buried structures, changes in topography and stockpiling. This may lead to sedimentation of overground water flow resulting in increased turbidity levels in rivers and streams and the local drainage system. At higher elevations along the Project alignment soil erosion is more likely to occur due to increased exposure. Furthermore, soil erosion is more likely to occur along the Project alignment at sections where extensive earthworks are to take place, such as for the two tube tunnel.

12.2.11. Pre-existing erosion, likely as a result of rainfall events, is already noted at chainage Ch 01+020 km, Ch 05+240 km and at Ch 05+340 to 5+380 km. Cuttings as a result of the Project are likely to increase the risk of soil erosion.

Magnitude and Severity of Impacts

12.2.12. The description of the magnitude thresholds is provided in Table 12-3 below.

Table 12-3– Magnitude of Impacts (Soil Erosion)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Type of Impact	Direct	Soil compaction, degradation of soil structure. Erosion occurs due to the undertaking of construction activities.
Reversibility	Irreversible	Eroded soil cannot be replaced, and soil compaction irreversibly affects the soils physical, chemical and biological properties.
Geographic Extent	Local	Limited to the Project alignment and any construction compounds.
Time when the Impact Occurs	Immediate	Soil erosion will occur as soil is exposed or when the topography is altered. Soil compaction occurs when it is exposed to heavy loads, such as construction machinery.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Moderate	Partial damage to soil features.

12.2.13. The sensitivity of the topsoil and Made Ground is **Medium.** The construction activities likely to cause soil erosion will be limited in time and physical extent. However, there is the potential for soil erosion to extent to the surrounding areas. Therefore, the magnitude of impact from the potential for soil erosion and compaction is **Moderate.**

Significance of Effects

12.2.14. Overall, it is considered that the potential effect on topsoil and Made Ground, associated with soil erosion and compaction is **Moderate Adverse (significant).** However, this will be reduced though the best practice measures outlined in the mitigation section (Section 12.5), resulting in a **Slight Adverse (not significant)** residual effect (Section 2.5).

Soil Loss and Degradation (borrow pits and surplus material disposal sites)

Description

12.2.15. Borrow pits are likely to be required to obtain subgrade material for the Project, as the material from the tunnel, and other excavations, is unlikely to meet the prescribed quality standards for highways construction materials. Several borrow pits are proposed for the construction of embankments and for the supply of stone as aggregate for infill material. Three disposal sites are proposed as part of the Project for the disposal of excavated material. The first disposal site is located at the northern end of the Project, the second to the south of the tunnel and the third to the west of Crvica (as shown in Figure 2-3 (Chapter 2)).

12.2.16. The use of borrow pits has the potential to lead to soil loss, due to the soil stripping required to access material. It should be noted that the planned borrow pits are existing quarries. Furthermore, the use of the three material disposal sites has the potential to lead to alterations in the soils ecological function, at these locations, due to compaction. There is also potential for the introduction of contamination at these locations, as the material will have been sourced from different areas along the Project alignment.

Magnitude and Severity of Impacts

12.2.17. The description of the magnitude thresholds is provided in Table 12-4 below.

Table 12-4 – Magnitude of Impacts (Soil Loss and Degradation)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Soil loss and degradation due to the creation of borrow pits. The use of the three material disposal sites has the potential to lead to alterations of soil ecological functions due to compaction and the potential for contamination.
Reversibility	Irreversible	Material sourced from the borrow pits cannot be replaced.
Geographic Extent	Local	The Project alignment, the locations of the borrow pits and the material disposal sites.
Time when the Impact Occurs	Immediate	Soil loss and destruction may occur as soil is removed from the borrow pits and compacted at the material disposal sites.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a high likelihood of occurring.
Magnitude	Moderate	Partial damage to soil features.

12.2.18. The borrow pits are pre-existing quarry sites that have already been subject to impacts associated with their use as quarry sites, so will therefore be less sensitive than new sites. Bigor Dolenci is an existing limestone quarry to the south east of Kichevo and Fashkovci is a gravel and sand quarry to the north-west of Kolibari. Neither site is located in an environmentally sensitive area or close to environmental constraints.

12.2.19. If any additional borrow pits are required, the Contractor would need to ask the PESR to request an approval from Ministry of Economy. The PESR would also notify the EBRD if their intention to make an application. The Contractor would then prepare Environmental Protection Elaborates will be prepared for any borrow pits, in accordance with the Law on Mineral Resources, as part of the application for approval. The Environmental Protection Elaborates would be prepared and approval would be obtained, before undertaking any excavation in order to assess the potential impacts on the environment and ensure the application of adequate measures for alleviating the impact on the environment. The selection and approval process is set out in Chapter 2, Section 2.14). The ESMP (Chapter 23) includes measures to ensure less sensitive locations are selected.

12.2.20. The use of the borrow bits and the material disposal sites will be limited in time and extent, however, there is the potential for the soil loss and degradation to be irreversible. Although, some soil will be stored for restoration of the borrow bits and the material disposal sites. Therefore, the magnitude of impact from the potential for soil loss and degradation is considered to be **Moderate.**

Significance of Effects

12.2.21. Overall, it is considered that the potential for significant effects associated with soil loss and degradation at the borrow pits and material disposal sites is Moderate Adverse (significant). The mitigation measures to reduce this effect are set out in Section 12.4, resulting in a Slight Adverse (not significant) residual effect (Section 12.5)

Loss of Fertile Topsoil

Description

12.2.22. The ground cover surrounding the Project generally comprises of covered agricultural land (largely grassland), areas of hardstanding associated with residential dwellings and the existing sections of road and areas of woodland, some of which is partially wetland. The agricultural land and the areas of woodland have well-preserved ecological functions and contain fertile topsoil.

Magnitude and Severity of Impacts

12.2.23. The description of the magnitude thresholds is provided in Table 12-5 below.

Table 12-5 – Magnitude and Sensitivity of Impacts (Loss of Fertile Topsoil)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct/ Cumulative	Loss of topsoil is likely to occur due to the land take needed to construct the Project.
Reversibility	Irreversible	Fertile topsoil is removed and cannot be replaced.
Geographic Extent	Local	The Project alignment, specifically where the alignment crosses agricultural land and areas of woodland.
Time when the Impact Occurs	Immediate	The removal of fertile soils will occur throughout the construction phase of the Project, specifically where the alignment crosses agricultural land and areas of woodland.
Duration	Long-term	It will last the time for which the construction activities occur. However, there is the potential for long term impacts associated with the economic profitability of the agricultural land and the ecological value of the woodland
Likelihood of Appearance	Probable	The impact has a high likelihood of occurring.
Magnitude	Moderate	Loss of fertile topsoil.

12.2.24. The construction phase of the Project will be limited in time and physical extent; however, the loss of fertile soil will be irreversible. Some topsoil will be stored and used for landscaping as outlined in the Waste and Materials Management Plan and Soil Management Plan. Therefore, the magnitude of impact from the potential for the loss of fertile topsoil is **Moderate.**

12.2.25. The sensitivity of the soil in the agricultural land and areas of woodland is considered to be **High** due impacts associated with fertile topsoil loss to impact upon the economic profitability of the agricultural land and the ecological value of the woodland.

Significance of Effects

12.2.26. The potential for significant effects associated with the loss of fertile soil is **Moderate Adverse** or **Large Adverse (significant),** without mitigation. The mitigation that will be implemented to reduce these effects is set out in Section 12.4 and will result in a **Slight Adverse (not significant)** residual effect (Section 12.5).

Slope Stability and Risk of Landslides

Description

12.2.27. During construction, there is a risk that excavations, quarrying, drilling, stockpiling, filing and blasting activities will cause instability and landslides. The surrounding area has a mountainous / hilly terrain, so is likely to be more susceptible to these risks.

12.2.28. As noted in Chapter 2 – Description of the Project, the Project includes a number of cuttings and excavations. Due to the nature of the bedrock, these areas are at risk of instability due to erosion. Mitigation is therefore required in the detailed design and for the construction phase.

Magnitude and Severity of Impacts

12.2.29. The description of the magnitude and sensitivity thresholds is provided in Table 12-6 below.

Table 12-6 – Magnitude of Impacts (Susceptibility to Landslides)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct/ Cumulative	Landslides may occur as a result of excavations, quarrying, drilling, stockpiling, filling and blasting.
Reversibility	Reversible	Landslides can be adequately prevented and managed.
Geographic Extent	Local	The Project alignment, specifically where excavations, quarrying, drilling and blasting activities are located.
Time when the Impact Occurs	Immediate	Landslides have the potential to occur at any point during construction and could occur during operation if not monitored and remedied following the end of construction activities.
Duration	Short-term impact but could occur any time over a long term period.	It will last the time for which the construction activities occur but could occur during operation if it is not monitored and remedied following the end of construction.
Likelihood of Appearance	Probable	The impact has a high likelihood of occurring.
Magnitude	Minor	Partial damage to the surrounding features.

12.2.30. The sensitivity of the mountainous / hilly terrain along the Project alignment, is considered to be **Medium**, due to the steep relief.

12.2.31. The construction phase of the Project will be limited in time and physical extent, but the impact without mitigation, would be **Moderate adverse (significant**) However, the good practice measures and construction method statements that will be applied are set out in the mitigation section (Section 12.4). Therefore, the anticipated magnitude of impact from the construction activities is Minor.

Significance of Effects

12.2.32. The potential effect associated with the landslides is **Moderate Adverse (significant**). However, following the implementation of the mitigation measures (Section 12.4) the residual effect will be **Neutral** or **Slight Adverse (not significant).**

Excavation of Potentially Contaminated Soils

Description

12.2.33. There is the potential for pre-existing contamination to exist within the soils along the Project alignment, particularly in the areas surrounding the existing roads which have high heavy metal contents. Other sources of contamination include fly tipped waste, agricultural processes and waste and sewage systems. The excavation activities associated with the construction phase of the Project have the potential to mobilise contaminants. The mobilisation of such contaminants has the potential to affect the local community, the construction workforce and the surrounding rivers and streams. The Health and Safety implications of contaminated land is addressed in Chapter 18 – Occupational Health, Safety and Security.

Magnitude and Severity of Impacts

12.2.34. The description of the magnitude thresholds is provided in Table 12-7 below.

Table 12-7 – Magnitude of Impacts (Excavation of Potentially Contaminated Soils)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Contaminants may be mobilised as a result of excavation activities.
Reversibility	Reversible	Potential to close the pathways after creation.
Geographic Extent	Local	Limited to the Project alignment, specifically where excavations activities are located, and disposal locations.
Time when the Impact Occurs	Immediate	The impacts of contamination could occur immediately after mobilisation.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Possible	The discovery of pre-existing contamination is possible, particularly near the watercourses where there was evidence of high levels of fly-tipping.

Magnitude	Minor	Mobilisation of such contaminants has the potential to affect the local community, the construction workforce and the surrounding rivers and streams.

12.2.35. The construction phase of the Project will be limited in time and physical extent. However there is potential for large impacts, should the construction activities create pathways that enable the contaminant to reach receptors. This has the potential to have adverse impacts on the local community, the construction workforce and the surrounding rivers and streams. Therefore, the magnitude of impact from the potential for contamination is considered to be **Minor.**

12.2.36. The sensitivity of the local community, the construction workforce and the surrounding rivers and streams is considered to be High due to the potential for impacts on human health and the ecological value of the surrounding rivers and streams.

Significance of Effects

12.2.37. Overall, it is considered that the potential for significant effects associated with the excavation of potentially contaminated soils is **Slight** or **Moderate Adverse (significant).** This will be managed, as set out in the mitigation section (Section 12.4), which will result in a **Sight Adverse (not significant)** residual effect (Section 12.5).

OPERATIONAL PHASE

Degradation of Topsoil and Made Ground Quality

Description

12.2.38. Topsoil and Made Ground contamination may occur during the operation of the Project, as a result of vehicle usage and accidental leaks and spillages. Contaminants include oil and / or petroleum leaks / spills from vehicles.

12.2.39. The pollutants originate from dust generated by the traffic, road surface wear, the wearing of tyres and leaks / spills. Chemicals, inclusive of salt, used for winter maintenance of the Project alignment may also cause contamination. Should the contamination settle adjacent to the Project alignment the topsoil or Made Ground quality may become impaired. This may lead to a reduction in the growth of vegetation, thus increasing the likelihood of erosion.

Magnitude and Severity of Impacts

12.2.40. The description of the magnitude and sensitivity thresholds is provided in Table 12-8 below.

Table 12-8 – Magnitude of Impacts (Topsoil and Made Ground Quality)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct/ Cumulative	Contamination may occur due to the runoff substances from the road surface once it is operational.
Reversibility	Reversible	Soil contamination can be remediated by natural means if contaminants are biodegradable and are in low concentrations. For severe contamination, a remediation strategy would be needed.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Geographic Extent	Local	Limited to the Project alignment and the adjacent topsoil and Made Ground.
Time when the Impact Occurs	Immediate and Delayed	An oil spill would result in immediate contamination; however, the airborne pollutants are likely to accumulate gradually over time.
Duration	Long-term	Throughout the operation of the Project.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Minor	Impacts would be limited to the Project alignment and the adjacent topsoil and Made Ground.

12.2.41. The sensitivity of the topsoil and Made Ground adjacent to the Project alignment once it is operational is considered to be **Low**, as it is likely to have been disturbed during the construction phase. The impacts would be limited in extent and the risk reduced though operational measures, set out in the OEMP, therefore the impact is expected to be **Minor.**

Significance of Effects

12.2.42. Overall, it is considered that the potential for significant operational effects associated with the contamination of topsoil and Made Ground is **Slight Adverse (not significant)**, due to the measures set out in the mitigation section (Section 12.4).

Soil Erosion

Description

12.2.43. There is a risk associated with the potential mobilisation of loose materials if disturbed surfaces are not stabilised or successfully revegetated following the construction activities. The mobilisation of such loose materials may lead to soil erosion. The soils in the areas surrounding the bridges, viaducts, cuttings and embankments, are likely to be most prone to soil erosion, together with those areas where the Project alignment runs through the mountainous / hilly terrain. Erosion may occur as a result of surface water flow over exposed soils as a result of topographical changes.

Magnitude and Severity of Impacts

12.2.44. The description of the magnitude thresholds is provided in Table 12-9 below.

Table 12-9 – Magnitude of Impacts (Soil Erosion)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Soil erosion occurs because of exposure soil left devoid of vegetation or retaining material after the construction activities.
Reversibility	Irreversible	Eroded soil cannot be replaced.

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Geographic Extent	Local	Limited to the Project alignment.
Time when the Impact Occurs	Delayed	There will likely be a delay in the evidence of soil erosion.
Duration	Medium-term	The establishment of vegetation will reduce the likelihood of soil erosion.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Minor	Impacts would be limited to the areas of the Project alignment where loose materials are present.

12.2.45. The sensitivity of the surrounding environment where soil erosion may occur is considered to be **Medium**, given the nature of the relief and geology.

12.2.46. There may measurable soil erosion during the operational phase of the Project, but the losses are likely to be **minor** and limited to the areas surrounding the bridges and those areas where the Project alignment runs through the mountainous / hilly terrain. The risk of erosion have been considered in the design, which includes slope stabilisation and pier protection measures. The magnitude of the impact is considered to be **Minor**.

Significance of Effects

12.2.47. Overall, it is considered that the potential for significant effects associated with soil erosion is Slight Adverse (not significant). Mitigation measures will be implemented to reduce this effect further (see Section 12.4). The residual effect is Neutral (not significant) (Section 12.5).

Seismic Activity

12.2.48. The Project is located in a region with a seismic intensity level of 7 (very strong). The sensitivity of the or the environment is therefore **High.**

12.2.49. As outlined in **Chapter 2 – Description of the Project**, various measures have been designed into the Project to ensure that it can withstand seismic events. These measures are designed to ensure the Project will experience negligible impact due to seismic events. These measures will form part of the detailed design and Bill of Quantities which will be part of the tender documentation for Contractors.

12.2.50. As mitigation is designed in to the Project, the effect of seismic activity is therefore considered to be **Neutral (not significant)** and no further mitigation is required.

12.3 SUMMARY OF EFFECTS

12.3.1. The following effects are anticipated Construction phase, before the implementation of mitigation:

- The potential for significant effects on shallow geology, topsoil and Made Ground as a result of the leaks / spills from HGVs, machinery, and hazardous material storage is **Slight Adverse (not significant)** to **Moderate Adverse (significant).**
- The potential for significant effects associated with soil erosion and compaction is **Moderate Adverse (significant).**

- The potential for significant effects associated with soil loss and degradation is **Moderate Adverse (significant).**
- The potential for significant effects associated with the loss of fertile soil is **Moderate Adverse** or **Large Adverse (significant).**
- The potential for significant effects associated with the landslides is **Slight Adverse (not significant).**
- The potential for significant effects associated with the excavation of potentially contaminated soils is **Slight Adverse** or **Moderate Adverse (significant).**

12.3.2. The following effects are anticipated Operational phase, before the implementation of mitigation:

- The potential for significant effects associated with the contamination of topsoil and Made Ground is **Slight Adverse (not significant).**
- The potential for significant effects associated with soil erosion is **Slight Adverse (not significant).**
- The potential for significant effects due to seismic activity is considered to be **Neutral (not significant),** due to existing measures in the detailed design.

12.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

12.4.1. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the following Plans will be prepared, which will form part of the Construction Environmental and Social Management Plan (CESMP):

- A **Soil Management Plan** (including Spoil Disposal Plan), which will outline measures to protect the quality of soils used during construction or directly impacted by construction activities. The Soils Management Plan will include measure for contaminated land (with cross references to the Waste and Materials Plan).
- A **Waste and Materials Management Plan**, which will detail a construction materials and waste management system for the Project.
- A **Land Restoration Plan**, which will include measures associated with erosion protection, such as vegetation planting and measures to improve the stability of slopes during bridge and viaduct construction.
- **Occupational Health and Safety Plan –** which will outline measures to keep the construction workers safe including personal protection equipment requirements.
- **Construction Plans and Method Statements –** Slope Stabilisation Plan, Bridge Construction, Tunnel Construction and Tunnel Handover Plan – which will outline measures to ensure a safe environment for construction workers.
- An **Emergency Preparedness and Response Plan** (including a Spill Management Plan), which will include a procedure for leak / spill prevention from HGVs, machinery, and hazardous material storage. The plan will also include a Tunnel Emergency Response Plan for issues during the tunnel construction such as collapse and fires.
- **Method Statements for Temporary Activities** which will include the following activities: Storage Areas, River Crossings, Storage and Access Roads.
- **Blasting Management Plan** which will set out methods and procedures for blasting activities associated with the construction of the tunnel.

12.4.2. During the construction phase of the Project these plans will be reviewed by the Contractor, as a minimum quarterly, and with changes to international and national legislation, as appropriate. Record of these reviews will be provided to the PESR/ Project Implementation Unit.

Soil Erosion, Soil Loss, Soil Degradation and Susceptibility to Landslides

Design Measures to be Included in the Detailed Design

12.4.3. The Designer has prepared a slope stabilisation study, which they are using to inform the detailed design, the following provides a summary of the slope stabilisation measures that are set out in the study.

12.4.4. The detailed design of the Project will incorporate the following measures to reduce the likely release of loose material or material with the potential to become loose in-situ:

12.4.5. Slope (road batter[76]) stabilisation – including mulching (straw mulching), brushwood mulching, erosion control blankets, soil binders (e.g. polyacrylamide) and gravelling;

- **Retaining walls** – to retain loose materials on slopes where it would not naturally be held, for example on near vertical or vertical slopes;
- **Sediment traps and basins –** which will intercept and retain sediment-laden runoff;
- **Drainage channels** – which will divert run-off water;
- **Treatment systems** – to remove material contained within the run-off water; and
- **Revegetation** – to increase the stability of the loose materials and surfaces which become exposed during the construction phase of the Project (detailed measures will be incorporated into the Land Restoration Plan, these will be inclusive of plant species, planting densities, fertile soil additions, and watering rates).

Protective Nets

12.4.6. The detailed design of the Project will incorporate the use of protective nets (or similar), where appropriate, to retain loose material or material with the potential to become loose in-situ. The protective nets will also increase the strength of the material over which it sits, reducing susceptibility to landslides. This will reduce the risk of the movement of loose material on the surface. The slope stabilisation measures outlined in Chapter 2 will reduce the risk of larger scale landslides.

12.4.7. These nets will protect users of the Project and infrastructure along the Project from the risk of adverse effects due to small scale landslides and falling material.

12.4.8. They will be incorporated into the detailed design of the Project, in locations where it passes through mountainous / hilly terrain, such as where gradients along the Project alignment exceed 1 in 4 (25%). They use will also be dependent on other factors, including the nature of the material, rock type and strength, level of erosion and structure of the geology.

12.4.9. The protective nets will be designed and constructed in accordance with applicable legislation and technical specifications.

[76] Road batters are slopes that connect the Project alignment to the surrounding mountainous / hilly terrain.

Construction Measures

12.4.10. As outlined in **Chapter 23 – Environmental Social Management Plan**, during the construction phase of the Project the following measures will be undertaken to reduce the likely release of loose material or material with the potential to become loose in-situ:

- Soil Management Plan
  - Careful removal of topsoil and Made Ground to protect soil structure;
- Waste and Materials Management Plan
  - Managing stockpiles heights to ensure that they are stable and not susceptible to landslide, in line with industry best practice;
  - Storage measures for potentially contaminative materials to ensure leaks/ spills do not enter the ground.
- Water Resource Management Plan
  - Regular monitoring of river and stream crossings to ensure slopes remain stable, notably during the construction of the bridges and viaducts; and
  - Considering run-off during the design of the construction compounds.

Borrow Pits and Excavated Material Disposal Sites

12.4.11. The ESMP incorporates measures to ensure the stability of the borrow pits and excavated material disposal sites and reduce the likelihood of soil loss and contamination, respectively. Such measures include appropriate compaction (at the materials disposal sites) and consideration of groundwater levels. The Waste and Materials Management Plan will set out the criteria for the selection of existing borrow pits, and any new borrow-pits that may be required, ensuring that they are located away from sensitive locations, and are aligned with EBRD environmental and social requirements.

Pollution and Contamination Prevention

12.4.12. During the construction phase of the Project, the Contractor will implement the CESMP (see Chapter 23 – ESMP) which will include measures to reduce pollution and contamination associated with airborne substances and oil and / or petroleum leaks / spills, such measure will include:

- Careful construction and thorough quality control processes;
- Provision of spill kits to contain leaks / spills;
- Program to ensure good driver behaviour / maintenance of vehicles; and
- Testing of soils for contamination and removal of material arisings in accordance with the **Soil Management Plan** (including **Spoil Disposal Plan**) and the **Waste and Materials Management Plan.**

OPERATIONAL PHASE

Soil Erosion

12.4.13. In order to prevent soil erosion, loss and degradation along the Project alignment an Operational Maintenance Plan and Operational Soil Management Plan will be prepared (see Chapter 23 - ESMP). It will include measures to:

- Maintain sediment traps and basins, drainage channels and treatment systems; and
- Maintain slope (cuttings and embankment).

12.4.14. These measures will ensure that the drainage system is working as designed which will reduce the risk of drainage flooding.

12.4.15. The Operational Soil Management Plan will include the monitoring requirements for slopes / cuttings.

Pollution and Contamination Prevention

12.4.16. The **Operational Maintenance Plan** will set out the storage requirements for materials required for the maintenance of the project, including storage locations and procedures. It will includes measures of maintaining the drainage infrastructure to ensure that there is no sediment build up and that the oil separators are functioning correctly. The Operational Maintenance Plan will outline the document - control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets.

Landslides, Accidents and Tunnel Management

12.4.17. The **Tunnel Operational Management Plan**; will outline maintenance activities for the tunnels. The plan will set out the specification for inspections. This will manage the risks of landslip affecting the operation of the tunnel.;

12.4.18. An Emergency Preparedness and Response Plans (EPRP) will be prepared which will include measures for prevention, mitigation and response to emergency scenarios, at a minimum covering:

- Road and traffic accidents;
- Other accidents and injuries;
- Spills of hazardous substances;
- Fire;
- Natural disasters (earthquake, landslide, flood, extreme weather events, etc.);
- Accidents during the operation of the tunnel (e.g. tunnel collapse, tunnel fires, gas release, etc.).

Details of the emergency response team(s) who will assess the risk of hazardous material releases and working to avoid any harmful effects in the event of an accidents or incident; and

The details and procedure for reporting emergencies, including coordination with the national relevant authorities.

12.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Degradation of Topsoil and Made Ground Quality

12.5.1. Prior to mitigation the effects on topsoil and made ground quality will be **Slight Adverse (not significant)** to **Moderate Adverse (significant**). With mitigation in the form of a **Soil Management Plan** and **Waste and Materials Management Plan**, it is anticipated that effects on topsoil and Made Ground as a result of the leaks / spills from HGVs, machinery, and hazardous material storage will be **Neutral (not significant).**

Soil Erosion and Compaction

12.5.2. Prior to mitigation, the effect on soil erosion and compaction is expected to be **Moderate adverse (significant).** This effect will be reduced though the implementation of mitigation measures, in the form of the detailed design, **Slope Stabilisation Plan**, and **Soil Management Plan** in place, it is anticipated that effects associated with soil erosion and compaction will be **Slight Adverse (not significant).**

Soil Loss and Degradation (borrow pits and excavated material disposal sites)

12.5.3. Prior to mitigation, the effect on soil loss and degradation is considered to be **Moderate adverse (significant)**. With mitigation in the form of a **Soil Management Plan** and **Waste and Materials Management Plan**, it is anticipated that effects associated with soil loss and degradation will be **Slight Adverse (not significant).**

Loss of Fertile Topsoil

12.5.4. Prior to mitigation the effect of the loss of fertile topsoil's is considered to be up to **Large Adverse**. With the mitigation in the form of a **Soil Management Plan** in place, it is anticipated that effects associated with the loss of fertile topsoil will be **Slight Adverse (not significant).**

Stability and Risk of Landslides

12.5.5. Prior to mitigation, the effects associated with stability and landslides is considered to be **Slight Adverse**. With mitigation in the form of the detailed design, **Slope Stabilisation Plan** and **Emergency Preparedness** and **Response Plan** in place, it is anticipated that effects associated with the potential for landslides will be **Neutral** or **Slight Adverse (not significant).**

Excavation of Potentially Contaminated Soils

12.5.6. Prior to mitigation, the effects associated with the excavation of contaminated soils will be up to **Large Adverse**. With mitigation in the form of a **Soil Management Plan** and **Waste and Materials Management Plan** in place, it is anticipated that effects associated with the excavation of potentially contaminated soils will be **Slight Adverse (not significant).**

OPERATIONAL PHASE

Degradation of Topsoil and Made Ground Quality

12.5.7. Prior to mitigation, the effects on the quality of topsoil and made ground is expected to be **Slight adverse (not significant)**. With mitigation measures in the form of the detailed design and the **Operational Maintenance Plan,** it is anticipated that effects associated with the contamination of topsoil and Made Ground will remain **Neutral** or **Slight Adverse (not significant).**

Soil Erosion

12.5.8. Prior to mitigation, the effects of soil erosion and compaction is expected to be **Slight adverse (not significant)**. With mitigation in the form of **Operational Maintenance Plan** and **Operational Soil Management Plan** in place, it is anticipated that effects associated with soil erosion will be **Neutral (not significant).**

Seismic Activity

12.5.9. Prior to mitigation, the potential effect due to seismic activity is anticipated to be **Neutral (not significant).** Mitigation in the form of **Emergency Preparedness** and **Response Plans (EPRP**) will be implemented during the operational phase of the Project. The residual effect will remain **Neutral (not significant).**

12.6 SUMMARY

Table 12-10 – Summary of Residual Effect

<table>
<tr><th>Topic</th><th>Phase</th><th>Potential Impacts</th><th>Effect (without mitigation</th><th>Mitigation Measures</th><th>Residual Effect</th></tr>
<tr><td rowspan="8">Geology and Soils</td><td rowspan="6">Construction</td><td>Degradation of Topsoil and Made Ground Quality</td><td>Slight Adverse (not significant) to Moderate Adverse (significant)</td><td rowspan="6">A Soil Management Plan (including Spoil Disposal Plan).
A Waste and Materials Management Plan.
A Land Restoration Plan.
An Emergency Preparedness and Response Plan (including a Spill Management Plan).</td><td>Neutral (not significant)</td></tr>
<tr><td>Soil Erosion and Compaction</td><td>Moderate Adverse (significant)</td><td>Slight Adverse (not significant)</td></tr>
<tr><td>Soil Loss and Degradation (borrow pits and excavated material disposal sites)</td><td>Moderate Adverse (significant)</td><td>Slight Adverse (not significant)</td></tr>
<tr><td>Loss of Fertile Topsoil</td><td>Moderate Adverse or Large Adverse (significant)</td><td>Slight Adverse (not significant)</td></tr>
<tr><td>Stability and Risk of Landslides</td><td>Moderate Adverse (significant)</td><td>Neutral or Slight Adverse (not significant)</td></tr>
<tr><td>Excavation of Potentially Contaminated Soils and impacts to the environment, the community and workers.</td><td>Moderate Adverse or Large Adverse (significant)</td><td>Slight Adverse (not significant)</td></tr>
<tr><td rowspan="2">Operation</td><td>Degradation of Topsoil and Made Ground Quality</td><td>Slight Adverse (not significant).</td><td>Development and implementation of an Emergency Preparedness and Response Plan.
Appropriate drainage design specified at detailed design</td><td>Slight Adverse (not significant).</td></tr>
<tr><td>Soil Erosion</td><td>Slight Adverse (not significant)</td><td>Operational Maintenance Plan
Operational Soil Management</td><td>Neutral (not significant)</td></tr>
</table>

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Seismic Activity	Neutral (not significant)	Design measures as outlined in Chapter 2 – Description of the Project. Emergency Preparedness and Response Plans	Neutral (not significant)

13 WASTE GENERATION AND RESOURCE EFFICIENCY

13.1 BASELINE CONDITIONS

13.1.1. This section provides an overview of baseline material consumption, and waste generation and disposal information, for the current land uses within the Project study area, prior to Project implementation.

13.1.2. The availability of data on material resource trends, and landfill capacity and waste recovery are limited in North Macedonia. The most up-to-date sources of available information at the time of writing have been used and referenced accordingly.

MATERIALS

Materials Currently Required

13.1.3. The current land uses along the Project alignment comprise: agricultural land, forested land and residential land uses with existing road infrastructure.

13.1.4. Given the nature of the current land uses along the Project alignment, it is expected that the present consumption of construction materials is negligible. At present construction material resources are only likely to be used for irregular minor maintenance and repair work to existing built assets, such as the residential and agricultural buildings.

Materials Availability

13.1.5. The Economic Chamber of Macedonia, Building Materials Group[77,] indicates that raw materials, such as plaster, marl, ceramic clays, lime and other non-metal minerals, will be available over the next 50 to 100 years. The importation of primary raw materials is negligible within North Macedonia. The report is however undated and there are no other publicly available data sources to provide a more robust indication of current material availability within North Macedonia.

Remaining Landfill Capacity

13.1.6. The Macedonian National Waste Management Plan estimates quantities of construction and demolition waste generated per annum to be in the region of 500,000 tonnes. This figure is refined in the North Macedonia Environmental Performance Review suggesting 1,120 tonnes was generated in 2016, of which 23 tons was hazardous wastes. The report however indicates that the accuracy of the figures should be treated with caution as the data may not have covered all construction activities in the country. There are no formal systems in place for the collection of construction and demolition wastes.

13.1.7. Within the Kichevo region, average waste composition statistics from 2016 indicate that just 1.18% of waste comprises construction waste[78].

[77] The Economic Chamber of Macedonia (undated), Building Materials Group
http://www.mchamber.org.mk/Default.aspx?mId=19&id=4&lng=2
[78] Ministry of Finance (2016) Regional Waste Management Plan for the Southwest Planning Region of R. Macedonia

13.1.8. Twenty waste sites are present in the Kichevo region; however, the majority are informal or non-regulated sites (commentary on fly-tipping is provided in Chapter 12 – Geology and Soils). Based on site observations, it is very unlikely that the existing facilities in the vicinity of the Project are aligned with EU requirements and regulations. See Figure 13-2 to 13-4.

Figure 13-1 - Waste site near Oslomej – construction and municipal waste

Figure 13-2 - Construction waste at Kichevo waste site

Figure 13-3 - River passing through the waste site in Kichevo

13.1.9. No data on remaining landfill capacity is available. Based on the information presented above, landfill infrastructure regionally and nationally is considered limited.

13.1.10. The existing local waste infrastructure will not be suitable for use by the Project. For this reason, 3 spoil disposal sites are included along the Project alignment as outlined in Chapter 2: Description of the Project, these sites will be used for spoil material from tunnelling activities as well as other inert materials. The first is located at the northern end of the Project, the second to the south of the tunnel and the third to the west of Crvica. Measures are outlined in the Environmental and Social Action Plan (ESAP) and Chapter 23 – ESMP to apply the waste hierarchy, whereby efficiencies will be sought to reduce the volume of materials used and waste produced.

13.1.11. As set out in Chapter 23 – ESMP, if additional waste sites are required by the Project, their locations will be confirmed with the municipality of Kichevo and be in accordance with the planning requirements of the region, as well as the annual waste management programmes / plans of the municipality of Kichevo. The Contractor will undertake an assessment of environmental effects associated with the additional waste sites in line with national legislation and EBRD requirements, for submission by the PESR to the municipality of Kichevo.

13.2 POTENTIAL IMPACTS AND EFFECTS

METHODOLOGY

13.2.1. The EIA Directive and EBRD Performance Requirement 3: Resource Efficiency and Pollution Prevention Control[79] requires consideration of resource efficiency and waste minimisation as part of environmental assessment.

- **Resource Efficiency:** There is a requirement for the client to adopt technically and financially feasible and cost-effective measures for minimising consumption and improving efficiency in its use of resources and material inputs and recovering and re-utilising waste on the project.
- **Waste:** There is a requirement for the client to avoid or minimise the generation of hazardous and non-hazardous waste and reduce its harmfulness as far as practicable. Where waste generation cannot be avoided, waste should be reused, recycled or recovered, or used as a source of energy. Where this is not possible, waste must be treated and disposed of in an environmentally sound manner.
- Where hazardous wastes are generated, consideration must be given to its environmentally sound disposal, taking into account the limitations applicable to transboundary movement and other legal requirements.
- Where wastes are taken off-site, the Contractor is required to obtain chain of custody documentation to the final destination and use contractors that are reputable and legitimate enterprises licenced by the relevant regulatory body. The Contractor should also ascertain whether licensed disposal sites are being operated to acceptable standards and consider alternative disposal options where this is not the case. This may include the development of a recovery and disposal facility at the project site.

13.2.2. In line with UK best practice for road infrastructure projects, the principles from Highways England's Design Manual for Road and Bridges (DMRB) LA 110 Material Assets and Waste[80], referred to as "LA110"[81,] have been adopted for the assessment of Waste Generation and Resource Efficiency. It is however understood that LA 110 has been developed for use in the UK and professional judgement will be used to apply the methodology to the Project.

13.2.3. The scope of the assessment will assess construction phase only, which includes site preparation. The waste produced during the operational phase are expected to be small and therefore are unlikely to result in significant effects. Operational phase effects have therefore been scoped out of further assessment[82].

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[79] EBRD Performance Requirement 3: Resource Efficiency and Pollution Prevention Control, 2014 (https://www.ebrd.com/documents/environment/performance-requirement-3.pdf)
[80] Standards for Highways (2019) Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA110 Material Assets and Waste [online] Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3.htm
[81] LA110 has been used due to the lack of national standards or guidance. It is highways specific material and waste EIA guidance, that has been developed in the UK to align with the requirements of the EU EIA Directive.
[82] Although operational waste has been scoped out, an Operational Waste Management Plan has been included in the ESMP, to ensure the small quantities generate during operation are reduced and managed.

13.2.4. The assessment has used available data to assess the types and quantities of materials required to construct the Project. This has been compared to baseline data to assess the impact and effect of material resources required for the Project during construction.

13.2.5. The reuse of excavated and other arisings (that meet waste exemption or other locally-accepted reuse criteria) will be evaluated as part of the assessment of materials, to determine whether the adverse impacts associated with the consumption of primary resources can be reduced.

13.2.6. Available data on the type and quantity of waste likely to be generated by the construction of the Project have been gathered. The data has been compared to the baseline data to assess the potential impact and effect on landfill capacity.

Significance Criteria

13.2.7. The assessment adopts the significance criteria set out in LA110. The criteria do not require separate assessment of sensitivity and magnitude of change. Significance criteria to be used are set out in Table 13-1.

Table 13-1 - Material Assets and Waste Significance Criteria

Significance category	**Description**	
	Materials	**Waste**
Very Large	No criteria: use criteria for large categories.	>1% reduction or alteration in national capacity of landfill, as a result of accommodating waste from a project; or Construction of new (permanent) waste infrastructure is required to accommodate waste from a project.
Large	Project achieves <70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials; and Aggregates required to be imported to site comprise <1% re-used / recycled content; and Project sterilises ≥1 mineral safeguarding site and/or peat resource.	>1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and 50% of project waste for disposal outside of the region.
Moderate	Project achieves less than 70% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and Aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target*.	>1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and 1-50% of project waste for disposal outside of the region.
Slight	Project achieves 70-99% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and	≤1% reduction or alteration in the regional capacity of landfill; and Waste infrastructure has sufficient capacity to accommodate waste from a

Significance category	Description	
	Materials	**Waste**
	Aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target*.	project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Neutral	Project achieves >99% overall material recovery / recycling (by weight) of non-hazardous Construction Demolition Waste (CDW) to substitute use of primary materials; and Aggregates required to be imported to site comprise >99% re-used / recycled content.	No reduction or alteration in the capacity of waste infrastructure within the region.
Notes	*Recycled Aggregate Target. In the absence of a Recycled Aggregate Target for Macedonia, professional judgement will be applied to account for the availability (or unavailability) of recycled aggregate. The general absence of waste recovery infrastructure within North Macedonia and consequential limitation for generating recycled materials will also be taken into account.	

13.2.8. The descriptions provided in Table 13-2 have been used to define whether effects identified are significant or not.

Table 13-2 - Descriptions for significance of effect

Significance Criteria	Materials Significance of Effect	Waste Significance of Effect
Very large	Significant	Significant
Large	Significant	Significant
Moderate	Significant	Significant
Slight	Not significant	Not significant
Neutral	Not significant	Not significant

13.2.9. Potential impacts and effects in relation to waste generation and resource efficiency are summarised in Table13-3. Indirect impacts have been assessed, as applicable to the chapter scope, in Chapter 9: Climate; Chapter 11: Surface Water; Chapter 14: Noise and Vibration; Chapter 16: Landscape and Visual Impacts of this ESIA.

13.2.10. The potential environmental impacts of the Project would occur principally during construction, therefore operational impacts and effects are outside the scope of this assessment.

Table 13-3 - Environmental Impacts

Element	Direct Impacts	Indirect Impacts
Materials	Consumption of natural and non-renewable resources	Release of greenhouse gas emissions Water consumption and scarcity Nuisance to communities (visual, noise) Impacts on health and wellbeing
Waste	Reduction in landfill capacity	Release of greenhouse gas emissions Nuisance to communities (visual, noise) Impacts on the environment Impacts on health and wellbeing

13.3 CONSTRUCTION PHASE

Description

13.3.1. Key construction materials required for the Project are presented in Table 13-4, as provided by the Designers (Balkan Consulting). Site arisings which will be recovered are presented in Table 13-5. Waste generated that cannot be recovered is presented in Table 13-6. This waste will be disposed to designated deposit areas along the route alignment as described in Chapter 2: Description of the Project.

Table 13-4 - Material resources required for the Project

Material type	Quantity (tonnes)	Comments
Earthworks	4,387,131	Earthworks and topsoil imported from borrow pits used to make embankments. Further information on the borrow pits can be found in Chapter 2: Description of the Project
Aggregate	6,086	Filter material for drainage channels
Crushed stone	204,764	Used for hardcore and levelling likely sourced from borrow pits
Asphalt	108,767	Used for road pavement
Concrete	6,128	Comprises concrete berms, concrete channels
Pre-cast concrete	731	Used for kerbs
Total	**4,713,606**	

Table 13-5 - Arisings to be diverted from landfill during construction of the Project

Waste type	Quantity (tonnes)	Comments
Vegetation removal	10,213	Comprises bushes, trees and roots. To be composted where possible/ feasible. Wood material to be made available to local residents for heating if requested.
Total	**10,213**	

Table 13-6 - Waste generated for disposal at designated deposit areas or landfill during construction of the Project

Waste type	Quantity (tonnes)	Comments
Earthwork excavation	3,637,664	Comprises topsoil and earthworks. To be disposed of at the three designated deposit areas (see Chapter 2 – Description of the Project).
Rock excavation	2,001,401	To be disposed of at the three designated deposit areas (see Chapter 2 – Description of the Project).
Hazardous Waste	Currently not quantifiable	Generation of hazardous wastes (for example, asbestos containing materials or contaminated land) may occur but the forecast types and volumes are not currently quantifiable. Measures for hazardous waste to be addressed via a Waste and Materials Management plan as per Chapter 23: ESMP.
General construction wastes e.g. plastics / packing, surplus materials and off cuts	Currently not quantifiable	Generation of general construction waste is likely to occur but cannot be quantified at the current design stage. Measures for construction waste to be addressed via a Waste and Materials Management plan as per Chapter 23: ESMP.
Total	**5,639,065**	

Significance of Effects

Materials

13.3.2. It is understood that material excavated from the Project may be unsuitable for re-use on the Project as testing of the material for re-use has yet to be undertaken as part of the Main Design preparation.

As such, fill material will be imported from borrow pits within Kichevo, as described in Chapter 2: Description of the Project.

13.3.3. No data is currently available on the use of recycled aggregate, however, given the absence of waste recovery infrastructure in North Macedonia, it is assumed that any recycled content would be minimal. A worst case scenario of ‘0% recycled aggregate’ will therefore be applied.

13.3.4. Using the criteria set out in Table 13-1, the significance for materials would be considered **adverse and Large**. The resultant effects would therefore be significant as less than 70% material recovery is expected to be achieved and aggregates are unlikely to contain recycled content.

13.3.5. Insufficient data is available to assess the potential sterilisation of mineral safeguarding sites or peat resources. The use of material from borrow pits within the region supports the proximity principle for material sourcing. It is noted that the limited material recovery infrastructure in North Macedonia performs poorly against the criterial classifications utilised in LA110.

13.3.6. Mitigation in the form of a Waste and Materials Management Plan, as outlined in Chapter 23 – ESMP will be applied to manage effects to acceptable levels. Measures will be applied during the detailed design stage to find efficiencies in the design to reduce material use.

Waste

13.3.7. Given the limited data availability, remaining national or regional landfill capacity is unable to be quantified at this time. Designated deposit areas, as described in Chapter 2: Description of the Project will, (subject to obtaining authorisation), be developed by Contractors along the route alignment for the disposal of earthworks. Vegetation cuttings (arisings) generated during pre-construction works will be provided to local residents for heating. The type and volume of potentially hazardous waste or general construction waste cannot currently be quantified[83]. Commitment will be made by the Client and the Contractor, as set out in the ESMP (Chapter 23) to ensure that wastes are appropriately managed in accordance with legal and good practice requirements to ensure it is disposed of in an environmentally sound manner and associated environmental harmfulness is reduced as far as practicable.

13.3.8. The impacts of the development of deposit areas to accommodate waste from the Project, which meet the assessment criteria set out in Table 13-1 of new (permanent) waste sites, are considered **adverse** and classified as Very Large and therefore **significant**. It is noted that the limited waste infrastructure in North Macedonia performs poorly against the criterial classifications utilised in LA110. Mitigation in the form of a Waste and Materials Management Plan, as outlined in Chapter 23 – ESMP will be applied to manage effects to acceptable levels.

Summary of Effects

- Construction phase

[83]This will be quantified during the Detailed Design of the Project and through the preparation of the Waste and Materials Management Plan by the Contractor. Measures for hazardous waste management will be set out in the Waste and Material Management Plan, including measures to manage any hazardous materials identified during construction activities.

- Material resource consumption - **Large; Significant**
- Generation and disposal of waste **– Very Large; Significant**

13.4 MITIGATION

CONSTRUCTION PHASE, INCLUDING PRE-CONSTRUCTION

13.4.1. The following mitigation measures are required to minimise the adverse effects of the Project on material resource consumption and waste generation and disposal.

13.4.2. The detailed design and construction specification should identify use of recycled materials in imported materials (such as earthwork, stone and aggregate, recycled content in cement and asphalt), were possible. It may be possible to reuse material from the adjacent section of the A2 Motorway that is currently being constructed.

13.4.3. The detailed design of the Project should maximise re-use opportunities of the earthwork and rock excavations currently identified for disposal at deposit sites (5.6 million tonnes as identified in Table 13-6). The material should be utilised in landscaping design, screening and habitat creation as much as practicable to minimise the quantity of imported material and minimise the quantity disposed at the deposit areas. Furthermore, it may be possible to identify other projects in the region or nearby regions where the material could be re-used.

13.4.4. A Waste and Materials Management Plan (WMMP) will be prepared by the Contractor (as detailed in Chapter 23: Environmental and Social Management Plan), and will include the following:

- **Quantification of waste and materials**
  - Quantities of generated waste from constructive activities;
  - The adherence to the waste hierarchy to prevent or reduce the generation of waste where possible, and then to reuse / recycle wastes where possible, in preference to disposal.
  - The exact quantity of the material that is intended for re-use on embankments on local, regional roads in the area in consultation with the competent institutions (local self-governments, etc.) in the region;
- **Waste Sites and Disposal**
  - If it is necessary to open new disposal sites (for topsoil/ excavation spoil and other inert materials) in addition to the three planned along the Project alignment (see Chapter 2 – Description of the Project). Their locations will be confirmed with the municipality of Kichevo and be in accordance with the planning requirements of the region, as well as the annual waste management programmes / plans of the municipality of Kichevo, and subject to the measures in the WMMP to identify a suitable location. The Contractor will prepare Environmental Protection Elaborates in line with national legislation, EU regulations and EBRD PRs;
  - Any new disposal site for non-inert waste (i.e. waste that will decompose), will be designed in line with EU regulations to prevent leakage or build-up of gas. The geological substrate, the groundwater level and the proximity to surface watercourses, will be key considerations. All the necessary measures such as lining with geosynthetic materials, drainage will be made in line with the Water Resources Management Plan. After the closure of the disposal sites, they will be stabilised, where required, and closed in accordance with a closure plan. The

Contractor will prepare Environmental Protection Elaborates in line with national legislation, EU regulations and EBRD PRs;
- Prohibit dumping of material or waste and undertake regular inspections.
- Tunnelling spoil excavated subsoil and demolition wastes will be reused as construction material in the Project where possible (such as in landscaping), or during post-construction maintenance, where possible.
- Tunnelling spoil and excavated subsoil, that is not used as fill material, will be disposed to agreed spoil disposal areas,
- Waste deposited at disposal sites is to be compacted, so as not to cause slippage;
- Spoil/ soil heaps will be vegetated to avoid erosion;
- The Contractor will be required to arrange the preparation of special Elaborates (permissions) for each of the three disposal sites, and any further sites that may be required, as set out in the ESMP[84]. This will be informed by the detailed design and Bill of Quantities. The Elaborates will include the planned capacity, and measures for regulation (for protection from heavy rainfall, protection of the ground, stability measures) as well as a plan for re-cultivation after the completed period of exploitation;

▪ **Sub-contractors and Waste Management**

- Agreements / contracts will be signed and maintained with the appropriate authority authorised company to ensure timely transportation and disposal of waste. Contractors will be responsible for maintaining these contracts and ensuring that all wastes are disposed in an environmentally responsible manner in accordance with the Waste and Materials Management Plan as well as Macedonian regulations. The Contractor shall audit waste disposal companies used to dispose of wastes from the Project.
- There are no waste disposal facilities for hazardous wastes present in the project area, and there is limited provision for the management of hazardous waste disposal in North Macedonia, so this category of waste must be handed over to an authorised contractor for disposal. Any hazardous waste agreement with a company authorised for treatment (deactivation, incineration) or re-use in other technological processes must be signed and made available to the Project Sponsor for approval. Treatment, utilisation, disposal of waste shall be carried out only by authorised contractors. The area allocated for temporary storage of hazardous waste shall have special preventive measures implemented, in particular, containers shall have secondary containment and no mixing of hazardous waste with any other waste shall be allowed. Hazardous waste containers shall be checked for tightness. The staff involved in hazardous waste management shall be trained in waste management and safety issues;
- The Contractor must ensure any sub-contractors used for the disposal of waste and the waste disposal sites are reputable, legitimate enterprises, are licenced by the relevant regulatory authorities, and are operating to acceptable standards; and

[84] This will form part of the contract documents and the Contractor will need to include it within their scope of works.

  - Implement measures to ensure the use of hazardous substance and materials is (where practicable) avoided or justifiably minimised. Where avoidance is not possible, appropriate risk management measure will need to be implemented.

- **Hazardous Waste**
  - The WMMP will include an Asbestos Disposal Management Plan (as although the Project will not involve the use of asbestos, in accordance with EBRD requirements, there is a risk that it may be present in existing buildings that need to be demolished, to enable construction) and a Contaminated Land Management Plan.
- **Soil**
  - The contractor will develop a Soil Management Plan, including Spoil Disposal Plan for approval by the Ministry of Environmental and Physical Planning (MoEPP) (and Department of Forestry, if the locations affect access to woodland). The Soil Management Plan will describe how soil (earthworks) will be managed to ensure the highest value for potential re-use. The Spoil Disposal Plan will encourage re-use of material in landscaping and ensure the deposit areas are suitable.

13.4.5. The following mitigation measures should be implemented, as far as practicable given the infrastructure and availability constraints within North Macedonia. It is noted that the waste recovery and landfill infrastructure within North Macedonia places constraints on the ability to maximise use of secondary and recycled content of materials:

- Design for resource optimisation: simplifying layout and form, using standard sizes, balancing cut and fill, and setting net importation as a Project goal and identifying opportunities to minimise the export and import of material resources.
- Design for off-site construction: Maximise the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction.
- Design for recovery and reuse: identifying, securing and using material resources at their highest value, whether they already exist on site, or are sourced from other schemes.
- Design for the future: Consider how materials can be designed to be more easily adapted over an asset lifetime, and how deconstructability and demountability of elements can be maximised at end-of-first-life.
- Manage engineering plan configurations and layouts to ensure the most effective use of materials and arisings can be achieved.
- Engage early with contractors to identify possible enhancement and mitigation measures and identify opportunities to reduce waste through collaboration and regional synergies.
- Identify areas for stockpiling and storing wastes that will minimise quality degradation and leachate and will minimise damage and loss.

13.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

13.5.1. Implementation of the mitigation measures provided in this assessment are expected to reduce the adverse effects on material resource consumption and generation and disposal of waste and align the Project to EBRD Performance Requirement 3: Resource Efficiency and Pollution Prevention Control.

13.5.2. As discussed, given the limited material recovery and waste infrastructure constraints within North Macedonia, the Project would perform poorly against the strict criterial classifications utilised in LA110.

13.5.3. All reasonable efforts will be made during Detailed Design and Construction to re-use site won arisings, maximise the secondary or recycled content of materials and minimise waste generation.

13.5.4. The **Waste and Materials Management Plan** will include strict requirements that the Contractor must comply with. This will ensure that waste generated by the Project does not worsen existing issues with waste management in the region.

13.5.5. With the application of mitigation, the effects for materials and waste have the potential to be reduced to **Not Significant** levels.

13.6 SUMMARY

Table 13-7 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Waste Generation and Resource Efficiency	Construction	Material resource consumption	Large adverse (significant)	Waste and Materials Management Plan Soil Management Plan Reasonably practicable measures to re-use site won arisings, and maximise the secondary or recycled content of materials	Potential to be Not-Significant However, likely to be constrained by existing recovery infrastructure within North Macedonia.
		Waste generation and disposal	Very adverse Large (significant)	Waste and Materials Management Plan Soil Management Plan Reasonably practicable measures to minimise waste generation	Potential to be Not-Significant However, likely to be constrained by existing waste recovery and landfill infrastructure within North Macedonia.

14 NOISE AND VIBRATION

14.1 Introduction

14.1.1. A Noise and vibration assessment has been undertaken in alignment with The Environmental Noise Directive (Directive 2002/49/EC)[85] and national legislation. The aims of the Environmental Noise Directive focus on:

- The determination of exposure to environmental noise;
- Ensuring that information on environmental noise and its effects is mitigated; and
- Preventing and reducing environmental noise where necessary and preserving environmental noise where it is good.

14.1.2. The effect of noise depends on the intensity, duration and frequency of the sound as well as the sensitivity of the receptor. The lowest sound (and change) that can be heard is 3 dB, which is a sound pressure of 60 mPa (absolute threshold of hearing). Noise has the greatest impact at a frequency range of between 2 kHz ÷ 5 kHz.

14.1.3. Noise is subjective and so the sensitivity of receptors can be dependent on multiple factors. Typically, receptors are grouped by sensitivity and an acceptable noise level applied. The following tables provide the noise limits based on Macedonian requirements and a comparison with World Bank criteria:

Table 14-1 - Limit noise levels in areas outside urban locations from Article 6 of the Rulebook on limit values of noise in the environment (Official Gazette of the Republic of Macedonia No. 147/08)

Types of Location	Noise level given in dBA		
	Ld (Day)	Lv (Evening)	Ln (Night)
Locations exposed to intensive road traffic	60	55	50
Locations exposed to intensive rail traffic	65	60	55
Locations exposed to air traffic	65	65	55
Locations with intensive industrial activity	70	70	70
Quiet locations outside settlements	40	35	35

[85] European Parliament and Council (2002), 2002/49/EC, relative to the assessment and management of environmental noise

Table 14-2 - World Bank/ IFC Environmental, Health and Safety Guidelines (2007)[86]

Criteria L_{Aeq}, 1h		
Location/ Time	Daytime (07:00 – 22:00)	Night time (22.00- 07:00)
Residential, institutional, educational	55dB	45dB
Industrial, Commercial	70 dB	70 dB

14.1.4. The World Health Organisation – Night Noise Guidelines for Europe[87] states that scientific evidence of noise exposure defined by the Environmental Noise Directive (2002/49/EC) of 40DB (Lnight,outside) should be targeted to protect the public, including vulnerable groups such as children, the chronically ill and the elderly. Where this is not possible, a value of 55db is recommended.

14.1.5. The World Health Organisation - Environmental Noise Guidelines for the European Region recommends updated noise exposure values to reduce the adverse health effects of noise from a variety of noise sources including: road, railway, aircraft, wind turbines and leisure. Recommended noise levels from road traffic sources are; 53 decibels (dB Lden) for average noise exposure and 45 dB (Lnight) for night noise exposure.

14.2 BASELINE CONDITIONS[88]

14.2.1. The Project is located in a mountainous region and for the most part is located away from sensitive receptors. There are however a number of sections where houses and other sensitive receptors are located in close proximity to the Project alignment.

14.2.2. A study of the area has identified the sensitive receptors in Table 14-3 that may be impacted by the Project due to increases in noise and vibration.

[86] International Finance Corporation, Worldbank Group (2007), Environmental, Health and Safety Guidelines
[87] World Health Organisation -Europe, 2009, Night Noise Guidelines for Europe
[88] World Health Organisation, 2019, Environmental Noise Guidelines for the European Region

Table 14-3 - Sensitivity values assigned to receptors of noise impacts

Settlement	Position at the road alignment	Distance of the nearest object from the road alignment (m)	Location in regard to the road alignment	Inhabitants**	Sensitivity***
Bukojchani	Ch 00+0.00 - 00+500 m	61.20	West	97	High
Gorno Strogomishte	Ch 00+500-02+0.00 m	186.60	East	1.123	Medium
Dolno Strogomishte	Ch 03+000-03+500 m	27.50	East	698	High[1]
Crvica	Ch 07+100.00-08 +000 m	240.85	East	1.725	Low
Strelci	Ch 08+100-08 +900 m	1226.35	East	1.421	Low
Mahmudovci	Ch 08+900-09+200 m	1564.00	East	401	Low
Osoj	Ch 11+700 - 11+950 m	25.23	East and West	593	High
Kichevo	Ch 11+500-end of line	364.00	East	27.067	Low
Rashtani	Ch 11+000-11 +300 m	56.20	West	/	High
Trapchin Dol	Ch 07+100-08 +0.00 m	293.50	West	914	Low
Kolibari	Ch 04+700-05+300 m	255.45	West	747	Low
Zajas	Ch 00+700-02+500 m	26.35	West	4.712	High[1]

** Data from the latest Census (2002).

*** Sensitivity assessed considering settlement distance from road alignment, population density, health/educational/recreational facilities present.

[1] Schools present

14.2.3. Noise levels have been measured at sites near the closest receptors in December 2018 (specific measurements taken for the assessment of the Project). There are very few stationary noise generating sources along the Project alignment and so noise levels are generally relatively low. Some of the settlements, including Zajas, Kolibari, Trapchin Dol and the city of Kichevo are near the existing A2 state road, which is an existing source of noise.

14.2.4. Baseline noise levels were measured at 5 locations along the Project alignment. The locations of the individual measuring points are shown in Figure 14-1. The results of the noise measurements are included in Table 14-4:

Table 14-4 - Current noise level measured at 5 locations along the Project alignment

Measuring point	Coordinates (UTM)		Period	dB(A)			
	X	Y		Leq	Lmax	L10	L90
1 – Close to the future A2 highway and dwellings near to Dolno Strogomishte (Figure 14.1)	496915	4604978	Day	54.6	72.1	57.9	39.1
			Evening	52.3	70.8	54.6	40.2
			Night	53.1	65.4	55.2	38.7
2 – Close to the future A2 highway and dwellings near to Dolno Strogomishte (Figure 14.1) highway	497144	4604935	Day	78.1	102.8	52.7	31.6
			Evening	76.6	81.3	61.3	39.7
			Night	53.7	74.2	52.5	34.5
3 – Close to the existing A2 state road, near the railway and the future A2 highway	496839	4599105	Day	71.5	87.6	76.2	45.8
			Evening	60.0	79.7	63.4	46.2
			Night	63.5	89.8	66.9	34.3
4 – In northern section of Osoj	495334	4597970	Day	45.8	64.7	49.2	38.3
			Evening	51.6	67.3	54.3	39.5
			Night	44.8	68.1	50.0	38.7
	495180	4597509	Day	44.3	65.1	46.5	33.0

Measuring point	**Coordinates (UTM)**		**Period**	**dB(A)**			
	X	**Y**		**Leq**	**Lmax**	**L10**	**L90**
5 – In southern section of Osoj			Evening	67.3	94.2	52.9	46.2
			Night	53.2	81.1	54.2	27.4

14.2.5. The baseline survey indicates that the baseline noise environment is dominated by the existing infrastructure. Locations 1 and 2 are close to local roads and where noise is dominated by the local traffic. In addition, the Location 2 is close to a local cross road, resulting in a significantly higher day time noise levels. Location 3 is further away from sensitive receptors, but pretty close to both the existing A2 state road and the Bukojchani – Kichevo railway. Lower noise levels were recorded at locations further away from the existing infrastructure (Locations 4 and 5). The highest noise levels recorded were at Location 2, which is positioned by a local cross road.

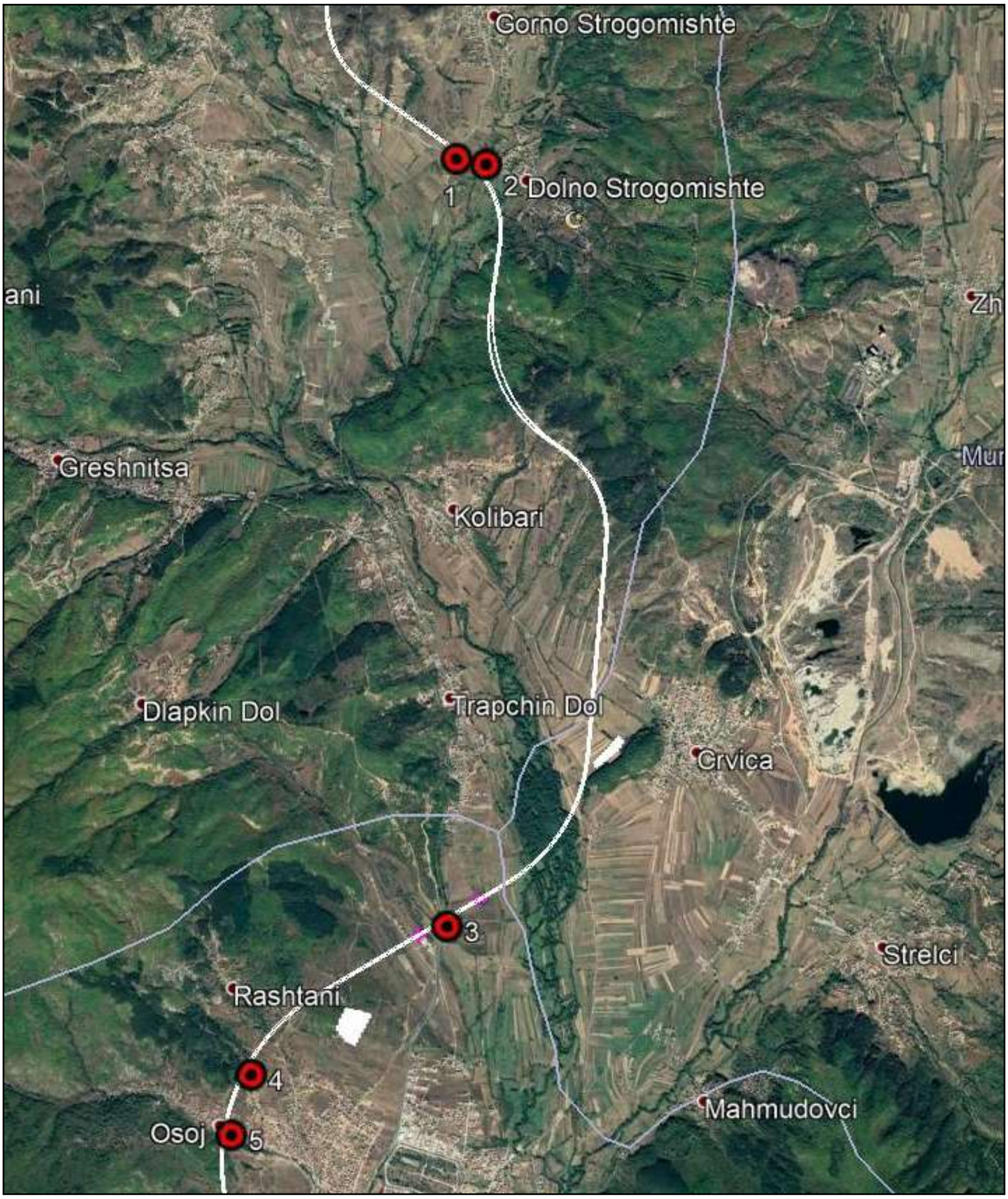

Figure 14-1 - Location of the noise measuring points

14.3 POTENTIAL IMPACTS AND EFFECTS

14.3.1. The noise levels along the Project alignment will increase as a result of the Project during both the construction and operational phases. The difference between the baseline noise levels and the noise levels during operation will determine the magnitude of impact, and consequently the significance of the effect.

Table 14-5 - Change in Noise Levels and Magnitude of Impacts

Change in noise levels (dB)	Magnitude of the Impact
Construction	
Less than 1	Negligible
Between 1 and 2.9	Minor
Between 3 to 4.9	Moderate
Greater than or equal to 5	Major
Operation – Long term	
Less than 3	Negligible
3.0 – 4.9	Minor
5.0 to 9.9	Moderate
Greater than or equal to 10.0	Major

14.3.2. During the construction phase, outdoor machinery and equipment will generate noise and vibrations, which will affect the nearest receptors.

14.3.3. During the operational phase, the noise will increase due to the motorway traffic. The 2019 Annual Average Daily Traffic (AADT) volumes have been calculated as 6,238. In 2030, the AADT is expected to increase to 10,669 and in 2040 it will increase further to 17,379.

14.4 Construction Phase

NOISE AND VIBRATION FROM CONSTRUCTION VEHICLES AND MACHINERY

Description

14.4.1. Construction operations (including excavation activities, construction, demolition, dredging, production of gravel and concrete and the transport of materials in and out of the construction site) will take place across the entire Project alignment. Most areas are rural and of low sensitivity, however, there are residential areas in the northern and southern ends of the Project alignment. The sensitivity of these areas is considered to be high.

Magnitude and Severity of Impacts

14.4.2. The magnitude of the noise impact from the outdoor construction equipment will depend on:

- Construction machinery, transportation vehicles and related equipment's noise emission levels[89];
- The machinery that is used at the same time in a single area; and
- Distance between the source and the sensitive receptors.

14.4.3. The average noise levels from the construction equipment most commonly used in this type of project is outlined in Table 14-6. It is assumed as per, Directive 2000/14/EC90 that the equipment used is in line with EU requirements as outlined within the directive. It is assumed that only a few pieces of equipment will be used at any single location at the same time. This will be ensured through the implementation of the Noise and Vibration Management Plan as outlined in Chapter 23: ESMP.

Table 14-6 - Construction Machinery and Noise Levels

Type of equipment (extraction - discharge work)	Sound level (dB)A	Duration	Type of equipment (excavation – earth work)	Sound level (dB)A	Duration
Bulldozer	90	long-term	Distributor	83	long-term
Compressor	80	short-term	Finisher	83	long-term
Grader	83	long-term	Trampling machine	90	long-term
Water jet machine	87	long-term	Truck	85	linear
Truck	85	short-term	Watering machine	87	long-term
Trampling machine	90	long-term	Pneumatic drill	85	short-term
Drilling machine	85	short-term	Concrete pump	110	short-term

14.4.4. Noise will be attenuated by structures, and it also decreases the greater the distance between the source and the receptor.

[89] Noise specification of equipment should be declared by the manufacturer in a noise certification.
[90] Official Journal of the European Communities, 2000, Directive 2000/14/EC - on the approximation of the laws of the Member States relating to the noise emission in the
environment by equipment for use outdoors

14.4.5. The magnitude of noise impacts is obtained by calculating the difference from the baseline noise levels. The significance of effect due to changes in noise levels, is determined by considering the sensitivity of the receptor and the magnitude[91] of the impact.

14.4.6. For all identified high sensitive receptors along the Project alignment, the magnitude of the noise impact during construction will be **Major** as an increase of 5dB is likely to occur during construction activities.

14.4.7. Other criteria to be considered in the assessment of this impact are given in the table below.

Table 14-7 - Magnitude of the impact – Noise and Vibration emissions from construction vehicles and machinery

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct/Cumulative	Noise emissions will occur because of the execution of construction works.
Reversibility	Reversible	Noise levels will return to baseline levels when the construction works are over.
Geographic Extent	Local	Noise increases will be limited to locations of sensitive receptors.
Time when the impact occurs	Immediate	Noise levels will increase as soon as vehicles, machinery, equipment enter the construction site.
Duration	Short-term	While construction works last at a given location.
Likelihood of appearance	Certain	Construction vehicles and equipment are sources of noise.
Magnitude	Major	Explained in the text above.

Significance of Effects

14.4.8. Considering the High sensitivity of receptors and the Major magnitude of the impact, the significance of the effect, without mitigation measures is **Large (significant)**.

[91] For the assessment of magnitude of the noise impact, "Guideline for Noise Impact Assessment" produced by the Institute of Acoustics (IOA) / Institute of Environmental Management and Assessment (IEMA) Joint Working Party, has been used.

Operational Phase

Traffic Noise Emission

14.4.9. A noise propagation model has been prepared to:

- Model the projected noise levels at respective distances from the Project alignment;
- Define the width of the buffer where Noise Levels exceed the limits and identify all sensitive receptors located within this buffer;
- Confirm the number of sensitive receptors along the motorway located in the buffer.
- The impact of noise from road traffic depends on a number of factors, such as:
  - Traffic volumes;
  - Types of vehicles and their speed;
  - Distance between the source and the receptor;
  - Height difference between the source and the receptor;
  - Characteristics of the terrain;
  - Meteorological conditions;
  - Background noise.

14.4.10. For the purposes of the study, the German standard RLS 90 was applied. In addition, the SoundPlan Essential software package with the RLS 90 standard for calculations was used. In accordance with RLS 90, the level of noise from the road traffic at a reference distance from the source (25 m) is determined, and then corrections are made for distance, height, speed, pavement, terrain and air.

14.4.11. Details of the calculations, background and source data used are given in the Construction and Traffic Noise Study Report in Appendix 14-1.

14.4.12. The traffic data have been derived from the Feasibility Study prepared for the Project which set out the annual average daily traffic (AADT) from 2017 to 2040. The expected hourly day, evening and night traffic volume for different vehicle categories in 2021 1nd 2040 are presented in Table 14-8 below.

Table 14-8 - Estimated frequency of traffic in 2021 and 2040 (vehicles/hour)

Estimated Traffic	Day	Evening	Night
Estimated number of passenger cars in 2021	372.9	74.9	69.9
Estimated number of freight vehicles in 2021	74.9	48.2	24.1
Estimated number of passenger cars in 2040	942.3	165.2	82.6
Estimated number of freight vehicles in 2040	189.2	121.7	60.8
Speed of passenger vehicles	80	80	80
Speed of freight vehicles	80	80	80

14.4.13. Based on the above traffic volumes, sound levels at a reference distance of 25 m[92] have been determined and given in Table 14-9.

Table 14-9 - Sound levels at a reference distance of 25 m

Year	Ld25	Le25	Ln25
2021	63.17	56.77	53.76
2040	67.99	63.19	58.97

Ld – day; Le – evening; Ln – night

The values in Table 14-10 have been obtained for the common correction factors.

Table 14-10 - Common correction factors

$D_{speed.d}$	$D_{speed.e}$	$D_{speed.n}$	D_{slope}	$D_{pavement}$	$D_{terrain}$
2.1	2.1	2.1	0	-1	0

14.4.14. Based on the estimated traffic density, traffic noise levels have been calculated for 2021 volumes as well as for 2040 volumes. Details are given in the Report in Appendix 14-1, Tables 8 and 9.

14.4.15. The results clearly indicate that the noise levels caused by the road traffic on the Project exceed the noise limit values prescribed in the Official Gazette of the Republic of Macedonia No. 107/08 (Rulebook on the use of noise indicators, additional noise indicators, the method of noise measurement and assessment methods with indicators for noise in the environment). The noise levels in Table 14-9 represent exceedances outlined in WHO for night time noise (Night Noise Guidelines for Europe) and for the recommended levels outlined in WHO Environmental Noise Guidelines for the European Region. The night time noise levels at Dolno Strogomishte and Osoj are shown in Figure 14-2 and Figure 14-3 respectively.

[92] 25m is the distance between the centre-line of the project and nearest adjacent properties (houses/ buildings).

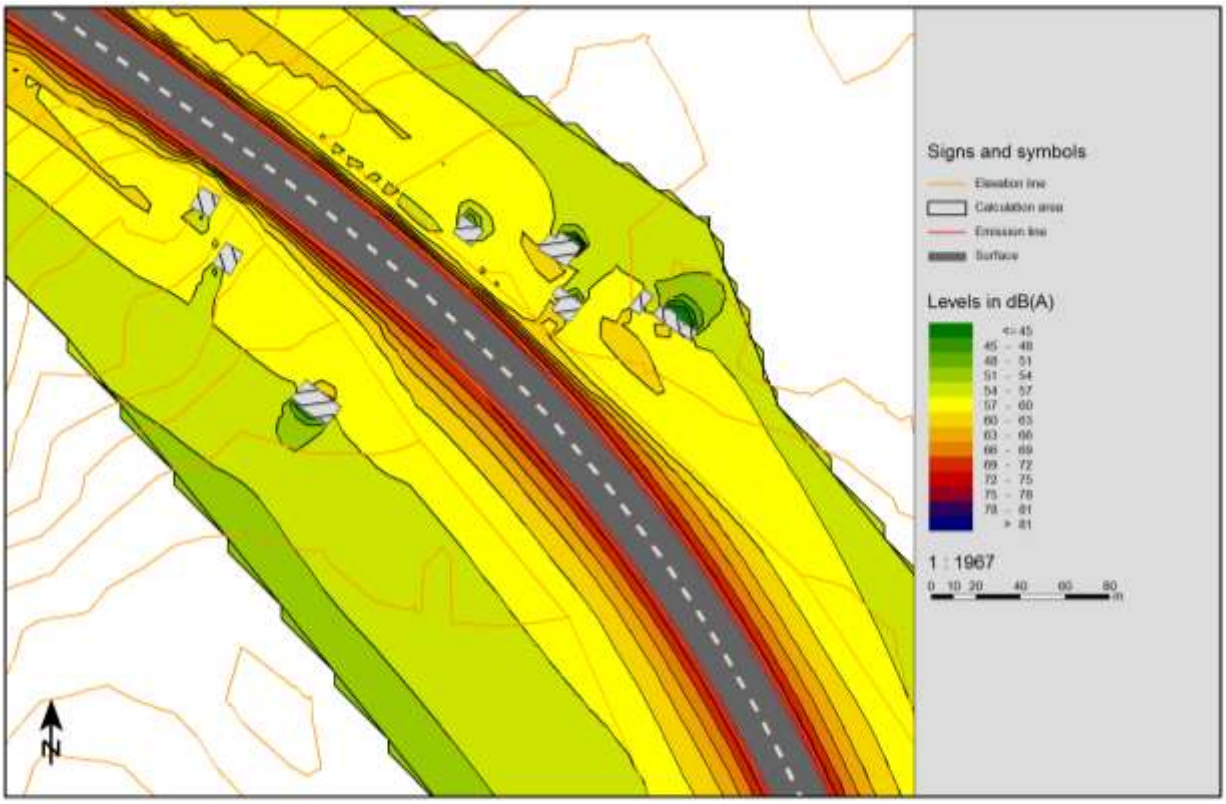

Figure 14-2 - Night time noise levels at Osoj – 2040 AADT

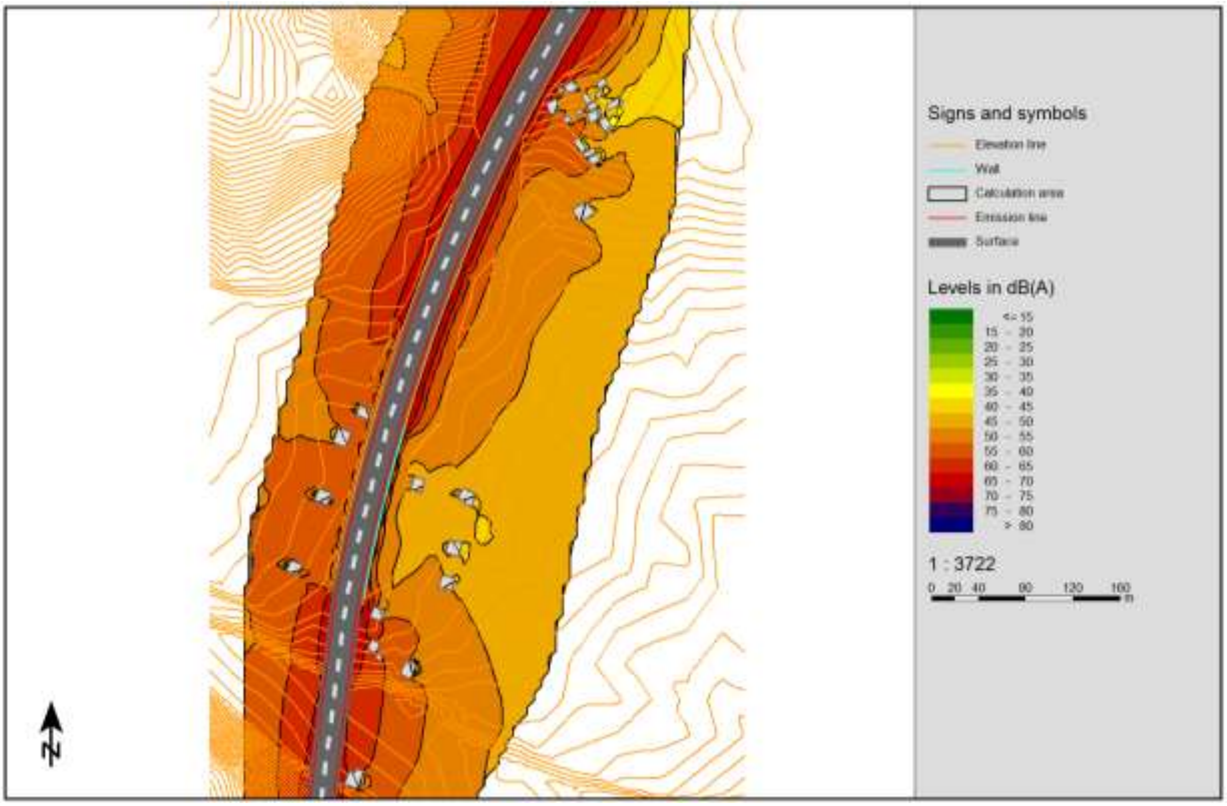

Figure 14-3 - Night time noise levels at Osoj – 2040 AADT

Magnitude and Sensitivity of Impacts

14.4.16. Assuming that the baseline noise level influencing receptors located at a distance of 15 m from the motorway is about 55 dB(A), an increase of 10-20 dB(A) is expected. The expected traffic noise level at the sensitive receptors is given in Table 14-11 (the values are taken from the report in Appendix 14-1). For these receptors (which have a sensitivity of Medium to High) the magnitude of the impact will be **Major**.

Table 14-11 - Expected traffic noise level at sensitive receptors*

Settlement	Position at the road alignment	Distance** (m)	Sensitivity	2021			2040		
				Ld	Le	Ln	Ld	Le	Ln
Gorno Strogomishte	Ch 00+500-02 +000 m	186.60	Medium	70.28	63.89	60.88	74.31	67.92	64.90
Dolno Strogomishte	Ch 03+000-03+500 m	27.50	High[1] [2]	63.80	57.41	54.40	67.83	61.44	58.42
Osoj	Ch 11+700-11+950 m	25.23	High	74.92	68.52	65.51	78.94	72.55	69.54
Rashtani	Ch 11+000-11+300 m	56.20	High	66.73	60.33	57.32	70.75	64.36	61.35
Zajas	Ch 00+700-02+500 m	26.35	High[1]	71.90	65.51	62.49	75.92	69.53	66.52

[1] Schools present;

[2] Cemetery present

* Values taken from the report in Appendix 14-1;

** Distance of the nearest object from the road alignment;

Ld – day; Le – evening; Ln – night.

14.4.17. Other criteria to be considered in the assessment of this impact are given in Table 14-12.

Table 14-12 - Assessment of the Impact - Traffic noise emission

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Noise emission will occur due to the traffic of vehicles.
Reversibility	Reversible	Noise levels should return to baseline levels when the motorway operations stop.
Geographic Extent	Local	Noise level increase will be limited to the footprint of the project.
Time when the impact occurs	Immediate	Noise levels will increase with the start of the traffic at the motorway.
Duration	Long term	During the operational phase of the motorway.
Likelihood of appearance	Certain	Motorway traffic is a major source of noise.
Magnitude	Major	See text above.

Significance of the Effect

14.4.18. Considering the High sensitivity of the receptors (residential areas – Table 13-4) and the Major magnitude of impact, the significance of this effect, without mitigation measures is **Large (significant)**.

SUMMARY OF EFFECTS ON NOISE AND VIBRATION

- Construction phase
  - Noise and Vibration emissions from construction vehicles and machinery – **Large (significant)**.
- Operation phase
  - Traffic noise emissions – **Large (significant)**.

14.5 Mitigation Measures for noise and vibration

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

14.5.1. Before the start of construction works, the Contractor will prepare a Noise and Vibration Management Plan (NVMP), as set out in the ESMP in Chapter 23. This will consider the following:

- Location of construction camp, welfare facilities, storage and maintenance areas;
- Construction access routes and construction traffic volumes;
- Pre-construction noise surveys in line with British Standard (BS) BS 5228;
- Pre-condition surveys of all structures and buildings within 25 m of the Project alignment.

14.5.2. The Noise and Vibration Management Plan will set out measures to be applied during the construction works to limit the impact of noise and vibration during the construction period.

14.5.3. A **Traffic Management Plan** will be prepared to ensure construction related traffic is minimised. The plan shall identify traffic diversion and management issues, traffic schedules, traffic arrangements showing all detours/lane diversions.

14.5.4. Further details are included in the Environmental and Social Management Plan in Chapter 23.

CONSTRUCTION PHASE

Noise

14.5.5. The Contractor will apply the measures outlined in the Noise and Vibration Management Plan, set out in the ESMP in Chapter 23, including:

- Construction site layout consideration.
- Construct temporary noise barriers between noisy activities and noise-sensitive receivers.
- Routing construction traffic away from residential streets, where possible. Streets with the fewest residential properties will be prioritised.
- Use of enclosures around especially noisy activities, or clusters of noisy equipment. For example, shields can be used around pavement breakers, loaded vinyl curtains can be draped under elevated structures.
- Sequence of operation:
  - Time operations to occur during periods of high background noise levels (potentially combining activities if required).
  - Construction works during the night should be avoided except under special circumstances; as sensitivity to noise increases during the night-time hours in residential neighbourhoods. The standard operations on site shall be restricted to the period between 0700 -1900.
- Alternative construction methods:
  - Avoid impact pile driving where possible in noise-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter alternatives where the geological conditions permit their use.
  - Use specially quieted equipment, such as quieted and enclosed air compressors and mufflers on all engines.
  - Select quieter demolition methods, where possible. For example, sawing bridge decks into sections that can be loaded onto trucks results in lower cumulative noise levels than impact demolition by pavement breakers.
- All vehicles and machinery used at the construction sites will be subject to regular maintenance. The vehicles and machines which emit excessive noise due to poor engine adjustment or damaged noise control devices shall not be operated until corrective measures are taken;
- Wherever possible all construction equipment will comply with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment used outdoors (there is a lack of national legislation on outdoor equipment emission noise levels). All the equipment shall bear the CE marking and the indication of the guaranteed sound power level and shall be accompanied by an EC declaration of conformity;
- The equipment will be fitted with appropriate noise muting devices that will reduce sound levels;

- Every effort shall be made for compliance with the correspondent noise limits for each area where the construction works will take place;
- Affected local residents will be informed (to the best of the project's efforts) on the time of the planned works and the vibration and noise levels, as well as the time when these are expected;
- The location of equipment emitting excess noise will be chosen as far as possible from sensitive receptors (residential properties, workplaces, schools and hospitals). When near sensitive receptors, construction works will be scheduled and provided with the necessary resources so that the time of exposure is as short as possible;
- In the case when construction works would need to be performed at night, due to special circumstances, or during a longer period than one day at a given site, an appropriate barrier will be placed around the working area;
- Monitoring of vibration during works (e.g. foundations of bridge structures, tunnel excavations) will be performed where buildings are located within 30 m of the works. Should buildings be damaged as a result of vibration generated by the construction works, the damaged buildings will be repaired, or compensation will be paid;
- Earth excavation equipment operating on the construction site will be located as far from vibration-sensitive receptors as possible;
- Activities such as demolition, excavation and ground-impacting operations will be scheduled not to occur in the same time period. Unlike noise, the total vibration level produced can be significantly less, when each vibration source operates separately;
- Decrease dynamic loads from construction sources such as:
    - Blasting. Explosive type and weight, delay-timing variations, size and number of holes, distance between holes and rows, method and direction of blast initiation;
    - Select demolition methods not involving impact, where possible;
    - Avoid vibratory rollers and packers near sensitive receptors.

14.5.6. Noise reduction measures to be implemented during construction also include:

- Installation of noise barriers (protective walls) with a noise reduction potential of 5-15 dB (A).
- The early completion of operational noise barriers where feasible, to reduce construction noise impacts.

Vibration

14.5.7. Most of the mitigation required for noise will also help reduce vibration. In addition to the noise mitigation, the following approach to piling will be applied.

14.5.8. The use of sonic pile drivers, opposed to vibratory pile drivers, may provide a substantial reduction in vibration levels. A sonic pile driver operates by continuously shaking the pile at a fixed frequency, literally vibrating it into the ground. Vibratory pile drivers operate on the same principle, but at a different frequency. However, continuous operation at a fixed frequency may be more noticeable to nearby residents, even at lower vibration levels. Resonant response may be unacceptable in cases of fragile buildings or vibration-sensitive manufacturing processes. Impact pile drivers, on the other hand, produce a high vibration level for a short time (0.2 seconds) with sufficient time between impacts to allow any resonant response to decay.

14.6 OPERATIONAL PHASE

14.6.1. Noise barriers have been included in design of the Project, in the vicinity of Dolno Strogomishte and Osoj (see Chapter 2: Description of the Project). The noise reduction achieved with the implementation of these barriers at night is shown in Figure 14-4 and Figure 14-5.

Table 14-13 - Operational Noise Barriers

Location		General location	Side	Length (m)	Height (m)
From	To				
Ch 02+640	Ch 02+780	Dolno Strogomishte	West	140	2
Ch 02+800	Ch 03+020		East	220	3
Ch 11+331	Ch 11+471	Osoj	East	140	4.5
Ch 11+471	Ch 11+529		East	58	2
Ch 11+701	Ch 11+885		West	184	3
Ch 11+723	Ch 11+912		East	189	2
Ch 12+020	Ch 12+051		East	31	2
Ch 12+343	Ch 12+528		East	185	2

14.6.2. The specifications include:

- Have a sound absorption coefficient of at least 8 dB (A) (EN 1793-1)
- The aerial sound insulation under direct conditions of the sound field shall not be less than 28 dB (A) (Class D3 EN 1793-6)
- To resist atmospheric influences (temperatures from -30 to + 70 ° C, humidity and wind)
- To be resistant to the dynamic force of snow when removed by snow-plow from the pavement (EN 1794-1)
- Be resistant to impacts of stones and scrap (Class 3 - EN 1794-2)
- To be water-resistant to salt and the effect of combustion gases
- To be resistant to fire (class 3 - EN 1794-2)
- Be resistant to the cumulative effects of the above factors
- To have a long life of exploitation and low maintenance costs
- In order to protect the landscape, it should be a colour in keeping with the landscape
- If transparent sound barriers are chosen, they should have clear warning signs for birds.

14.6.3. An **Operational Noise Management Plan**, as specified in the ESMP in Chapter 23, will be prepared and implemented throughout the operational stage of the project. It will include regular monitoring of traffic noise as per national legislation and/or international good practice. Appropriate maintenance activities will be carried out to assess the barriers' effectiveness of sound attenuation (in line with ISO 10847:1997) . The **Operational Stakeholder Engagement Plan and Grievance Mechanism** will feed into the Operational Noise Management Plan and complaints will be remedied where possible.

14.6.4. If noise levels exceed national standards and the barriers are found not to be working as intended, alternative measures will be considered, including:

- Upgrading of the barriers;
- Alternative barrier designs (earth bunds where feasible);
- Use of low noise surfacing in appropriate locations (where traffic speeds are above 40 kph);
- Sections of reduced speed; and
- Provision of upgraded glazing/ insulation at affected properties.

14.6.5. The ESMP contains requirements to monitor the effectiveness of noise barriers and consider alternative mitigation, if required.

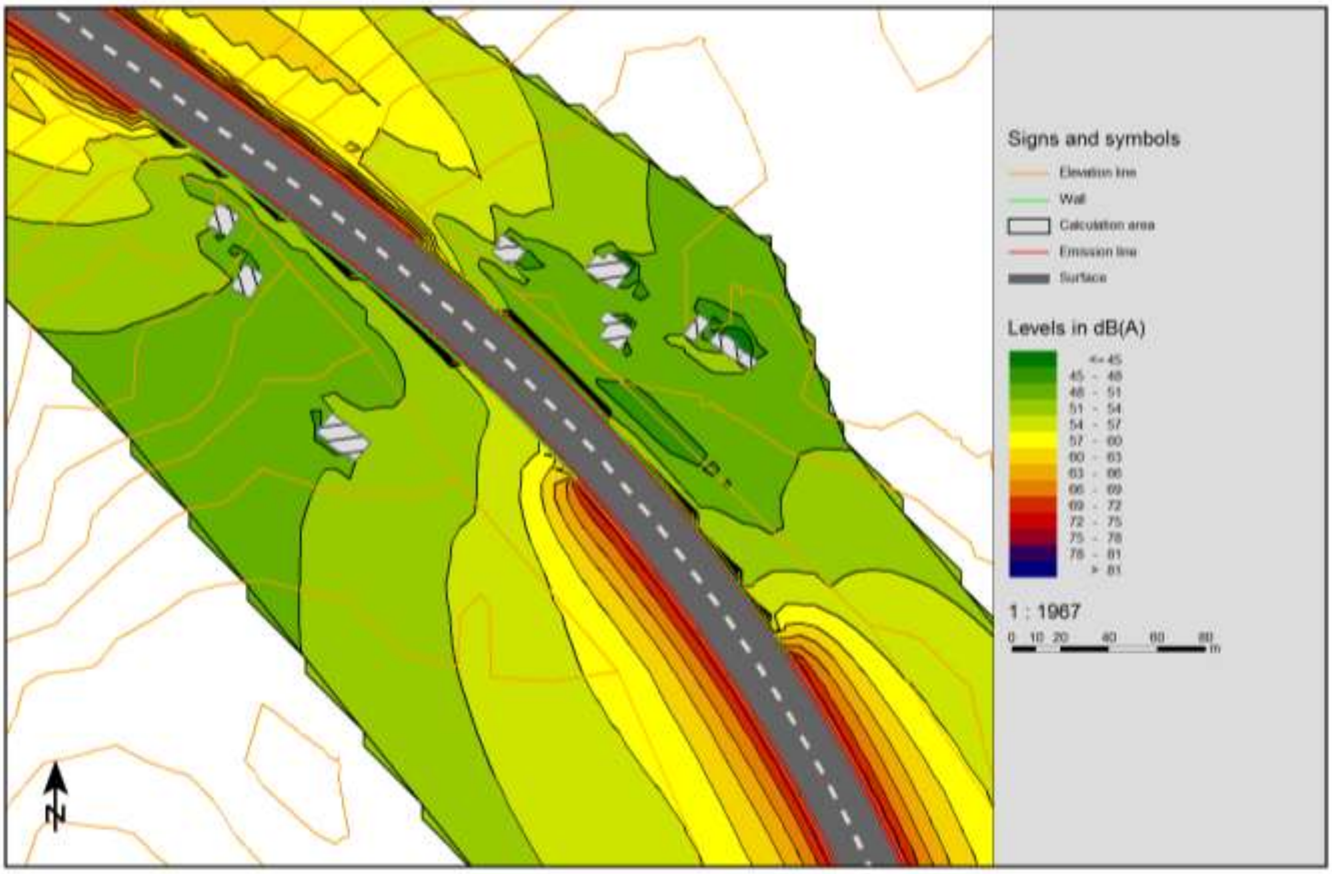

Figure 14-4 - Noise levels (night) at Dolmo Strogomishte with barriers – 2040 AADT

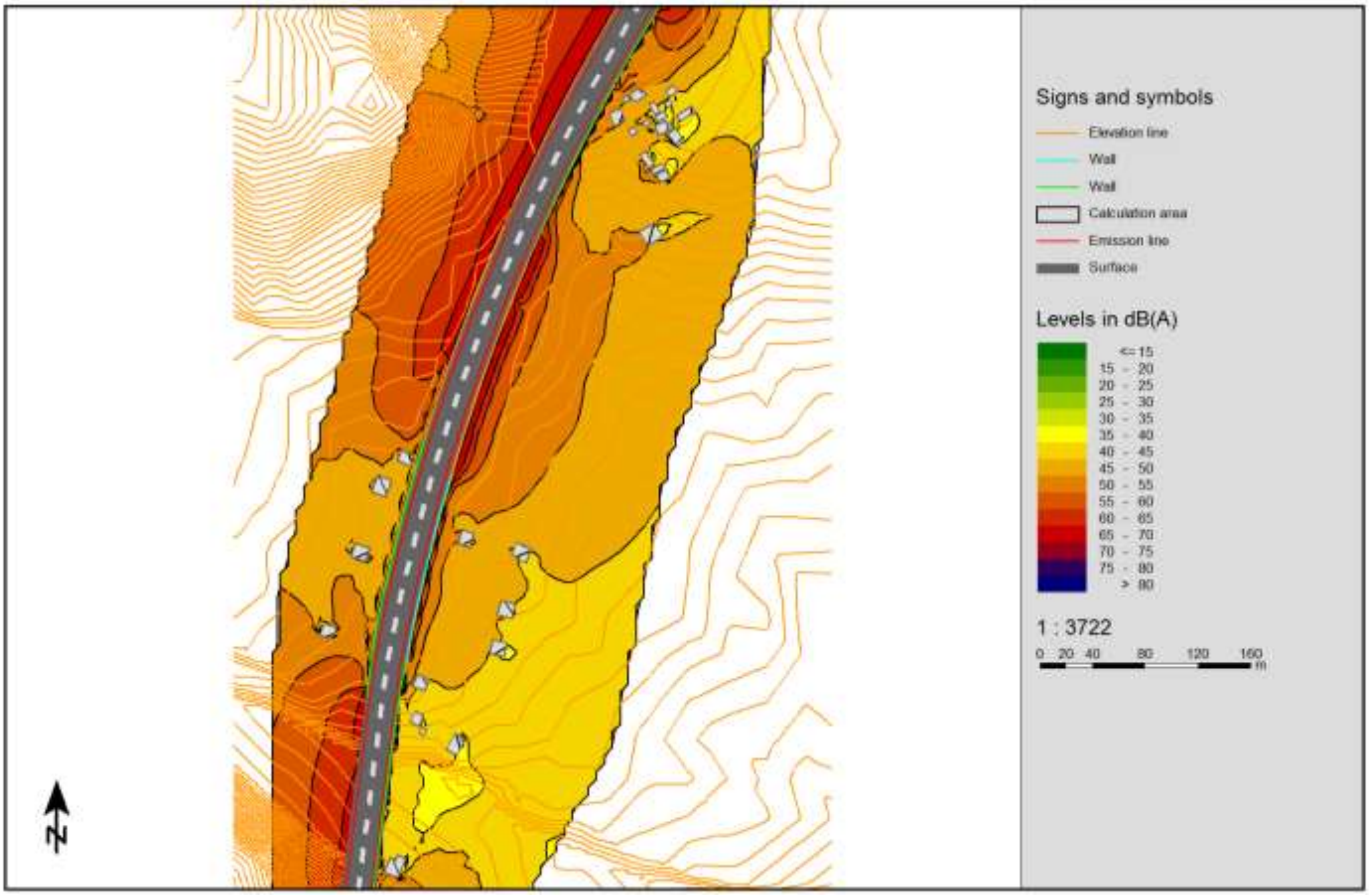

Figure 14-5 - Noise levels (night) at Osoj with barriers – 2040 AADT

14.7 Residual Effects

CONSTRUCTION PHASE

Noise and vibration emissions from construction vehicles and machinery

14.7.1. The significance of this effect without mitigation measures was estimated to be **Large (significant)**, and the probability of success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of the mitigation measures is **Moderate**. Therefore, the significance of the residual effect is considered to be **Moderate (significant)**.

OPERATIONAL PHASE

Traffic noise emission

14.7.2. The significance of this effect without mitigation measures was estimated to be **Large (significant)**. The probability of success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of the mitigation measures is **Moderate**. Therefore, the significance of the residual effect is considered to be **Moderate (significant)**.

14.8 SUMMARY

Table 14-14 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Noise and Vibration	Construction	Noise emissions from construction vehicles and machinery	Large (significant)	Noise and Vibration Management Plan	Moderate (significant)
	Operation	Traffic noise emission	Large (significant)	Operational Noise Management Plan	Moderate (significant)

15 BIODIVERSITY

15.1 BASELINE CONDITIONS

METHODOLOGY

15.1.1. This ecological impact assessment follows international guidance (as well as relevant documents referenced in Chapter 3). Determination of the baseline has been undertaken in accordance with EBRD Performance Requirement (PR) 6.

15.1.2. This assessment has taken into consideration updated industry guidance (EBRD 2020[93]), which focusses upon impacts associated with the Project, within the context of an area that is appropriate to the receptors in question, i.e. one that is ecologically linked to the functioning of that receptor. This is defined as the *ecologically appropriate area of analysis* (EAAA) and in most cases it requires consideration of the landscape-level distribution of the feature requiring study (and assessment).

15.1.3. The Project Zone of Influence (ZoI) is the area within which impacts from the Project may occur. This is referenced where relevant and is used to inform assessment of impacts within the context of each receptor's EAAA.

15.1.4. A Rapid Baseline Survey (Appendix 15.1) was conducted in three stages, as follows:

- Stage 1: A review of relevant literature was completed, including reports and previous environmental assessments for the scheme. A one-day drive (March 2019) over survey of the area was made, by three ecologists. The purpose of this was to: update the habitat maps; identify areas of natural and potential Critical Habitat (CH) or Priority Biodiversity Features (PBF) as required for PR6; and identify habitats of conservation importance. The survey also identified key areas of concern where additional survey would be needed (in particular to confirm presence of CH/PBF).
- Stage 2: Follow-up survey visits (April 2019 for terrestrial surveys and October 2020 for aquatic surveys – Appendix 15.2) were made to survey the areas specifically identified as either:
  - Containing CH/PBF; or
  - Being exposed to particular risks or impacts from the Project.

These field surveys extended across the Project and for a distance of up to c.500m from the Project centreline. These areas included:

- The area surrounding the River Zajaska (Bridge No. 1), close to the village of Crvici. The area is characterised by mixed riparian gallery community, and common alder is the dominant tree species. The EU HD (Annex I): 91E0* advises that: Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* have a high priority for protection and its status as a 'Priority' habitat under this classification qualifies it as Critical Habitat (CH) - as per GN6.

[93] EBRD. 2020. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (v. January 1, 2020). Sept 10, 2020

- The area surrounding the River Zajaska crossing, close to the village of Zajas (Bridge No. 3). The area is characterised by abandoned fields and meadows, with ruderal vegetation and riparian willow-poplar belt (EU HD Annex I: 92A0 *Salix alba* and *Populus alba* galleries). In accordance with PR6, this habitat is considered to be a PBF.
- The area immediately north of the tunnel, north of Kolibari. This area includes mosaic woodland that has some characteristics of EU HD (Annex I): 91M0 Pannonian-Balkanic turkey oak-sessile oak forests. Other components of this mosaic include plantation woodland dominated by pine *Pinus* sp. However, because of the presence of an Annex I this woodland is considered to be PBF.
- The area surrounding the location where the Project crosses an intermittent stream, near the village of Osoj (Bridge No. 2). The area is characterised by the riparian willow-poplar belt (EU HD Annex I: 92A0 *Salix alba* and *Populus alba* galleries). In accordance with PR6, this habitat is considered to be a PBF.
- The area surrounding the location where the Project crosses an intermittent watercourse (the River Strogomishka), near the village of Dolno Strogomishte. The area is characterised by the riparian willow-poplar belt (EU HD Annex I: 92A0 *Salix alba* and *Populus alba* galleries). In accordance with PR6, this habitat is considered to be a PBF.
- Aquatic surveys (October 2020) at the three bridge crossing locations discussed above (as shown in Figure 15-1).

▪ Stage 3: The habitats were then mapped using: aerial photographs; the information gathered from the site visits; and photographs taken during the survey. A description of the habitats, and the typical species found within them, was made using available literature on the area, past survey work conducted in the area and information gathered during the Rapid Baseline Survey. This enabled the further evaluation of biodiversity along the alignment and in the areas of the above CH/PBF in accordance with PR6. This process also included expansion of habitat mapping to each habitat’s EAAA, in order to provide the appropriate context for assessment of these habitats as well as associated fauna.

15.1.5. The timing of surveys were appropriate for the purpose of characterising the habitat types present. Habitat surveys can be completed throughout the year but conducting the surveys during the spring allowed for more detailed plant species lists to be recorded, which aided in the classification of habitats.

15.1.6. Key biodiversity features are shown on Figure 15-1.

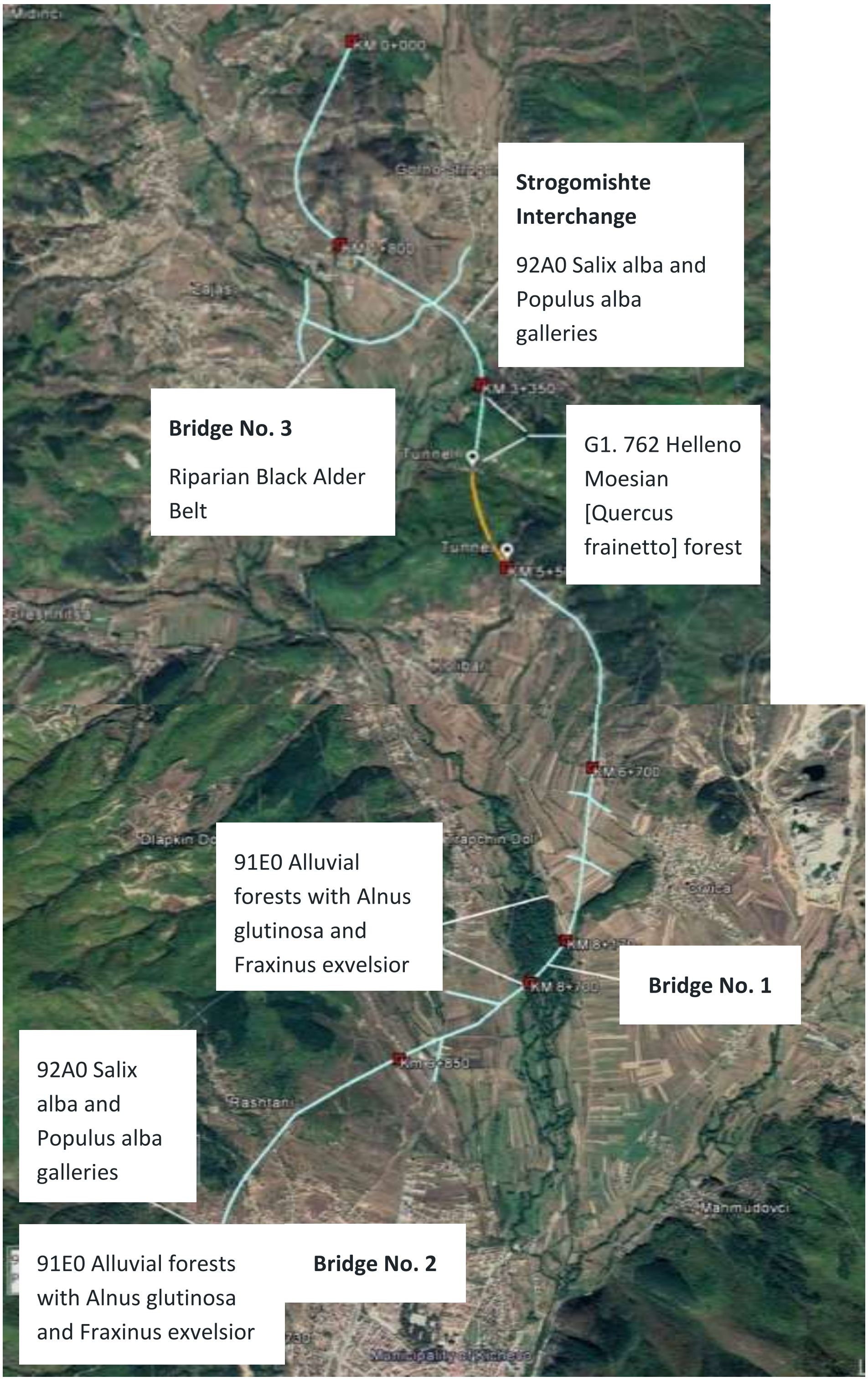

Figure 15-1 - Biodiversity features

15.1.7. There are 3 Habitat Maps, covering the entire length of the Project corridor, in Appendix 15-1. Spring and winter species monitoring is presented in Appendix 15-2.

Table 15-1 - Identification of Priority Biodiversity Features and Critical Habitat

Priority Biodiversity Features as per EBRD PR6	
Threatened habitats	Two EU HD Annex I habitats are present and considered to be PBF: ▪ Riparian willow-poplar belt (EU HD Annex I: 92A0 *Salix alba* and *Populus alba* galleries); and ▪ 91M0: Pannonian-Balkanic turkey oak-sessile oak forests
Vulnerable species	Fire-bellied toad is an EU HD Annex II species. The EAAA for this species therefore qualifies as PBF.
Significant biodiversity features	The range-restricted Macedonian trout *Salmo macedonicus* was recorded from the Zajaska River. Additionally, a range-restricted barbel (subspecies of the Danube barbel *Barbus balcanicus*) was also recorded. These species are restricted in distribution to the Vardar watershed; the Zajaska River is therefore considered to be PBF by association.
Ecological structures and functions required to maintain PBFs	PBFs occur within riparian zones of rivers within the wider area and are dependent upon the presence and continued flow of these rivers.
Critical Habitat (CH) as per EBRD PR6	
(i) Highly threatened or unique ecosystems	Riparian alder woodland (EU HD 91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior.)
(ii) Habitats for significant importance to endangered species	None present
(iii) Habitats of significant importance to endemic or geographically restricted species	None present
(iv) Habitats supporting globally significant migratory species	None present
(v) Areas associated with key evolutionary processes	None present

Priority Biodiversity Features as per EBRD PR6	
(vi) Ecological functions necessary for maintenance of CH	None

OVERVIEW OF FINDINGS

15.1.8. This section presents the results of the habitat mapping, field observations, and literature review conducted between January – April 2019, in relation to the habitats and species composition of the Project corridor. It contains a description of the habitats, characterisation of their distribution, their importance at a local and regional level, and recommendations for their preservation during the road construction. It also presents information on the flora and species composition in each area.

15.1.9. The habitats in the study area comprise two main categories according to their origin: Natural and modified habitats. Natural habitats include forests and shrublands, grasslands and water habitats, while modified habitats are primarily agricultural fields.

15.1.10. The Project is situated within an area that has several belts of Italian and Turkey oak forest. This is the dominant natural vegetation type within the hilly forested landscape, throughout the Project corridor and across the wider area. Riparian habitats are found along the watercourses, represented by willow and alder woodlands, which occur in small forests or woodland belts along rivers and streams. The extent of the riparian habitats that are PBF listed in 15.0.1.2 above extends along the lines of the associated watercourses into the habitat's wider EAAA (see Figure 15-9)..

15.1.11. All of these habitat types have been under intense anthropogenic pressure for centuries, due to the need for arable farmland. They are in different stages of degradation. The other main habitat types found along the Project alignment are different types of grasslands and hill pastures with shrubs. Substantial parts of the study area have been modified, and are either agricultural, abandoned agricultural, or otherwise planted and/or urbanised.

15.1.12. The Project Alignment runs through habitats that can be divided into five sections:

- First section (Chelopeci–Dolno Strogomishte): degraded oak forest with burnt pine plantations, agricultural arable land and alder and willow belts;
- Second section (Dolno Strogomishte-Kolibari): well developed Italian and Turkey oak forest and meadows;
- Third section (Kolibari–Crvica): significant presence of degraded Italian and Turkey oak forests and patches of arable land;
- Fourth section, the area between the villages Crvica and Rashtani: black alder forest close to the River Zajaska, dominated by agricultural fields and degraded Italian and Turkey oak forest; and
- Firth section, close to Kichevo: degraded Italian and Turkey oak forests intermixed with pine plantations and willow belts

15.1.13. The breakdown of habitats crossed by the Project is shown in the

15.1.14. Table 15-2.

Table 15-2 - Habitats in the Project Corridor

Habitats	Area (Hectares)
Italian and Turkey oak forests and patches	432.92
Riparian black alder woodland and belts (PBF)	57.37
Riparian willow belts (PBF)	10.52
Hill pastures	37.84
Meadows	36.42
Pine plantations	73.48
Anthropogenic tree belts and lines	10.88
Abandoned arable land & ruderal sites	35.69
Orchard	4.00
Fields and acres	471.48
Rural settlement	75.01
Industrial, commercial and other man-made structures	10.05

PROTECTED FLORA, FUNGI AND FAUNA

15.1.15. Records of protected flora, fungi and fauna recorded during the two surveys of the Site on 7th March and 18th April 2019 are presented in Table 15-3 - Species Recorded During Surveys, along with findings from fish surveys undertaken in October 2020.

15.1.16. The range-restricted Macedonian trout was recorded from the crossing points on the Zajaska River, with 33 individuals captured across the two sampling points. This species is endemic to the River Vardar catchment. This species is a PBF trigger species given the limited spatial Extent of Occupation (EOO). A range-restricted subspecies of the Danube barbel was also recorded alongside a common and widespread fish assemblage. See the Fisheries Assessment Technical Report (Appendix 15.2) for full details.

15.1.17. A single species listed on Annex II of the EU Habitats Directive was recorded during surveys, fire-bellied toad *Bombina variegate*, which was found within the riparian woodland. This species is a EU Habitats Directive Annex II species that contributes to the designation of Natura 2000 sites and are PBF trigger species.

15.1.18. There were no further populations of sensitive plant or fungi species within the Project corridor (500 m study area), such as are those characterised by limited distribution (rare, endemic or designated as priority species in the Habitats Directive).

15.1.19. Five bird species recorded during surveys were listed under the Annex II of the EU Bird Directive[94], which allows hunting of certain species during defined periods. These were: common starling *Sturnus vulgaris*, Eurasion blackbird *Turdus merula*, Eurasian jay *Garrulus glandarius*, Eurasian magpie *Pica,* and rock dove *Columba livia*. These species are common and widespread. Desk study data indicates that several common and widespread amphibians could also be present in the area including fire salamander (*Salamandra Salamandra)*, European tree frog (*Hyla arborea)*, common toad (*Bufo bufo)* and European green toad (*Bufo viridis)*.

[94] European Commission. (2020). *The Habitats Directive*. Available online at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm [Accessed 07/08/2020].

Table 15-3 - Species Recorded During Surveys

Order	Latin Name	Common Name	IUCN status	European Habitats Directive Annex I & II and EU Bird Directive	National Red List of North Macedonia	Habitats
Winter Surveys – 7th March 2019						
Amphibians	*Bombina variegata*	Fire bellied toad	Least Concern (LC)	II	LC	Riparian woodland EAAAs
Amphibians	*Rana ridibunda*	Marsh frog	LC	-	LC	In all streams and wet places
Birds	*Corvus cornix*	Hooded crow	LC	-	-	Agricultural land
Birds	*Dendrocopos major*	Great spotted woodpecker	LC	-	-	Italian and Turkey oak forest
Birds	*Fringilla coelebs*	Common chaffinch	LC	-		Italian and Turkey oak forest
Birds	*Motacilla cinerea*	Grey wagtail	LC	-	-	Italian and Turkey oak forest
Birds	*Parus* spp.	Tit spp.		-	-	Italian and Turkey oak forest
Birds	*Passer domesticus*	House sparrow	LC	-	-	Agricultural land and rural settlements

Order	Latin Name	Common Name	IUCN status	European Habitats Directive Annex I & II and EU Bird Directive	National Red List of North Macedonia	Habitats
Birds	*Pica*	Eurasian magpie	LC	II	-	Italian and Turkey oak forest; Agricultural land
Birds	*Sturnus vulgaris*	Common starling	LC	II	-	Agricultural land
Birds	*Turdus merula*	Eurasian blackbird	LC	II	-	Agricultural land
Fungi	*Astraeus hygrometricus*	Barometer earthstar	Not Evaluated (NE)	-	-	Meadows and abandoned fields
Fungi	*Bovista plumbea*	Grey puffball mushroom	NE	-	-	Meadows and abandoned fields
Fungi	*Daedaleopsis confragosa*	Thin walled maze polypore	NE	-	-	Riparian belts
Fungi	*Fomes fomentarius*	Hoof fungus	NE	-	-	Riparian belts
Fungi	*Panellus stipticus*	Bitter oyster	NE	-	-	Oak forest and riparian belts
Fungi	*Phellinus igniarius*	Willow bracket fungus	NE	-	-	Riparian belts
Fungi	*Phellinus tremulae*	Aspen bracket	NE	-	-	Riparian belts
Fungi	*Stereum hirsutum*	False turkey-tail	NE	-	-	Oak forest and riparian belts

Order	Latin Name	Common Name	IUCN status	European Habitats Directive Annex I & II and EU Bird Directive	National Red List of North Macedonia	Habitats
Fungi	*Trametes versicolor*	Turkey tail	NE	-	-	Oak forest
Fungi	*Vuilleminia comedens*	Fungus	NE	-	-	Oak forest
Invertebrate	*Helix lucorum*	Edible snail	LC	-	-	Riparian belts
Lichen	*Xanthoria parietina*	Maritime sunburst lichen		-	-	Riparian belts
Plant	*Alnus glutinosa*	Common alder	LC	-	-	Riparian belts
Plant	*Amorpha fruticosa*	False indigo bush	NE	-	-	Riparian belts
Plant	*Bromus* spp.	Bromes spp.	Not Applicable (N/A)	-	-	Meadows and abandoned fields
Plant	*Carpinus orientalis*	Oriental hornbeam	LC	-	-	Oak forest
Plant	*Clematis viticella*	Italian leather flower	NE	-	-	Riparian belts
Plant	*Cornus mas*	Cornelian cherry	LC	-	-	Oak forest and riparian belts
Plant	*Crataegus monogyna*	Common hawthorn	LC	-	-	Oak forest and riparian belts
Plant	*Crocus chrysanthus*	Snow crocus	NE	-	-	Meadows

Order	Latin Name	Common Name	IUCN status	European Habitats Directive Annex I & II and EU Bird Directive	National Red List of North Macedonia	Habitats
Plant	*Crocus veluchensis*	Crocus	NE	-	-	Meadows
Plant	*Ficaria verna*	Lesser celandine	LC	-	-	Meadows
Plant	*Gagea lutea*	Yellow star-of-Bethlehem	LC	-	-	Meadows
Plant	*Humulus lupulus*	Common hop	LC	-	-	Riparian belts
Plant	*Lamium maculatum*	Spotted deadnettle	NE	-	-	Meadows and abandoned fields
Plant	*Lamium purpureum*	Red deadnettle	NE	-	-	Meadows and abandoned fields
Plant	*Lolium* spp.	Ryegrass spp.	N/A	-	-	Meadows
Plant	*Ornithogalum umbellatum*	Garden star-of-Bethlehem	NE	-	-	Meadows
Plant	*Populus tremula*	Eurasian aspen	LC	-	-	Riparian belts
Plant	*Quercus cerris*	Turkish oak	LC	-	-	Oak forest
Plant	*Quercus frainetto*	Italian oak	LC	-	-	Oak forest
Plant	*Rosa galica*	Gallic rose	Data Deficient (DD)	-	-	Oak forest and meadows

Order	Latin Name	Common Name	IUCN status	European Habitats Directive Annex I & II and EU Bird Directive	National Red List of North Macedonia	Habitats
Plant	*Salix alba*	White willow	LC	-	-	Riparian belts
Plant	*Salix amplexicaulis*	Willow	LC	-	-	Riparian belts
Plant	*Salix fragilis*	Crack willow	LC	-	-	Riparian belts
Plant	*Sambucus nigra*	Elder	LC	-	-	Riparian belts
Plant	*Tussilago farfara*	Coltsfoot	LC	-	-	Meadows and abandoned fields
Plant	*Verbascum* spp.	Mullein spp.	N/A	-	-	Abandoned fields
Plant	*Veronica hederifolia*	Ivy-leaved speedwell	NE	-	-	Riparian belts
Reptiles	*Podarcis muralis*	Common wall lizard	LC	-	LC	Rural settlements

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Spring Surveys – 18th April 2019						
Amphibians	*Bombina variegata*	Fire bellied toad	LC	II	LC	In all streams and wet places
Amphibians	*Rana ridibunda*	Marsh frog	LC	-	LC	In all streams and wet places
Birds	*Columba livia*	Rock dove	LC	II	-	Rural settlements
Birds	*Columba palumbus*	Common woodpigeon	LC	-	--	Rural settlements
Birds	*Corvus cornix*	Hooded crow	LC	-	-	Agricultural land
Birds	*Dendrocopos syriacus*	Syrian woodpecker	LC	-	-	Italian and Turkey oak forest
Birds	*Emberiza calandra*	Corn bunting	LC	-	-	Agricultural land
Birds	*Fringilla coelebs*	Common chaffinch	LC	-	-	Italian and Turkey oak forest
Birds	*Garrulus glandarius*	Eurasian jay	LC	II	-	Agricultural land

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Birds	*Hirundo rustica*	Barn swallow	LC	-	-	Rural settlements
Birds	*Motacilla cinerea*	Grey wagtail	LC	-	-	Riparian habitats
Birds	*Parus major*	Great tit	LC	-	-	Italian and Turkey oak forest
Birds	*Parus* spp.	Tit spp.	N/A		-	Italian and Turkey oak forest
Birds	*Pica*	Eurasian magpie	LC	II	-	Agricultural land
Birds	*Streptopelia decaocto*	Eurasian collared-dove	LC		-	Italian and Turkey oak forest and rural settlements
Birds	*Streptopelia decipiens*	Mourning collared-dove	LC	-	-	Rural settlements
Birds	*Sturnus vulgaris*	Common starling	LC	II	-	Agricultural land
Birds	*Turdus merula*	Eurasian blackbird	LC	II	-	Agricultural land
Fungi	*Athelia* spp.	Fungus spp.	N/A	-	-	Italian and Turkey oak forest

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Fungi	*Bovista plumbea*	Grey puffball mushroom	NE	-	-	Meadows and abandoned fields
Fungi	*Coprinellus domesticus*	Firerug inkcap	NE	-	-	Abandoned fields
Fungi	*Daedaleopsis confragosa*	Thin walled maze polypore	NE	-	-	Riparian belts
Fungi	*Fomes fomentarius*	Hoof fungus	NE	-	-	Riparian belts
Fungi	*Ganoderma applanatum*	Artist's bracket	NE	-	-	Riparian belts
Fungi	*Hyphoderma praetermissum*	Crust fungus	NE	-	-	Oak forest and riparian belts
Fungi	*Hypholoma fasciculare*	Sulphur tuft	NE	-	-	Oak forest and riparian belts
Fungi	*Laetiporus sulphureus*	Chicken of the woods	NE	-	-	Riparian belts
Fungi	*Melanoleuca excissa*	Fungus spp.	NE	-	-	Meadows and abandoned fields

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Fungi	*Panellus stipticus*	Bitter oyster	NE	-	-	Oak forest and riparian belts
Fungi	*Phellinus igniarius*	Willow bracket fungus	NE	-	-	Riparian belts
Fungi	*Phellinus tremulae*	Aspen bracket	NE	-	-	Riparian belts
Fungi	*Physisporinus vitreus*	Crust fungus	NE	-	-	Riparian belts
Fungi	*Pleurotus ostreatus*	Oyster mushroom	NE	-	-	Riparian belts
Fungi	*Polyporus arcularius*	Fungus	NE	-	-	Oak forest and riparian belts
Fungi	*Polyporus badius*	Black-footed polypore	NE	-	-	Oak forest and riparian belts
Fungi	*Polyporus melanopus*	Fungi	NE	-	-	Oak forest and riparian belts
Fungi	*Psathyrella* spp.	Psathyrella spp.	N/A	-	-	Abandoned fields
Fungi	*Schizopora paradoxa*	Fungus	NE	-	-	Oak forest

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Fungi	*Stereum gausapatum*	Bleeding oak crust	NE	-	-	Oak forest and riparian belts
Fungi	*Stereum hirsutum*	False turkey-tail	NE	-	-	Oak forest and riparian belts
Fungi	*Trametes hirsuta*	Hairy bracket	NE	-	-	Oak forest and riparian belts
Fungi	*Trametes versicolor*	Turkey tail	NE	-	-	Oak forest and riparian belts
Invertebrate	*Helix lucorum*	Edible snail	LC	-	-	Riparian belts
Lichens	*Xanthoria parietina*	Maritime sunburst lichen	NE	-	-	Riparian belts
Plants	*Alnus glutinosa*	Common alder	LC	-	-	Riparian belts
Plants	*Amorpha fruticosa*	False indigo bush	NE	-	-	Riparian belts
Plants	*Bellis perennis*	Common daisy	NE	-	-	Meadows and abandoned fields

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Plants	*Bromus* spp.	Brome spp.	N/A	-	-	Meadows and abandoned fields
Plants	*Capsella bursa-pastoris*	Shepherd's-purse	LC	-	-	Meadows and abandoned fields
Plants	*Clematis vitalba*	Wild clematis	NE	-	-	Riparian belts
Plants	*Equisetum arvense*	Field horsetail	LC	-	-	Riparian belts
Plants	*Erodium cicutarium*	Common stork's-bill	NE	-	-	Meadows and abandoned fields
Plants	*Eryngium vulgare*	Sea holly	NE	-	-	Abandoned fields
Plants	*Euonymus verrucosus*	Warted spindle tree	LC	-	-	Riparian belts
Plants	*Euphorbia cyparissias*	Cypress spurge	NE	-	-	Meadows and abandoned fields
Plants	*Ficaria verna*	Lesser celandine	LC	-	-	Meadows and abandoned fields

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Plants	*Galium verum*	Lady's bedstraw	LC	-	-	Meadows and abandoned fields
Plants	*Humulus lupulus*	Common hop	LC	-	-	Riparian belts
Plants	*Juniperus oxycedrus*	Cade juniper	LC	-	-	Oak forest and meadows
Plants	*Lamium maculatum*	Spotted deadnettle	NE	-	-	Meadows and abandoned fields
Plants	*Lamium purpureum*	Red deadnettle	NE	-	-	Meadows and abandoned fields
Plants	*Lathraea squamaria*	Common toothwort	NE	-	-	Riparian belts
Plants	*Lolium* spp.	Ryegrass spp.	N/A	-	-	Abandoned fields
Plants	*Lonicera caprifolium*	Italian honeysuckle	NE	-	-	Oak forest
Plants	*Malus* spp.	Apple spp.	N/A	-	-	Agricultural areas and rural setlements
Plants	*Mentha piperita*	Peppermint	LC	-	-	Riparian belts

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Plants	*Petasites albus*	White butterbur	LC	-	-	Riparian belts
Plants	*Plantago lanceolata*	Ribwort plantain	LC	-	-	Abandoned fields
Plants	*Plantago major*	Broad leaf plantain	LC	-	-	Abandoned fields
Plants	*Populus tremula*	Eurasian aspen	LC	-	-	Riparian belts
Plants	*Posa* spp.	Posa spp.	N/A	-	-	Meadows and abandoned fields
Plants	*Primula veris*	Cowslip	LC	-	-	Oak forest
Plants	*Prunus cerasifera*	Cherry plum	DD	-	-	Agricultural areas and rural settlements
Plants	*Prunus spinosa*	Blackthorn	LC	-	-	Meadows and abandoned fields
Plants	*Rubus fruticosus*	Bramble	LC	-	-	Meadows and abandoned fields
Plants	*Salix alba*	Crack willow	LC	-	-	Riparian belts

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	National Red List of North Macedonia	
Plants	*Salix amplexicaulis*	Willow	LC	-	-	Riparian belts
Plants	*Sambucus nigra*	Elder	LC	-	-	Riparian belts
Plants	*Tanacetum vulgare*	Tansy	NE	-	-	Abandoned fields
Plants	*Taraxacum officinale*	Common dandelion	LC	-	-	Meadows and abandoned fields
Plants	*Urtica dioca*	Common nettle	LC	-	-	Riparian belts
Plants	*Verbascum* spp.	Mullein spp.	N/A	-	-	Abandoned fields
Plants	*Veronica tournefortii*	Persian speedwell	NE	-	-	Riparian belts
Reptiles	*Lacerta trilineata*	Balkan green lizard	LC	-	LC	Oak forest and meadows

Order	Scientific Name	Common Name	IUCN Status	European Habitats Directive Annex II and EU Bird Directive	Endemism	Habitats on the Project site
Aquatic Surveys – 27th October 2020						
Fish	*Salmo macedonicus**	Macedonian trout	DD	-	Endemic to River Vardar watershed	Zajaska River
Fish	*Barbus balcanicus**	Danube barbel	LC	-	Balkan endemic	Zajaska River
Fish	*Gobio bulgaricus**	Aegean gudgeon	LC	-	Balkan endemic	Zajaska River
Fish	*Alburnoides bipunctatus*	Spirlin	LC	-	--	Zajaska River
Fish	*Phoxinus phoxinus*	Common minnow	LC	-	-	Zajaska River

PROTECTED AREAS AND FEATURES

15.1.20. This Section presents a description of the natural areas in the vicinity of the Project corridor that have a notable interest due to the value of their natural resources. Except for already declared protected natural areas, none of these areas have a legal status under Macedonian law that fully warranties their protection. These areas include:

- Protected natural areas declared (or anticipated to be declared) under Macedonian law;
- Proposed areas for the management of species;
- Other areas of natural interest without protection coverage (IBAs, IPAs); and
- Natural areas covered under the protection regime of European Union legislation or international conventions (Emerald sites);

PROTECTED AREAS AND PROPOSED PROTECTED AREAS UNDER MACEDONIAN LEGISLATION

15.1.21. There are six categories of protected areas in the Republic of Macedonia (according to the Law on Nature Protection 67/2004): Strict Natural Reserve, National Park, Monument of Nature, Nature Park, Protected Landscape, and Multi-purpose Area. The categorisation of protected areas has been done in accordance with the International Union for Conservation of Nature.

15.1.22. There are four protected and proposed protected areas beyond the Project corridor, however, they are all over 5 km from the project alignment. Three of these sites have been proposed for protection under the 2010 UNDP/GEF project Development of a Representative Protected Areas' Network in the Republic of Macedonia, which is still not officially accepted by the Ministry of Environment and Physical Planning. The proposed River Treska – Kichevo, area for the management of species, is 5.4 km south of the Project.

15.1.23. These are listed in Table 15-4 shown in Figure 15-2 and Figure 15-3.

Table 15-4 - Protected Areas and Proposed Protected Areas in Project Area

Code	Name of the Area	Protected/ Proposed Category for protection	Surface Area (ha)	Approximate distance from the Project
185	Mavrovo	National Park	73 463,51	12 km north west
378	Cave Ubavica	Monument of Nature	121	12.4 km north
265	Studenchica	Monument of Nature (proposed)	864,69	5 km west
215	Bachishka Reka	Nature park (proposed)	101,51	5.1 km west
550	River Treska - Kichevo	Area for management of species (European otter) - proposed	1154,35	5.4 km south

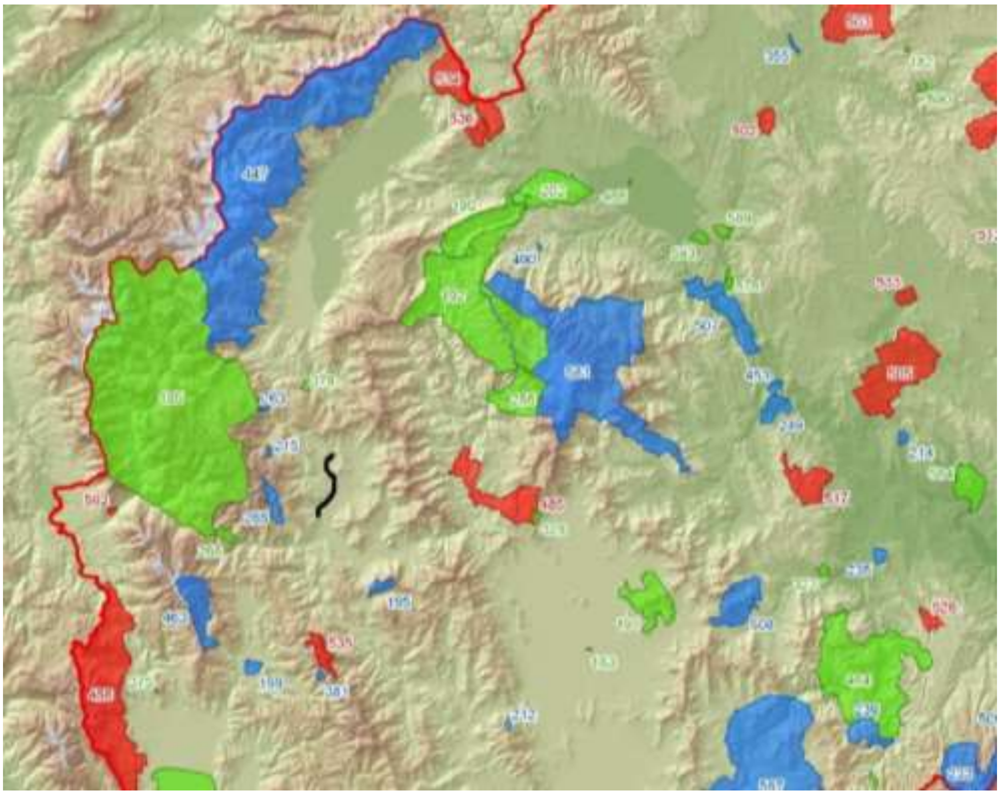

Figure 15-2 - Map with Protected and Proposed for Protection Areas (source: Brajanoska et all. 2011), (The Project is shown in black)

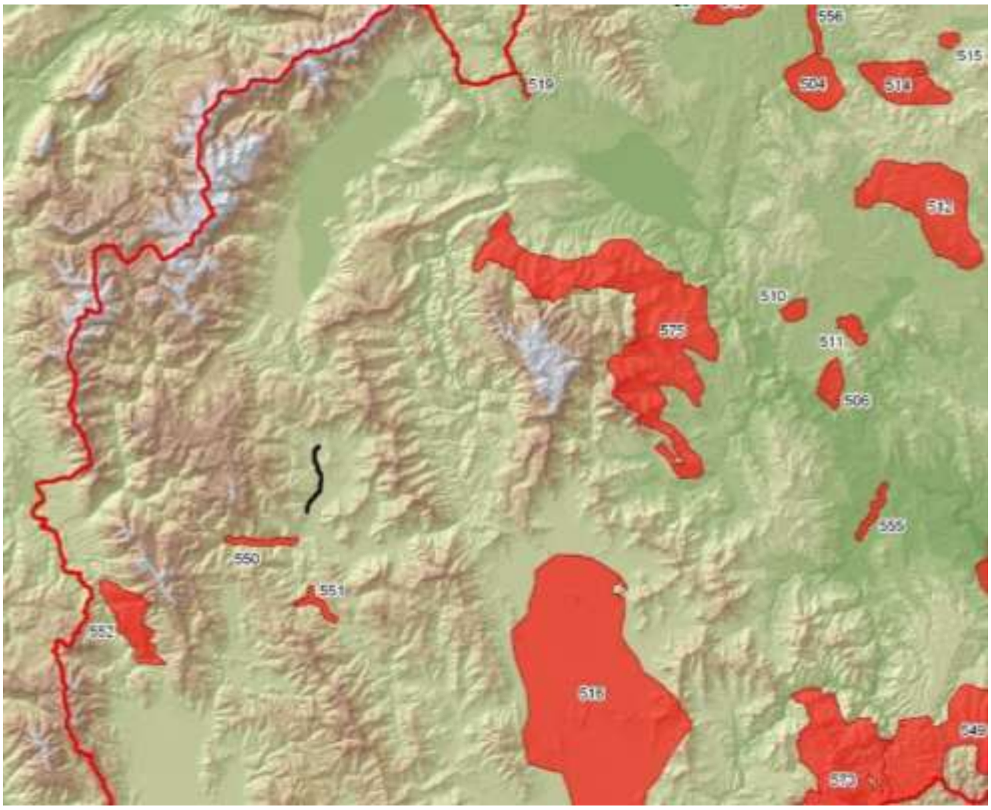

Figure 15-3 - Map with the Proposed areas for Management of Species (Source: Brajanoska et all. 2011), (The Project is shown in black)

IMPORTANT PLANT AREAS (IPA)

15.1.24. The designation of Important Plant Areas (IPAs) is an initiative of Plantlife International for the identification of areas important for the diversity of wild plants based on the presence of endangered plant species, endangered habitats and species richness. The Project does not intersect with any IPAs.

15.1.25. The nearest IPA, Bukovik – Straza, is located approximately 11.5 km to the north of the Project alignment. It includes important habitats at a European level, in accordance with EUNIS Classification E4.34 (C2) and G1.69 (C2). There are also three important plant species which satisfy A(iv) criterion: *Solenanthus scardicus Centaurea grbavacensis* and *Erodium guicciardii*.

Figure 15-4 - Centaurea Grbavacensis on National Post Mark from 2008, Present at Bukovikj – Straza IPA

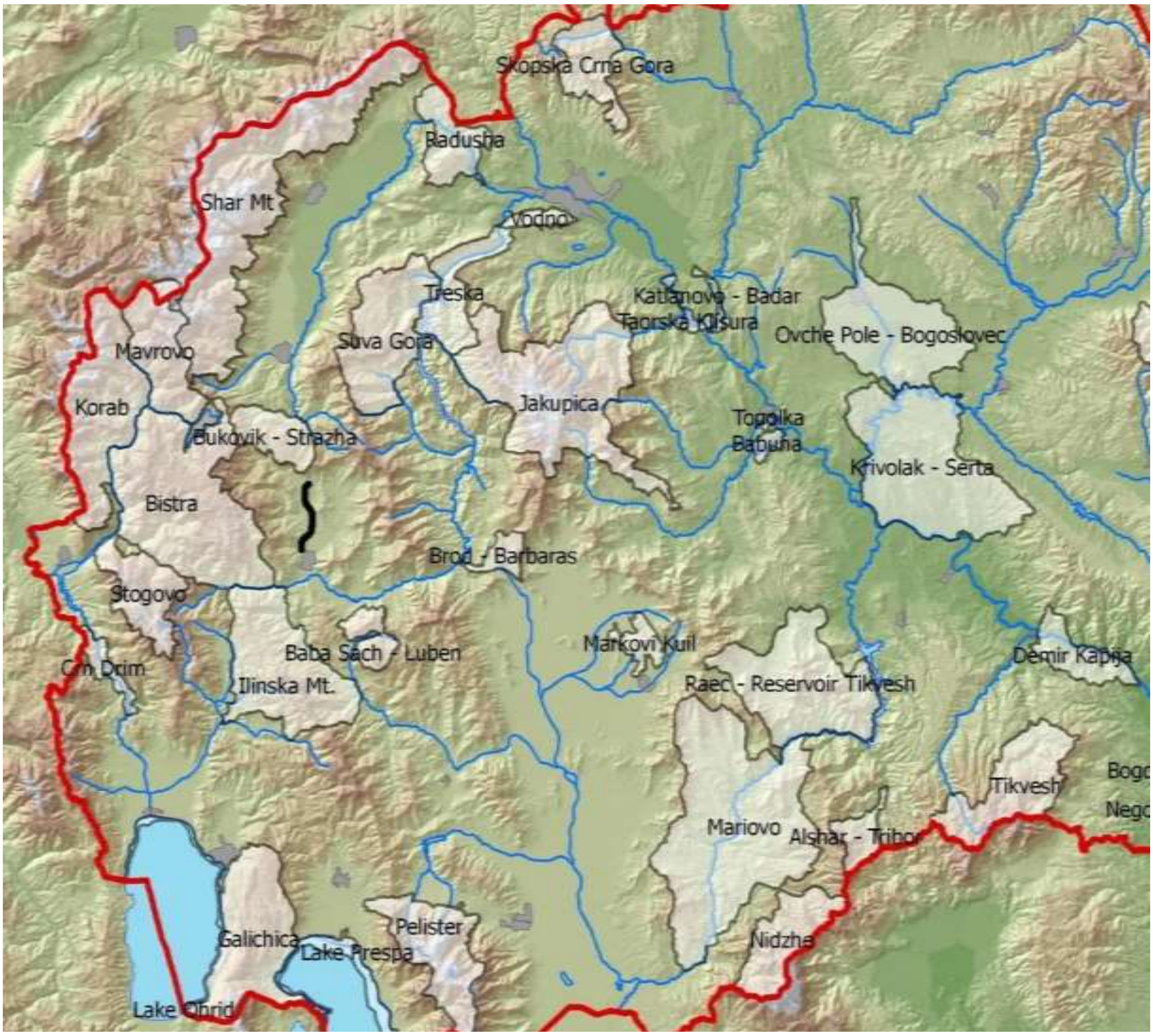

Figure 15-5 - Map of the Important Plant Areas in Macedonia (Source: Brajanoska et all. 2011), (The Project is shown in black)

IMPORTANT BIRD AREAS (IBAS)

15.1.26. There are 24 sites IBA in North Macedonia, covering 6,907 km^2 or 26.9% of the total the total land area. The nearest IBA is the River Radika catchment and it is located over 11 km to the west of the Project alignment, as shown in Figure 15-6.

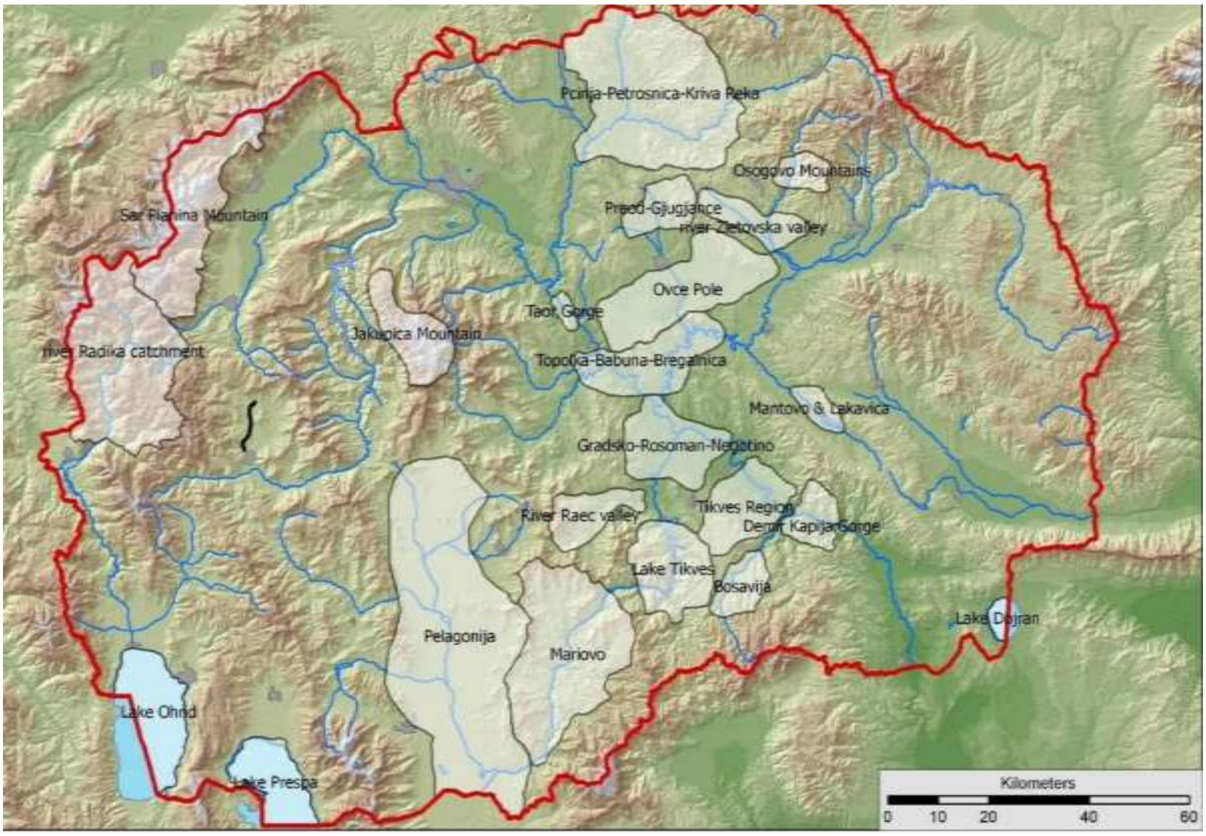

Figure 15-6 - Important Bird Areas in Macedonia (source: Velevski et all. 2010),

EMERALD SITES

15.1.27. The Republic of North Macedonia initiated the development of the EMERALD network in 2002, in order to promote a European wide system of protected areas. Figure 15-7 shows the Emerald Sites in North Macedonia.

15.1.28. These Emerald sites are still not officially approved by the Council of Europe, and Macedonian legislation has not yet incorporated the obligations arising from of Article 6.4 of Habitats Directive 92/43 /EC regarding the assessment of plans and projects significantly affecting Natura 2000 sites. However, Emerald sites have been considered in this assessment in accordance with EBRD and EU requirements.

15.1.29. The nearest Emerald site (Mavrovo), a proposed Site of Community Importance, is located 12 km to the northwest of the Project, and outside of the area over which the Project is likely to have influence.

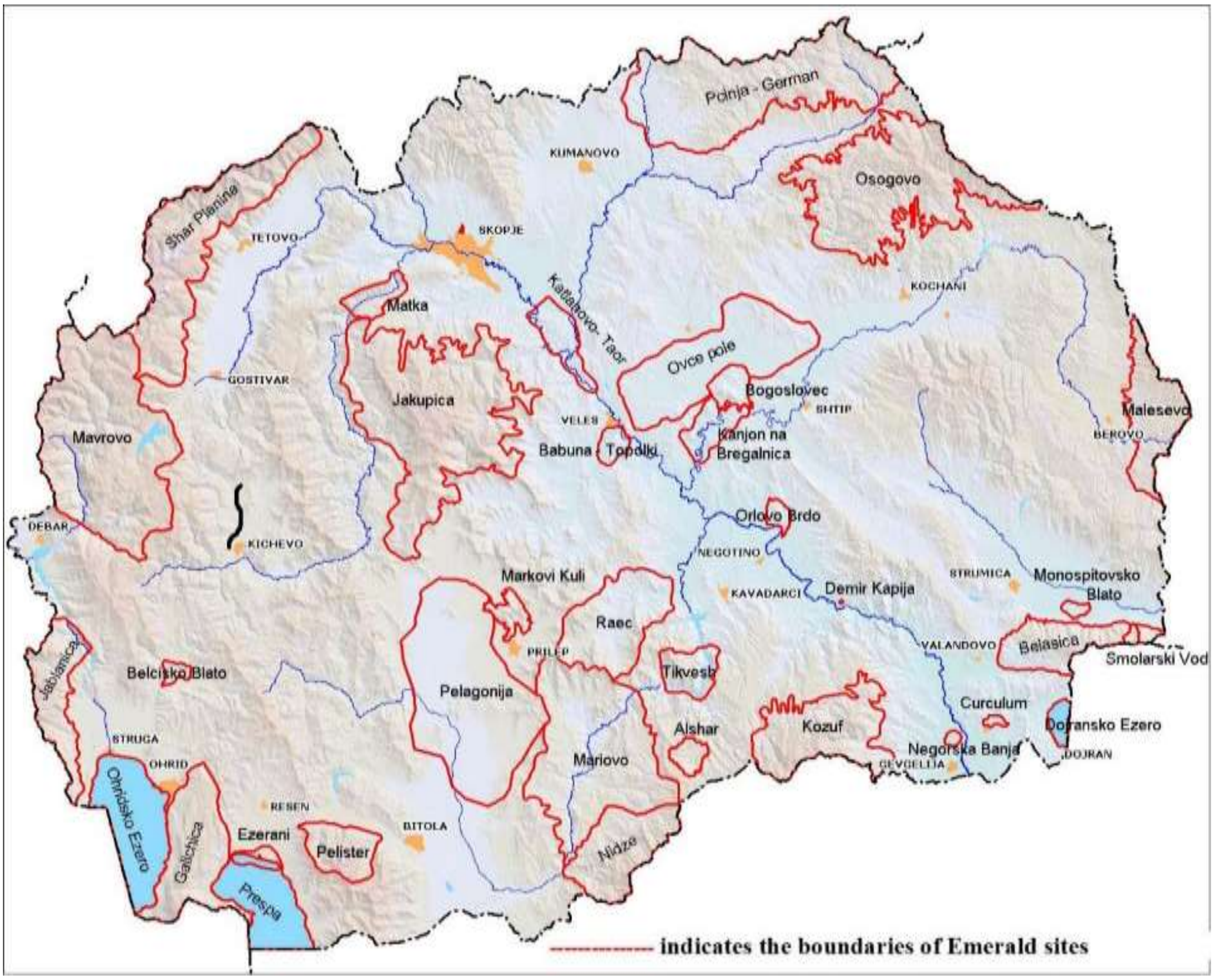

Figure 15-7 - Map of Emerald Sites in Macedonia, source: European Environment Agency, 2015, National Emerald Network of the Republic of Macedonia,

BIO-CORRIDORS

15.1.30. Bio-corridors connect different parts of the same or similar habitats, allowing movement of animals and/or plants between them. This movement can be a significant survival factor for many species in relation to the changes in land use, new areas of development and climate change. One function of bio-corridors is to preserve vital ecological processes and relations by sustaining the connection between habitats and the species populations. Bio-corridors provide daily, periodical and/or seasonal movements for animal species, as well as facilitating the propagation of plants. They are of exceptional importance for the life cycle of a numerous animal species including lynx, grey wolf, bear and ungulates.

15.1.31. Bio-corridors have been identified through the MAK-NEN project implemented by the Macedonian Ecological Society[95], see Figure 15-8. The Bukovik (Kolari) bio-corridor (10.6 km north of the Project) extends from eastern slopes of Bistra Mountain, close to the eastern boundary of the Mavrovo National Park, through southern slopes of the Bukovic Mountain up to the western slopes of the Suva Gora Mountain (the southern part of Suva Gora is known as Cheloica or Dobra Voda). It is very important for the season migration of large carnivores and ungulates. The bottleneck Strazha (Kolari) is an important mountain passageway and is located approximately 5 km north of the Project. It is the main connection between Skopje and Ohrid and beyond (to Albania).

[95] Project on Development of the National Ecological Network in the Republic of Macedonia (MAK–NEN), in realization of Macedonian Ecological Society and European Centre for Nature Conservation (ECNC) in collaboration with MoEPP, 2008 - 2011

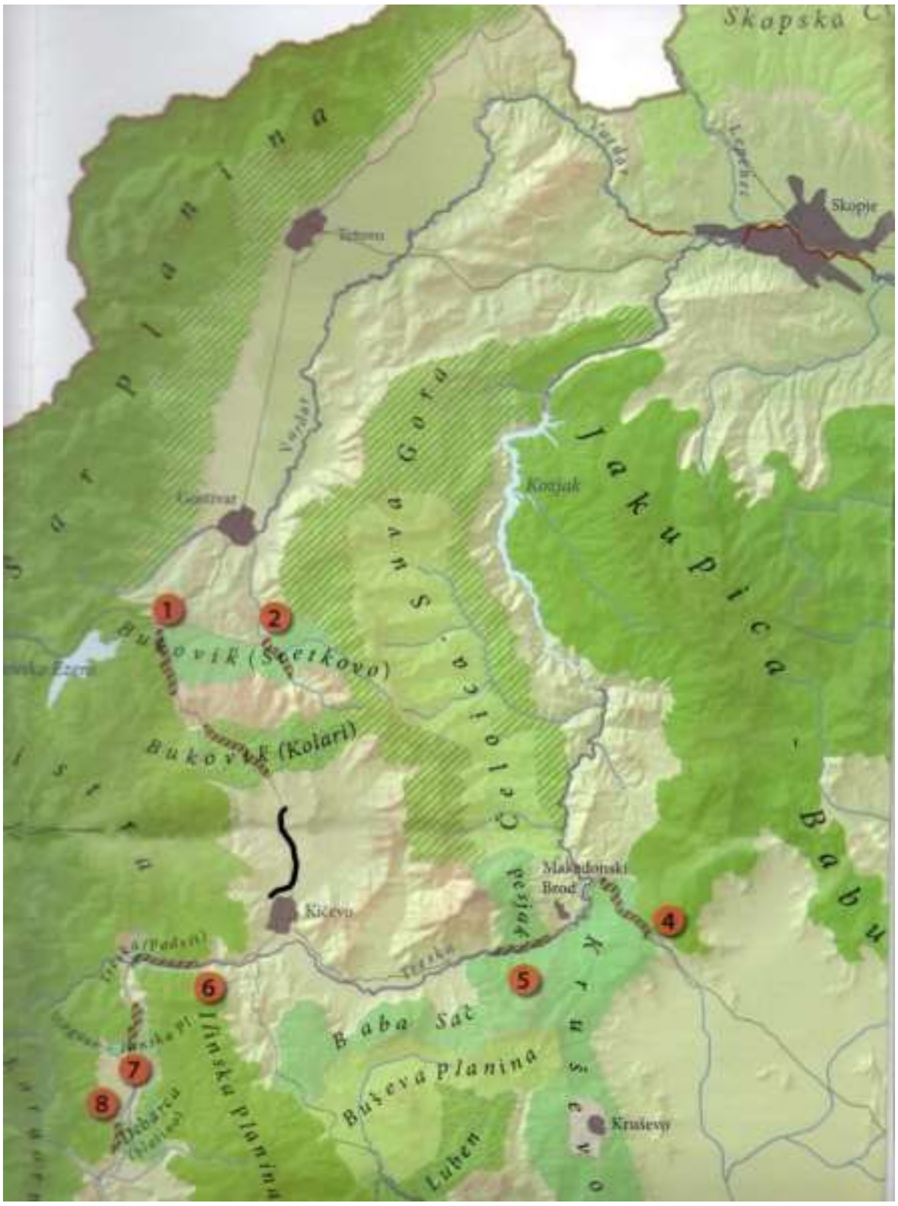

Figure 15-8 - Location of Landscape Corridor Bukovik (Kolari) with Bottleneck Straza – Kolari (The Project shown in Black, Bottleneck Straza – Kolari shown in red)

ASSESSMENT OF HABITATS SENSITIVITY

15.1.32. Sensitivity was assessed using matrix that was specifically designed for this purpose. The matrix was used to evaluate the sensitivity of natural ecosystems and habitats, both in terms of their direct value and also their value by association with important species of flora/fauna that they support. The following ecosystems were evaluated:

- Italian and Turkey oak forests
- Degraded Italian and Turkey oak forests
- Black alder woodland
- Riparian willow and poplar belts

- Hill pastures
- Meadows
- Hiporhithral Stream
- Intermittent streams
- Fields and acres
- Abandoned Arable Land
- Ruderal Vegetation
- Orchards
- Pine plantations
- Mixed tree stands
- Lines of trees
- Rural settlements
- Industrial, commercial and other man-made sites
- Roads

15.1.33. In total, nine different criteria were applied in order to evaluate sensitivity of the above mentioned ecosystems/habitats.

- Habitat Directive[96]
- Rare communities
- Well preserved natural communities
- Bio-corridor function
- Landscape value
- Economic value
- Erosion prevention
- Pollution prevention value
- Associated fauna/flora of interest[96].

15.1.34. The scoring in regard to each criterion was from 0 to 3. The meaning of these scores is the following:

- 0 - no occurrence/importance
- 1 - low occurrence/importance
- 2 - medium occurrence/importance
- 3 - high occurrence/importance

[96] These criteria represent over-riding features for the purposes of identifying CH/PBF as per PR6.

15.1.35. The sum of scores for a habitat determined its sensitivity. The highest possible score is 24. The rating of sensitivity was performed on the basis of the following criteria:

- 0 - 7 - low sensitivity (ls)
- 8-14 - medium sensitivity (ms)
- 14-19 - high sensitivity (hs)
- 20-24 - very high sensitivity (vhs)

15.1.36. The meaning of each degree of sensitivity is described as follows:

- Ls – Low Sensitivity – there are no special obstacles for construction works; however, the aesthetic value of the landscape should be protected, and redundant destruction and excessive perturbation should be avoided; the impacts on these habitats will have lower significance.
- Ms – Medium Sensitivity - the construction works are permitted but the work should be done with precaution measures; the destruction of these habitats or their parts should be avoided; if the destruction is inevitable than the re-cultivation measures should be undertaken; the impacts on these habitats will have medium significance.
- Hs – High Sensitivity (this category includes PBF) - such sites, biotopes or localities have great importance concerning natural, or economic value; any kind of construction work should be avoided; if no other solution is possible, maximum measures for protection of the site or locality should be undertaken; when natural sites are concerned, special construction regime should be applied (e.g. seasonal restrictions, strict territorial recommendations etc.); the damage done to these kinds of ecosystems should be revitalized and compensated in compliance with the Law on Nature Protection and should achieve No Net Loss (in line with PR6). Permanent monitoring during the construction work has to be organised by the Investor. The impacts on these habitats will have high significance.
- Vhs – Very High Sensitivity – (this category includes Critical Habitats) any kind of construction work is forbidden unless certain conditions can be met, including demonstrating a measurable Net Gain for the receptor in question (in line with PR6); any kind of construction work close to such sites or localities should be restricted and measures should be undertaken as in the case with hs habitats/localities. Very high adverse impacts will cause irreversible changes in these habitats/localities i.e. they will be permanently lost. Permanent monitoring during the construction work has to be organised by the Investor as in the case of hs habitats/localities. The impacts on these habitats will have very high significance.

15.1.37. Habitats/features which trigger CH/PBF irrespective of the above assessment method are automatically assigned the corresponding sensitivity score (i.e. Vhs/Hs) regardless of cumulative scoring from the individual criteria, in line with PR6.

15.1.38. The results of the sensitivity evaluation are presented in

15.1.39.

15.1.40. Table 15-5. None of the habitats was assessed as vhs. Two habitats (riparian black alder woodlands and riparian willow - poplar belts, both of which are priority biodiversity features in accordance with PR6) were assessed as being of **high sensitivity**. Three habitats were assessed as being of **ms**, while the rest of the habitats (11) were assessed as being of **ls**.

Table 15-5 - Sensitivity Estimation Matrix for Natural and Modified Habitat

HABITATS EAAAs	Rare communities	Well preserved natural communities	Bio-corridor function	Landscape value	Economic value	Erosion prevention	Pollution prevention	SUM	Habitat Directive[97]	Associated fauna/flora of interest	CH/PBF?	Sensitivity
Italian and Turkey oak forests	1	2	3	1	3	2	1	13	Y	N	**PBF**	**Hs**
Riparian alder woodlands	1	1	3	2	2	2	2	16	Y*	Y	**CH**	**Vhs**
Riparian willow - poplar belts	1	1	2	2	1	3	3	15	Y	Y	**PBF**	**Hs**
Hill pastures	2	0	0	1	0	1	0	5	N	N	-	**Ls**
Meadows	1	1	0	2	3	1	0	9	N	N	-	**Ms**
Hiporhithral streams	1	1	3	3	3	1	1	13	N	Y	**PBF**	**Hs**
Intermittent streams	0	1	1	1	0	1	0	4	N	N	-	**Ls**
Fields and acres	0	1	1	1	3	1	0	7	N	N	-	**Ls**
Abandoned arable land	0	1	1	0	0	1	0	3	N	N	-	**Ls**
Ruderal vegetation	0	1	1	0	0	1	0	3	N	N	-	**Ls**
Orchards	0	0	1	2	1	1	0	5	N	N	-	**Ls**
Pine plantations	0	0	1	2	0	2	2	4	N	N	-	**Ls**
Anthropogenic tree belts and lines	0	0	2	2	0	1	2	7	N	N	-	**Ls**
Rural settlements	0	1	1	2	3	0	0	7	N	N	-	**Ls**
Industrial, commercial and	0	0	0	0	3	0	0	3	N	N	-	**Ls**

[97] Y* signifies Priority Annex I habitat.

HABITATS EAAAs	Rare communities	Well preserved natural communities	Bio-corridor function	Landscape value	Economic value	Erosion prevention	Pollution prevention	SUM	Habitat Directive[97]	Associated fauna/flora of interest	CH/PBF?	Sensitivity
other man-made sites												

PRIORITY BIODIVERSITY FEATURES AND CRITICAL HABITAT

15.1.41. There are no protected or designated areas located within the Project corridor, or within the 500 m ZoI. This applies to already declared protected areas, as well as Emerald sites (EU legislation) and areas without legal status (IBAs, IPAs and proposed or designated areas for species management).

15.1.42. Riparian alder and willow belts are present along watercourses crossed by the Project alignment, which are habitat types listed on Annex I of the EU Habitat Directive; the former being classified as a Priority habitat. Furthermore, remnant oak forest is present, which is also listed on Annex I. According to the EU Habitat Directive, these habitat types are of community interest and require the designation of special areas of conservation. These habitats have been considered as CH (in the case of riparian alder woodland) and PBF for the purposes of this assessment and in accordance with PR6.

15.1.43. The riparian habitats are present as contiguous bands that follow the lines of their associated watercourses throughout their length within the wider areas of the broad valley in which the road alignment is located. These habitats, along with the watercourses, also provide habitat for fire-bellied toad, which is listed on EU HD Annex II and therefore represents a PBF trigger. The species is noted as being often associated with polluted waterbodies (as per Agasyan *et al.* 2009[98]).

15.1.44. The Zajaska river EAAA also supports a population of Macedonian trout (a restricted range species). Two range-restricted fish subspecies have also been recorded, also within the Zajaska river. The EAAA is therefore considered to be PBF.

15.1.45. The oak woodland forms more extensive habitat blocks across the landscape.

15.1.46. Table 15-9 - Type and Extent of Habitat ReplacementFigure 15-9 provides an overview of sensitive habitats (and their associated EAAA) according to their sensitivity which are present along the Project alignment. Only those habitats considered to be of medium sensitivity and above are included here (habitat polygons with more than one sensitivity category have the higher category

[98] Agasyan, A., Avisi, A., Tuniyev, B., Crnobrnja Isailovic, J., Lymberakis, P., Andrén, C., Cogalniceanu, D., Wilkinson, J., Ananjeva, N., Üzüm, N., Orlov, N., Podloucky, R., Tuniyev, S. & Kaya, U. 2009. *Bombina*. *The IUCN Red List of Threatened Species* 2009: e.T2865A9489517.

illustrated – e.g. as is the case for CH riparian woodland and hyporhithral streams). As per table 15-5 above, the habitats illustrated are as follows:

- Very high sensitivity (purple): Riparian alder woodland
- High sensitivity (red): Oak forests (forming non-linear areas); and riparian willow-poplar belts (linear extents alongside watercourses)
- Medium sensitivity (orange): Meadows

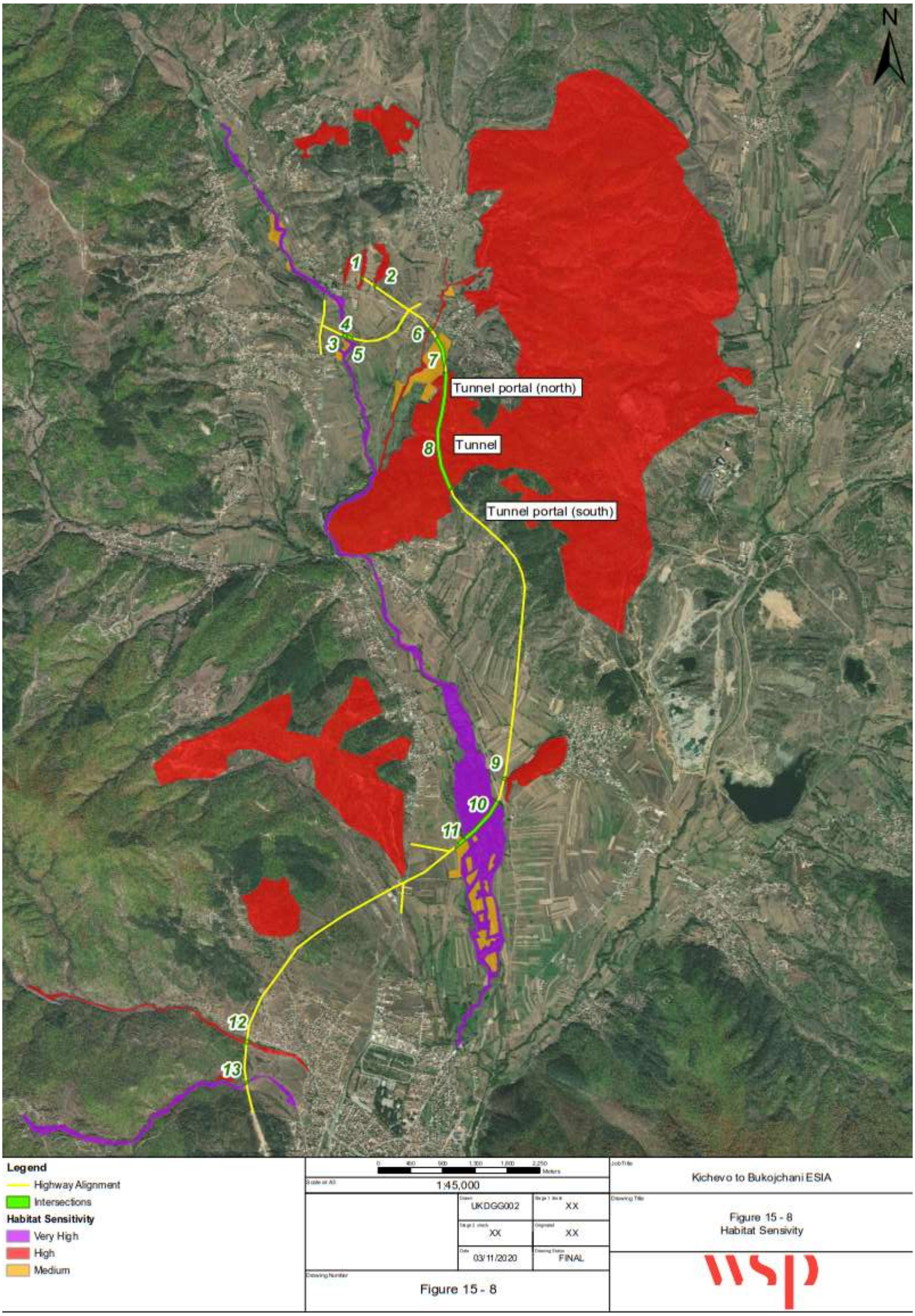

Figure 15-9 - Habitat EAAAs in the ZoI and Assigned Sensitivity (13 points of intersection numbered)

15.2 POTENTIAL IMPACTS AND EFFECTS

15.2.1. Roads are a major contributor to habitat fragmentation because they divide large landscapes into smaller patches and convert interior habitat into edge habitat. As additional road construction and timber harvest activities increase habitat fragmentation across large areas, the populations of some species may become isolated, increasing the risk of local extirpations or extinctions.

15.2.2. The following potential impacts on habitats have been identified for the construction and operational phases of Project:

- Construction phase
  - Habitats loss (direct destruction)
- Operation phase
  - Habitats fragmentation

CONSTRUCTION PHASE

Habitat Loss (Direct Destruction)

Description

15.2.3. A 50 m wide area (60 in the bridge construction area) which is approximately 25 (30) m from both sides of the centre line of the Project, has been considered to assess the actual surface of habitat loss.

15.2.4. Table 15-6 presents a breakdown of areas of respective habitats to be lost as a result of the Project.

Table 15-6 - Habitat Loss due to the Project (CH in bold/underlined; PBF in bold)

Habitats	Habitat Loss (ha)	Sensitivity
Italian and Turkey oak forests	**3.59**	**Hs**
Riparian black alder belts and woodland	**3.97**	**Vhs**
Riparian willow belts	**0.73**	**Hs**
Hill pastures	6.36	Ls
Meadows	3.09	Ms
Conifer tree plantations	0.39	Ls
Tree belts and lines	1.54	Ls
Total	24.63	-
Built-up areas	6.81	N/A
Total	31.44	-

15.2.5. **Magnitude and Severity of Impacts** In order to assign a level of magnitude to the above habitat loss impacts, these losses are considered within the EAAA context (only those habitats of medium sensitivity or above are considered here). On this basis, relative losses are provided in Table 15-7.

Table 15-7 - Habitat Loss due to the Project (CH in bold/underlined; PBF in bold)

Habitats	Habitat Loss (ha)	Relative loss (approx. %)
Italian and Turkey oak forests	**3.59**	**0.14**
<u>Riparian black alder belts and woodland</u>	**3.97**	**1.70**
Riparian willow belts	**0.73**	**1.54**
Meadows	3.09	4.51

Critical Habitats

15.2.6. Construction impacts to CH (riparian black alder belts and woodland) are expected to result in a loss of 2.7 ha, which represents c. 1.7% of the habitat's EAAA. This impact is not considered likely to compromise the habitat's integrity across the EAAA given the relatively small losses expected. Furthermore, at viaduct No.3 (Ch12+460 km) there will be elements of this habitat retained so the overall value of habitat loss will likely be lower than the estimate presented here (this will also serve to maintain habitat connectivity at this location). The impact magnitude is therefore considered to be **Minor.**

Priority Biodiversity Features

15.2.7. Construction impacts to Italian and Turkey oak forests (PBF) are expected to result in a loss of 3.59 ha, which represents c. 0.14% of the habitat's EAAA (this habitat has been largely avoided due to tunnelling beneath the largest extent of this habitat here). This impact is not considered likely to compromise the integrity of habitat across the EAAA given these low losses. The impact magnitude to this PBF is therefore considered to be **Minor**.

15.2.8. Construction impacts to riparian willow belts (PBF) are expected to result in a loss of 0.73 ha, which represents c. 1.54% of the habitat's EAAA. This impact is not considered likely to compromise the integrity of habitat across the EAAA given these relatively low losses. The impact magnitude to this PBF is therefore considered to be **Minor**.

Other Habitats

15.2.9. The above figures highlight that construction impacts to meadow habitats will be 3.09 ha, which represents c. 4.5% of the habitat's EAAA. This impact is not considered likely to compromise the integrity of habitat across the EAAA given these relatively low losses. Furthermore, this habitat is represented by a number of discrete extents, rather than a large contiguous area and so has demonstrated a resilience to a legacy of fragmentation. The impact magnitude to this PBF is therefore considered to be **Minor**.

Table 15-8 - Magnitude of the Impact – Habitat Loss (Direct Destruction)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable
Type of Impact	Direct	The loss of habitat derives directly from the land clearance needed for the construction of the Project
Reversibility	Irreversible	Except for the construction camps, the loss of habitat will be, for practical purposes, irreversible on the long term
Geographic Extent	Local	The loss of habitats is limited to the footprint of the project
Time when the impact occurs	Immediate	The loss of habitat occurs as soon as land clearance is executed
Duration	Long-term	It will last during the operational life of the project and later
Likelihood of appearance	Certain	The land will necessarily be cleared for the Project construction
Magnitude	**Minor**	See above

Significance of Effects

Critical Habitats

15.2.10. Considering the very high sensitivity attributed to the alder woodland EAAAs and the minor impact magnitude expected, the overall significance to this habitat will be **Moderate adverse (Significant).**

Priority Biodiversity Features

15.2.11. Considering the high sensitivity attributed to the alder woodland EAAAs and the minor impact magnitude expected, the overall significance to this habitat will be **Slight adverse (not Significant).**

Other Habitats

15.2.12. Considering the medium high sensitivity attributed to the alder woodland EAAAs and the minor impact magnitude expected, the overall significance to this habitat will be **Slight adverse (not Significant).**

Mitigation

15.2.13. In order to mitigate for these losses and with particular relevance to PR6 compliance, a comprehensive mitigation strategy (including (at least) like-for-like replacement for PBF habitat losses) and a replanting plan that secures a net gain in the extent of the EAAA for CH will be implemented, as set out in the Chapter 23: Environmental and Social Management Plan. Specific details regarding such mitigation measures will be provided within a Biodiversity Management Plan (BMP), to ensure No Net Loss/Net Gain is secured in perpetuity in accordance with EBRD PR6.

15.2.14. The extent of each habitat type that needs replanting is show in Table 15-9

Table 15-9 - Type and Extent of Habitat Replacement

	Minimum extent (ha)	Location (see Figure 15-10)
Italian and Turkey oak forests	**3.59**	1
Riparian black alder belts and woodland	7.94	2
Riparian willow belts	1.46	3

15.2.15. Re-planting of the PBF/CH woodland habitats will take place within and around the EAAAs for each habitat type, these areas are identified in Figure 15-10. The process is outlined in the Land Restoration Plan. The materials required for replanting will be included in the Bill of Quantities.

15.2.16. The land required for replanting will be secured by the PESR, and will be maintained as the specified habitat type in the long-term (i.e. for the lifetime of the Project), through commitments secured from the landowners by PESR

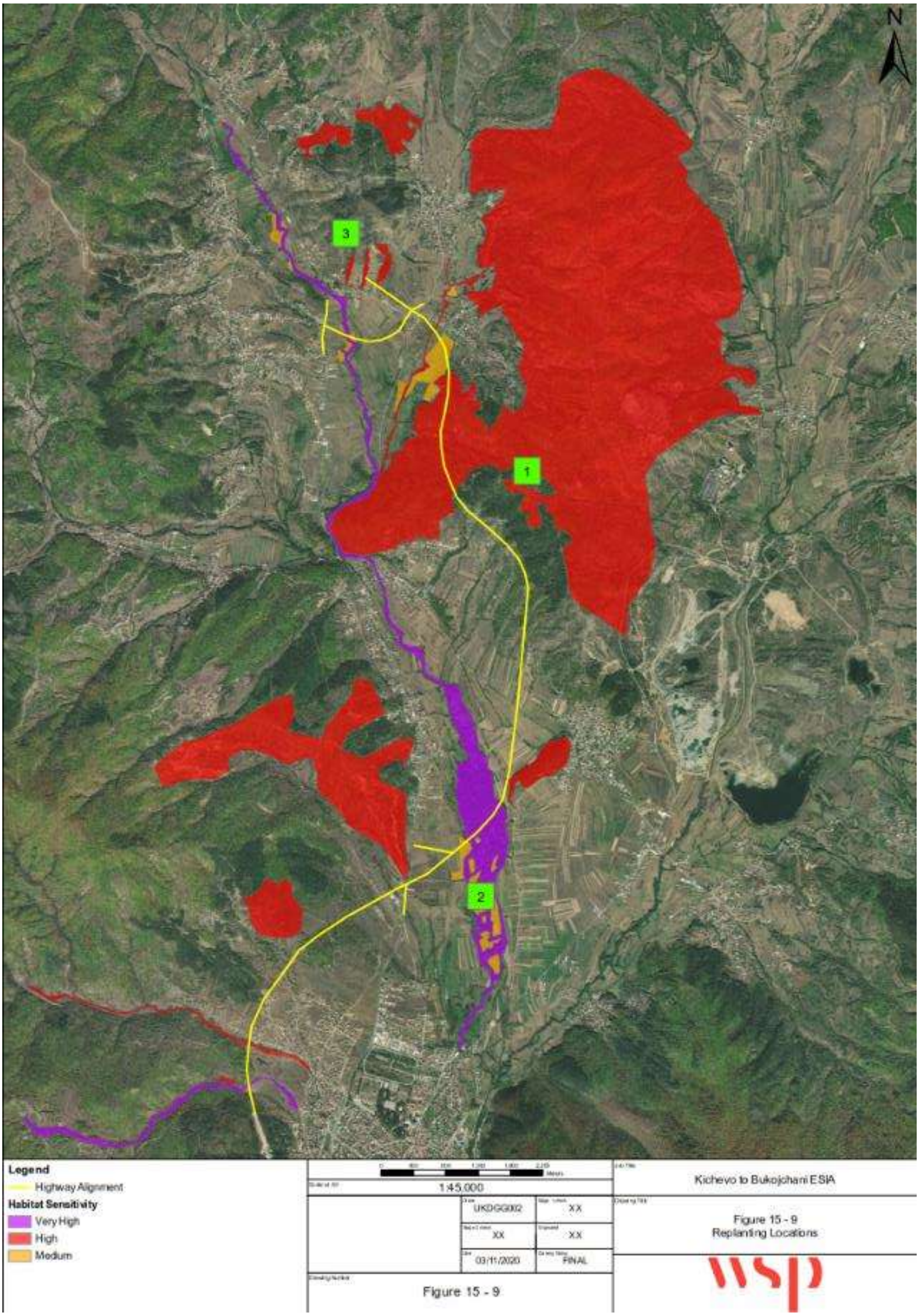

Figure 15-10 - Replanting locations (habitat types 1, 2 and 3 are detailed in Table 15-8)

Residual Effects

15.2.17. With the application of the above measures, the residual effect to PBF habitats will be **negligible**. Effects to CH are expected to be **Slight positive** as a result of the requirement to achieve net gains for this habitat. Residual effects to habitats will therefore be **not Significant**.

Breeding Cycle Interruption

Description

15.2.18. In the absence of mitigation, the construction of the Project is likely to cause direct interruptions in the breeding cycle and may potentially decrease the breeding success of the birds along the corridor. This included the five species listed under the European Habitats Directive Annex II and EU Bird Directive: common starling, Eurasian blackbird, Eurasian jay, Eurasian magpie and rock dove. Most affected will be the bird community of the oak forests, including Eurasian jay. and species using the arable fields and riparian woodland, including common starling. The passerine species, including Eurasian blackbird, will be most affected by fragmentation and direct habitat lost.

15.2.19. The sensitivity of breeding birds along the Project alignment is considered to be low due to their common and widespread occurrence across the study area.

Magnitude and Severity of Impacts

Table 15-10 - Magnitude of the Impact – Breeding Cycle Interruption

	Assessment Thresholds	
Criteria	**Threshold**	**Descriptions**
Characterisation of Impact	Negative	Not desirable
Type of Impact	Direct	Loss of habitat and construction disturbance.
Reversibility	Reversible	The effects will likely stop when construction stops.
Geographic Extent	Local	Limited to the construction site
Time when the impact occurs	Immediate	As soon as construction works begin.
Duration	Long - term	The breeding cycle could be permanently affected
Likelihood of appearance	Possible	Habitat will be removed as a result of the Project.
Magnitude	Moderate	

Significance of Effects

15.2.20. The sensitivity of the receptor is considered to be low and the magnitude of impact is considered to be **minor**. The significance of the effect, without mitigation measures is ***Slight adverse (Not Significant).***

Mitigation

15.2.21. Where possible, construction activities around nesting bird habitat should be timed to avoid the nesting bird season (broadly March to July inclusive). Where this is not possible, construction should be preceded by a pre-works nesting bird check by a suitably experienced ecologist across suitable nesting bird habitat. This should be done no greater than 48 hours in advance of works. Any active nest identified should be protected (from direct and indirect disturbance) during construction until such time that the young have fledged the nest or the nest has failed due to natural causes.

15.2.22. These measures will be included within the Project ESMP and discharged through the BMP.

Residual Effects

15.2.23. With the application of the above mitigation residual effects to nesting birds will be **neutral (not Significant)**.

Alteration, Disruption or Destruction of Amphibian and Fish Habitats

Description

15.2.24. The alteration, disruption or destruction of amphibian and fish habitats can occur due to the clearance of riparian vegetation, temporary water diversion and as a result of an inappropriate construction methods.

15.2.25. The Zajaska river is considered to be a high sensitivity habitat due to the presence of Macedonian trout (PBF). There are no direct habitat losses expected as a result of the Project and no in-channel works will be required; however, pollution impacts from constriction activities have the potential to adversely affect the water quality within the context of this species.

15.2.26. The amphibian habitats (riparian woodland) are considered to be a maximum of high sensitivity based on the presence of fire-bellied toad (PBF). The EAAA for this species extends for approximately 281 ha and predicted direct losses to it are considered to be approximately 3.1 ha (which represents 1.1% of this EAAA).

15.2.27. Pollution/hydrological impacts here have the potential to have a long-term impact on the viability of fire-bellied toad across the EAAA, given hydrological connectivity and the species' reliance on water.

15.2.28. Finally, there is the risk of direct mortality/disturbance to fire-bellied toad during construction activities.

Magnitude and Severity of Impacts

Table 15-11 - Magnitude of the Impact – Alteration, disruption or destruction of amphibian and fish habitats

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable
Type of Impact	Direct and Indirect	Loss of habitat, direct mortality and release of sediments/pollution into the water bodies.
Reversibility	Reversible	Habitat loss will be irreversible. Direct mortality will be a short-term impact, with recruitment outwith the Project footprint likely to reverse this impact in the medium term. Pollution impacts may result in long-term effects upon habitat suitability; however, these will be reversible.
Geographic Extent	Regional	Limited to the construction site and downstream extents of the Zajaska river.
Time when the impact occurs	Immediate	As soon as construction works begin.
Duration	Long - term	The impact will end once construction activities stop but the effect will be realized for a longer period.
Likelihood of appearance	Possible	The land will necessarily be cleared for the bridge construction. In the absence of mitigation, pollution impacts are very likely.
Magnitude	Minor for habitat loss and direct mortality. Major for hydrological impacts	

Significance of Effects

15.2.29. The sensitivity of the Macedonian trout is considered to be high and the magnitude of the pollution impact is considered to be major. The significance of the effect, without mitigation measures is ***Major adverse (significant).***

15.2.30. The sensitivity of the fire-bellied toad is considered to be high. The magnitude of the habitat loss impact is considered to be minor given the low relative losses and the prevalence of retained habitat across the EAAA. The significance of effect from habitat losses are considered to be ***Slight adverse (Not Significant).***

15.2.31. The magnitude of the pollution impact to fire-bellied toad is considered to be major. The significance of the effect, without mitigation measures is ***Major adverse (significant).***

15.2.32. The magnitude of the potential mortality/disturbance impact is considered to be minor given the extent of the EAAA outwith the ZoI and the likely limited Project footprint here. The significance of effect from direct morality/disturbance is considered to be ***Slight adverse (Not Significant).***

Mitigation

15.2.33. Mitigation will be required to prevent degradation of the aquatic environment resulting from pollution/sedimentation. This should be achieved through implementation of standard pollution prevention measures as described within Section 15.3.3 onwards, the success of these measures will be captured through ongoing water quality monitoring (as described within the Water Resources Management Plan - WRMP in Chapter 23).

15.2.34. Furthermore, net gains for this species will be secured through Project commitments to improve water quality by removing existing sources of pollution/sedimentation around the Project. This will be discussed and agreed with the Ministry of Environmental and Physical Planning (MOEPP), who are responsible for water management consent, and also with relevant local landowners and stakeholders and will form a commitment within the ESMP, as part of the Land Restoration Plan.

15.2.35. As set out in the ESMP, general animal welfare good practice will be applied and delivered by the Project Ecological Clerk of Works. This will include measures such as pre-construction checks and destructive searches to minimise risks of animal mortality during construction. The ECoW will also deliver Toolbox Talks (TBT) to Project contractors to communicate good ecological practice (e.g. such as securing works areas, covering excavations, preventing access to non-works areas, etc.).

Residual Effects

15.2.36. With the application of the above mitigation, impacts to the Zajaska river PBF will be **neutral (not Significant)**. Should ongoing pollution/litter management be secured then there is an opportunity for **slight positive** effects to be realised.

Disturbance Due to Construction Activities

Description

15.2.37. The construction activities will have negative effects on both plant and animal species and communities (not including birds or PBF-triggers, which are covered separately above), especially as a result of noise, vibration and pollution. The sensitivity of these species is considered to below.

Magnitude and Severity of Impacts

Table 15-12 - Magnitude of the Impact – Indirect construction effects

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterization of Impact	Negative	Not desirable
Type of Impact	Direct	Noise, vibration and dust caused by construction activities.
Reversibility	Reversible	The effects will likely stop when construction stops.
Geographic Extent	Local	Limited to the construction site
Time when the impact occurs	Immediate	As soon as construction works begin.
Duration	Short-term	Likely to end once construction activities stop.
Likelihood of appearance	Likely	The works will likely affect nearby plant and animal populations.
Magnitude	Moderate	

Significance of Effects

15.2.38. The sensitivity of the receptor is considered to be low and the magnitude of the impact is moderate. The significance of the effect, without mitigation measures is ***Slight adverse (significant).***

Mitigation

15.2.39. Construction best practice will be applied as set out in the ESMP. This includes measures to prevent/minimise pollution, dust and noise impacts during construction.

Residual Effects

15.2.40. With the implementation of the above mitigation the residual effects to general flora and fauna will be **neutral (not Significant)**.

OPERATIONAL PHASE

Habitat Fragmentation

Description

15.2.41. The cleared land strip along the Project will be permanently occupied by the carriageway and the associated structures. This will cause the fragmentation of habitats, this is, their division into a number of discrete parts. Over time, the populations can become divided into a number of subpopulations, and if they are too small, they may be prone to local extinction. Also, fragmentation of habitats can lead to a reduction in genetic diversity within populations at both sides of the Project, which can also make the populations more susceptible to extinction.

Magnitude and Severity of Impacts

15.2.42. The magnitude of this impact has been evaluated in a qualitative manner, taking into account the types and sensitivities of the habitats that will be separated by the Project, as well as the species that will have to cross the Project.

15.2.43. Thus, the impact due to fragmentation will be generally more important in those areas where very high/high sensitivity habitats are located at both sides of the Project alignment. Fragmentation impacts will also occur in medium and low sensitivity habitats.

15.2.44. The impact magnitude has been considered within the context of the habitat EAAAs. None of the habitats will be fragmented to the extent that the viability of the habitat within its EAAA will be compromised. The smallest ‘fragments’ of habitat that will remain will be riparian woodland between Rashtani and Kichevo (at the Bridge No.2 river crossing).

15.2.45. The areas where fragmentation of habitats can occur and where sensitive habitats are present is shown in Table 15-13.

Table 15-13 - Assessment of the Magnitude of Fragmentation

Section	Habitat Types	Sensitivity	Magnitude of Fragmentation
Chelopeci-Dolno Strogomishte	Degraded (burnt) oak an pine forest, agricultural fields and willow and poplar belts. Black alder woodland.	Ls, hs and vhs	Minor
Dolno Strogomishte-Kolibari	Italian and Turkey oak forests and meadows	Ms and hs	Minor
Kolibari - Crvica	Agricultural fields and degraded oak forest	ls and hs	Negligible
Crvica - Rashtani	Agricultural fields, degraded oak forest and black alder woodland	Ls, hs and vhs	Minor
Rashtani-Kichevo	Degraded oak forest and willow and poplar belts. Black alder woodand.	Ls, hs and vhs	Minor

15.2.46. The magnitude of the impact on habitat fragmentation is moderate, as shown in Table 15-14.

Table 15-14 - Magnitude of the Impact – Habitat Fragmentation

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable
Type of Impact	Direct	The fragmentation effect arises from the physical presence of the Project together with the barrier effect and potential for collision mortality resulting from the operational Project.
Reversibility	Irreversible	Once the fragmentation effects commence, it may be difficult to revert them. The Project will be present in perpetuity.
Geographic Extent	Local	Some species of fauna present in the highly and moderately sensitive habitats will face difficulty to migrate due to the barrier effect of the Project.
Time when the impact occurs	Delayed	The effects of fragmentation will take a time (years) to be observable.
Duration	Long term	The fragmentation effect will continue throughout the operational life of the Project.
Likelihood of appearance	Probable	The Project has three bridges, two viaducts and a number of culverts that attenuate the fragmentation effects, but it would be expected to occur at least in some areas of the alignment and with some species.
Magnitude	**Up to Minor**	See above

Significance of Effects

15.2.48. The sensitivity of the receptor is up to high, and the magnitude of the impact is up to minor, mainly due to the limited impact to CH woodland. According to the significance matrix, the initial significance of this effect, without mitigation measures, is **Slight adverse (not Significant)**.

Mitigation

15.2.49. The comprehensive replanting programme described in ESMP (Chapter 23) will also serve to mitigate operational impacts, given the measures it includes to ensure a Net Gain of riparian alder woodland and No Net Loss of PBF in accordance with EBRD PR6.

Residual Effects

15.2.50. With the implementation of mitigation measures in Section 15.3, including monitoring of the measures, this will reduce the effect that is **neutral** and remains **not Significant** (Section 15.4 and 15.5).

Breeding Cycle Interruption

15.2.51. No significant effects on flora are expected during the operational phase.

15.2.52. Similar to the habitat fragmentation considered above, there will be an impact to fauna associated with the operational Project whereby the road presents a barrier effect to fauna that ultimately fragments their range within their EAAAs and also poses a collision mortality risk to animals attempting to cross the road. The only notable species in this case is the fire-bellied toad that was recorded within riparian woodland and whose EAAAs extend across contiguous riparian woodland crossed by the Project.

15.2.53. Given the extent of suitable habitat across the riparian woodland EAAAs outwith the Project footprint, together with the likely small range of fire-bellied toad individuals, the magnitude of impact here is considered to be **minor** on the basis that the road could feasibly be located on a route used by resident toads for local movement (i.e. to/from breeding ponds). This would then impact likely result in mortality of frogs within the vicinity of the Project footprint. The resulting effect would be **Slight adverse (not Significant)**.

Mitigation

15.2.54. A comprehensive mitigation strategy (including of placing culverts to maintain connectivity for wildlife, in particular fire-bellied toad) as set out in Chapter 23: Environmental and Social Management Plan, is required to contribute towards ensuring *No Net Loss* of PBF in accordance with EBRD PR6 and the EU Habitats Directive. As a minimum, these culverts should be installed within road sections located within riparian woodland habitat at a frequency of 100m. Exact locations will be detailed at the detailed design stage.

Residual Effects

15.2.55. With the implementation of mitigation measures in Section 15.3, including monitoring of the measures, this will reduce the effect to a level that is **neutral** and remains **not Significant** (Section 15.4 and 15.5).

IMPACTS ON PROTECTED AND DESIGNATED AREAS

15.2.56. There are no protected or designated areas, including critical habitat, located within the Project corridor. This applies to already declared protected areas, as well as Emerald sites (EU legislation) and areas without legal status (IBAs, IPAs and proposed or designated areas for species management). No significant effects on protected or designated areas are expected.

IMPACTS ON BIO-CORRIDORS

15.2.57. The Project does not intersect within any of the bio-corridors as the nearest bio-corridor Bukovik (Kolari) bottleneck Straza–Kolari is more than 5 km away from the Project, so no significant effects in bio-corridors are expected.

SUMMARY OF EFFECTS ON BIODIVERSITY

- Construction phase
  - Habitats loss (direct destruction) - Moderate adverse (significant)
  - Breeding cycle interruption – Slight adverse (significant)
  - Alteration, disruption or destruction of amphibian and fish habitats – **Major adverse (significant)**
  - Disturbance due to construction activities – **Slight adverse (significant)**
- Operational phase
  - Habitats fragmentation – Slight adverse (significant)
  - Impacts on Protected and Designated Areas **– Neutral (not significant)**
  - Impacts on Bio-corridors – Neutral (not significant)
  - Breeding cycle interruption - **Neutral (not significant)**

15.3 MITIGATION

SUMMARY

15.3.1. Mitigation measures have been described within the assessment sections above, specific to each impact identified and further details are provided within this section where considered relevant. These measures will be delivered in accordance with the ESMP (Chapter 23), which includes the provision of a BMP. This will describe the detailed measures to be taken to minimise impacts throughout the lifetime of the Project and will be produced (and approved/adopted) in advance of any construction activities. The BMP will provide sufficient detail such that mitigation measures are clear and deliverable and a monitoring programme that can report back on the efficacy of measures described. Finally, the BMP will be required to include mechanisms for adaptive management such that mitigation can be tweaked to achieve the desired results if it is demonstrated that it is not effective at any point.

PRE-CONSTRUCTION PHASE

15.3.2. Pre-construction walkover surveys should be undertaken to update findings from this study and corroborate the outcome of this assessment. In particular this should focus on areas of greatest perceived sensitivity to construction impacts such as nesting birds, roosting bats, amphibian hibernacula, etc. Pre-construction survey requirements will be detailed within the BMP. These surveys should be undertaken sufficiently in advance of construction such that findings can be incorporated in to design, construction methods and programme where possible (e.g. six months).

15.3.3. The design of the bridges, the tunnel and box and pipe culverts will be designed to provide connectivity of habitats and will not create obstacles for migration of animal species and fish.

15.3.4. The bridges design: will avoid loss or damage of plants, animals and their habitats; will not create a barrier to the movement of fish and other wildlife; will not prevent sediment and woody debris being moved downstream; will not prevent natural river movement; will not increase flood risk. Box and pipe culverts will:

- Be adapted to facilitate the passage of small animals.
- Be embedded into the streambed to at least 20% of the culvert height at the downstream invert.
- Be used only on "flat" streambeds (slopes no steeper than 3%).
- Have openings with at least 1.25 times the width of the stream channel bed. This width is measured bank to bank at the ordinary high-water level or edges of terrestrial, rooted vegetation.
- Ensure that water depths and velocities at low flows, are the same as they are in natural areas upstream and downstream of the crossing.
- Use natural substrate within the crossing, matching the upstream and downstream substrates; the substrate should resist displacement during floods and should be designed so that appropriate material is maintained during normal flows.

15.3.5. As outlined in Chapter 23: Environmental and Social Management Plan prior to the start of construction, the PESR/ specialist employed by PESR will prepare a **Woodland Clearance Plan** and **Land Restoration Plan** for implementation during construction. The delivery of replacement woodland will align with the mitigation requirements for the natural woodland being lost (i.e. riparian woodland and oak forests) to ensure No Net Loss for these habitats. The specifics of replacement planting will depend on land ownership. State owned woodland will involve financial compensation to the Public Enterprise for National Forests for: reforestation, loss of timber, reproduction and disturbance of their forest system, and they will be responsible for the habitat replacement. Loss of privately held woodland will involve financial compensation to the owners, but the owners are not asked to provide habitat replacement. In this situation habitat replacement will be provided as part of the detailed design and will be provided as close as feasibly possible to where it is lost.

15.3.6. The Woodland Clearance Plan will include the following specifications:

- The roles and responsibilities of those working on site, including the supervising ecologist and contractors clearing vegetation.
- A map showing the extent of the woodland loss, including access routes, compounds and locations for the storage of equipment and plant.
- A prescribed working corridor through the use of, where practicable, temporary barriers to minimise the damage to habitats and potential direct mortality and disturbance to animals located within and adjacent to the Project corridor.
- For trees to be retained during the construction works, Root Protection Areas (RPA) will be mapped, and protective fencing will be erected around the RPA to reduce risks associated with vehicles trafficking over roots system or beneath canopies and to prevent soil compaction.

- Selective removal of lower branches of trees will be conducted to reduce risk of damage by construction plant and vehicles.
- Vegetation buffer strips (where practicable) will be maintained to protect retained trees.
- Any tree felling will be carried out by experienced contractors.
- Where loss of trees is unavoidable, the trees will be soft-felled, and sections placed within retained habitats to provide a continued deadwood resource
- Planting will be undertaken to replace any trees that were intended to be retained which are felled or die as a result of construction works.
- Vegetation clearance will be conducted outside of the breeding bird season to avoid impacts to these species.
- Trenches, holes and pits will be kept covered at night or a means of escape for mammals that may become entrapped will be provided, such as earth ramps. Gates to compound areas will be designed to prevent mammals from gaining access and will be closed at night.

15.3.7. The **Land Restoration Plan** will specify the type of species and specific location for replacement (following the locations confirmed within this chapter – see Figure 15-9). This includes at least like for like replacement habitat for the woodland loss predicted (excluding planted coniferous woodland). This will feed into the detailed design for the Project, which in turn will inform the Tender Specifications for the Contractor and the Bill of Quantities. The detailed designs for the Project will include sufficient landscaping to replace CH habitats lost at a ratio of 2:1. The **Land Restoration Plan** will incorporate a species assemblage reflective of those PBF/CH being lost.

15.3.8. All woodland replacement will be detailed within the project BMP along with ongoing monitoring and management plans for this mitigation. The BMP will also include a mechanism for adaptive management to ensure long-term viability of this mitigation.

CONSTRUCTION PHASE

15.3.9. As outlined in Chapter 23: Environmental and Social Management Plan prior to the start of construction, the Contractor will elaborate the **Biodiversity Management Plan** (BMP). The **Biodiversity Management Plan** will specify the surveys required to inform the construction programme.

15.3.10. An ECoW will be engaged to support delivery of mitigation measures at the Project site during construction. This role will vary depending upon ongoing Project requirements but will include as a minimum the following measures:

- Pre-construction checks (including nesting bird checks);
- Identification and maintenance of exclusion zones around ecological sensitivities;
- Delivery of TBT to contractors;
- Regular (monthly to begin with but at a frequency deemed appropriate by the ECoW) audits of construction activities to ensure compliance with ecological mitigation/commitments.

15.3.11. A detailed **Water Resources Management Plan (WRMP)** (see Chapter 23 – ESMP) will be produced and approved in advance of construction activities and implemented throughout the construction phase. The WRMP will detail the measures required to minimise the risk of any pollution incidents to an acceptable level and will cover direct sources (e.g. such as run off) and indirect sources (e.g. as a result of soil erosion). The WRMP will include (but will not be limited to the following):

- Controlling water movement through/off the site through appropriate drainage plan (i.e. to include diversion ditches, cut-off drains, etc.).
- Maintaining an adequate buffer distance of works from watercourses and drainage paths.
- Securing high-risk areas/features (e.g. refuelling areas, chemical storage, stockpiles, etc.).
- Minimising run-off of contaminated water.
- Diverting run off from exposed soils.
- Minimising erosion of exposed soils through vegetation retention or temporary protection measures.
- Preventing polluted water from leaving the site.

15.3.12. Access will be prohibited to all sensitive habitat areas, except where it is necessary to construct the Project. Good construction controls, including measures to reduce noise, vibration, dust and effluent/ water with high levels of sediment, will be part of the ESMP which the contractor will implement. The BMP will define times for specific tasks (i.e. tree clearance outside breeding season).

15.3.13. Due to the presence of suitable habitat for breeding birds, reptiles and amphibians within and directly adjacent to the Site, a Precautionary Method of Works (PMoW) will be prepared for these species respectively by a suitably experienced ecologist. The PMoWs will contain the following specifications to enable vegetation clearance to be undertaken in a sensitive manner:

- Vegetation clearance will be undertaken under the supervision of an experienced ecologist.
- The supervising ecologist will provide a Toolbox talk to contractors working on site, to explain the ecological sensitivities present and working methods to be used to protect these.
- The timings of work to avoid the breeding bird season.
- Specification on the machinery to be used to clear vegetation.
- The location of features on site which may be used by reptiles and amphibians, which should be retained where possible, for example hibernacula, ponds or basking locations. This will include methods for protecting these features during construction works including fencing off of these. The procedure for when a breeding bird, reptile or amphibian is discovered during construction works.

15.3.14. The **Land Restoration Plan** will require the like-for-like replacement of any vegetation damaged during construction (i.e. land that will not form part of the final Project, such as construction camps). It will be the Contractor's responsibility to restore all land used during construction to its original condition.

15.3.15. The riparian vegetation around the bridge areas will be restored and vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings.

15.3.16. All areas necessary for construction, but not required for the operational phase of the road, will be rehabilitated, such as areas disturbed by construction of the bridges and the tunnel. As outlined in Chapter 23: Environmental and Social Management Plan rehabilitation will aim to re-establish the original regional ecosystems present prior to disturbance and will be staged where necessary.

15.3.17. The mitigation measures to minimise the effect of fragmentation mainly consist of the establishment of enough wildlife crossings to increase the permeability of the Project alignment as follows:

- Afforestation activities to be performed in line with the No net loss principle, i.e. preparation of Land Restoration Plan. Riparian vegetation along the streams of Zajaska Reka, Strogomishka Reka, Sushica and Rechishte to be restored to achieve No Net Loss. The Detailed Design will include sufficient land for revegetation at a minimum of 2:1 revegetation ratio (for example for 3.97 ha of riparian black alder belts and woodland will be lost which will have to be replaced by 7.94 ha of the same species). This includes Priority Biodiversity Feature species.
- The undersides of bridges will be vegetated to create vegetal screens that hide the bridges structure (e.g. shrubs and small trees in the area of the abutments).
- Fenced areas will be vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wild life crossings.

15.3.18. As outlined in Chapter 23: Environmental and Social Management Plan the **Land Restoration Plan** will incorporate a wide variety of species typical of the regional ecosystem. The species composition for rehabilitation will depend on the type of ecosystem in question. The PESR will appoint individuals or companies, prior to the completion of the Detailed Design, to calculate the habitat replacement requirements (areas, species and locations) to inform the **Land Restoration Plan**. There will be no net loss of Priority Habitat Features.

OPERATIONAL PHASE

15.3.19. As outlined in Chapter 23: Environmental and Social Management Plan, an **Operational Biodiversity Management Plan** will be prepared and implemented. It will include measures such as regular control and maintenance of drainage structures. Regular maintenance activities will also include: protective fence maintenance, removal of food, waste, animal carcasses from roads in order to reduce the attraction of scavengers.

15.4 MITIGATION MEASURES FOR PROTECTED AND DESIGNATED AREAS

15.4.1. The Project will not result in adverse effects on any protected or designated area. Therefore, no mitigation measures are planned.

15.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Loss of Habitats

15.5.1. Prior to mitigation, a slight to moderate adverse effect is expected due to the medium to very high sensitivity of the receptor and minor magnitude of impact. As outlined in Chapter 23: ESMP, the Biodiversity Management Plan will be implemented as mitigation which will ensure at no net loss of PBF and a net gain for CH. The magnitude of the impact following the implementation of the proposed mitigation measures is anticipated to reduce the potential impact. Therefore, the significance of the residual effect due to loss of habitats is considered to be **neutral adverse to slight positive (not significant)**.

Breeding Cycle Interruption

15.5.2. Prior to mitigation, a slight adverse effect is expected due to the low sensitivity receptor and moderate magnitude. The Biodiversity Management Plan will be implemented as mitigation. The magnitude of the impact with the implementation of mitigation measures is expected to be reduced. Therefore, the significance of the residual effect is considered to be **neutral (not significant)**.

Alteration, disruption or destruction of amphibian and fish habitats

15.5.3. Prior to mitigation, a major adverse effect is anticipated due to the high sensitivity of the receptor and the moderate impact. The Biodiversity Management Plan will be implemented as mitigation to ensure no net loss to Macedonian trout (as PBF trigger for the Zajaska river EAAA). The magnitude of the impact with the implementation of mitigation measures is expected to be reduced. Therefore, the significance of the residual effect is considered to be **neutral (not significant)**.

Disturbance Due to Construction Activities

15.5.4. Prior to mitigation, a slight adverse effect is expected due to the medium sensitivity of the receptor and the moderate impact. The Biodiversity Management Plan will be implemented as mitigation. The magnitude of the impact with the implementation of mitigation measures is expected to be reduced. Therefore, the significance of the residual effect is considered to be **neutral (not significant)**.

OPERATIONAL PHASE

Habitats Fragmentation

15.5.5. Prior to mitigation, a slight adverse effect is anticipated as a comprehensive biodiversity strategy in the form of a Land Restoration Plan will be in place and will feed into the detailed design of the Project. The detailed design will include habitat replacement at a ratio of 2:1 (two replaced for everyone lost).

15.5.6. An Operational Maintenance Plan will be implemented. The magnitude of the impact with the implementation of mitigation measures is expected to be reduced. Therefore, the significance of the residual effect is considered to be **neutral (not significant)**.

CUMULATIVE EFFECTS

15.5.7. As detailed in Chapter 21 – Cumulative Effects, the cumulative effects of the pipeline development, National Gasification System: Section 5, that runs alongside the Project for approximately 400 m have been assessed. Given the limited nature of residual impacts predicted for the Project together with the close proximity of the two projects (i.e. assumed to be within the same construction footprint), the cumulative effects are predicted to be **Slight** and **Not Significant**.

15.6 SUMMARY

Table 15-15 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Biodiversity	Construction	Loss of Habitats	Moderate adverse	Biodiversity Management Plan (BMP) Including: Woodland Clearance Plan Land Restoration Plan (including replanting to achieve no net loss/net gain as required)	Neutral – Slight positive
		Breeding cycle interruption	Slight adverse		Neutral
		Alteration, disruption or destruction of amphibian and fish habitats	Up to Major adverse		Neutral
		Disturbance due to construction activities	Slight adverse		Neutral
	Operation	Loss of Habitats	Slight adverse	Detailed design. Regular maintenance activities, as set out in the Operational Maintenance Plan	Neutral
		Protected and Designated Areas	Neutral	No specific mitigation required	Neutral
		Bio-corridors	Neutral		Neutral

16 LANDSCAPE AND VISUAL

16.1 BASELINE CONDITIONS

16.1.1. The baseline data has been obtained through a combination of observations during a site visit, and the desk-based review of third-party information.

LANDSCAPE

Surrounding Landscape

16.1.2. The Project is located within an area of mountainous / hilly terrain. The landscape surrounding the Project consists of:

- Agricultural land;
- Woodland (both degraded and mature forests);
- Areas of residential dwellings, predominately located to the south and north of the Project (Kichevo and Zajas, respectively);
- Sections of existing road and the railway line;
- A number of cemeteries; and
- A number of rivers and streams, inclusive of Rivers Zajaska, Sushica, Rechishte and Strogomishka.

16.1.3. The primary landscapes are agricultural land and woodland. The locations of these landscape are identified in Figure 16-1.

16.1.4. A summary of the surrounding landscapes by distance along the Project alignment are show in Table 16-1. Figure 2-1, presented within Chapter 2, depicts the chainage locations.

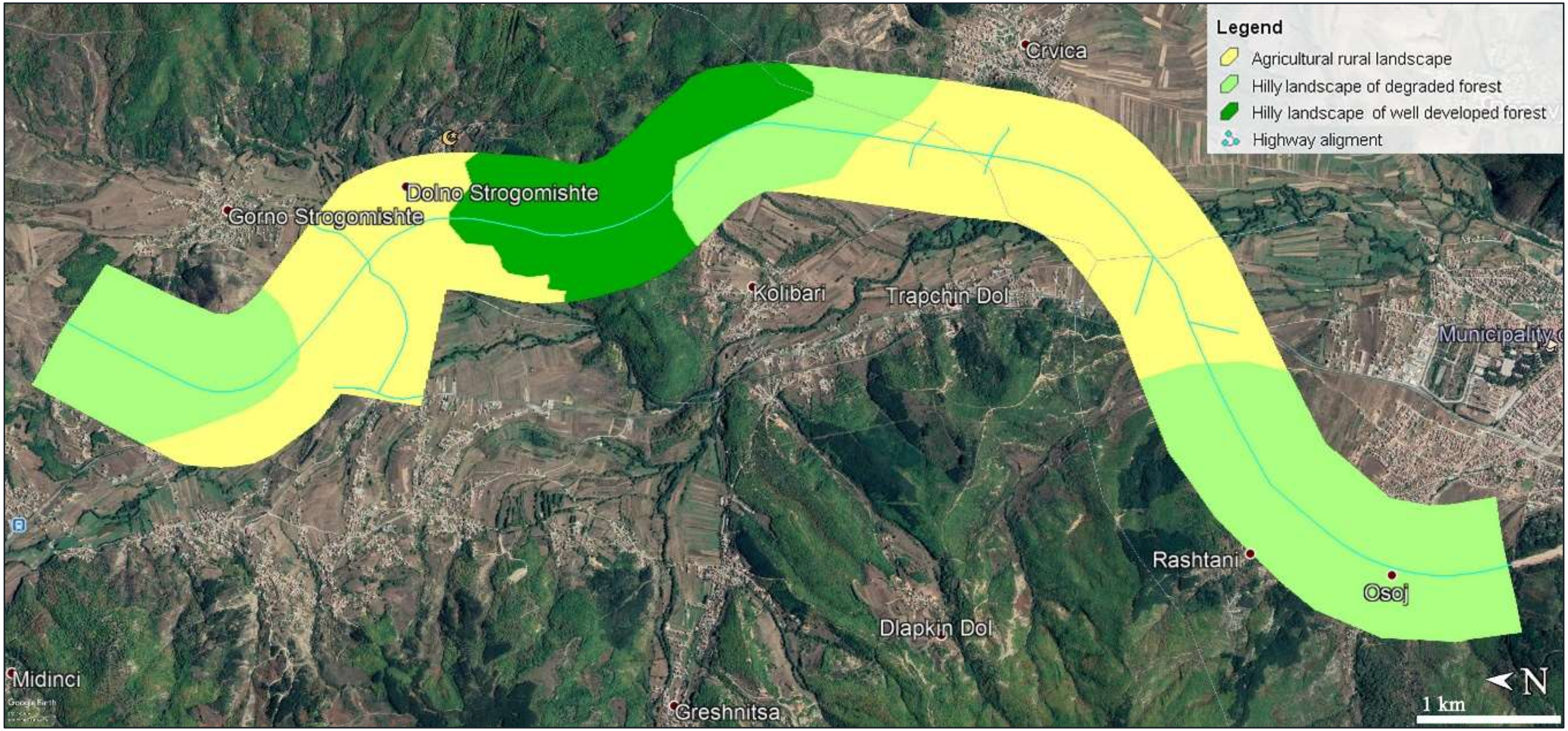

Figure 16-1 - Project Alignment Primary Landscapes

Table 16-1 - Project Alignment Landscape Descriptions

Chainage	Altitude	Summary of Terrain	Summary of Landscape	Description
Ch 02+000 m – 03+300 km[99] (Please note: The Project starts at Ch 02+000m)	710 – 730 MASL	Flat Terrain	▪ Agricultural land.	Agricultural land interspersed with lines of alder and willow trees. The trees provide shelter for livestock, reduce the potential for soil erosion and create a habitat for pollinators.
Ch 03+300 – 05+000 km	730 – 900 MASL	Hilly Terrain	▪ Woodland (mature forests).	Woodland consisting of mature forests. The forests largely consist of oak and pine trees. The Kolibari tunnel is located between Ch 04+116 to 04+ 847 km.
Ch 05+000 – 06+600 km	650 – 760 MASL	Hilly Terrain	▪ Agricultural land; and ▪ Woodland (degraded forests).	Small areas of agricultural land combined with woodland areas of degraded oak and pine trees.
Ch 06+600 – 10+000 km	640 – 660 MASL	Flat Terrain	▪ Agricultural land; ▪ Woodland (degraded forests); and ▪ Woodland (mature forests).	Agricultural land combined with woodland areas of degraded oak and pine trees. Mature riparian woodland of black alder and oak trees surrounding the rivers and streams.
Ch 10+000 – 12+700 km	640 – 780 MASL	Hilly Terrain	▪ Agricultural land; and ▪ Urban areas.	Agricultural land interspersed with lines of willow trees. Increased density of urban areas in the vicinity of City of Kichevo which largely consists of residential dwellings.

[99] See Chapter 2 – Description of the Project. The Project starts at approximately Ch 02+000 m, due to the removal of the first section from the Project

16.1.5. A detailed description of each of the landscapes is provided below.

Agricultural Land

16.1.6. The agricultural land consists of arable and grazing fields interspersed with lines of trees and riparian mature woodlands. The lines of trees around the fields provide shelter for livestock, reduce the potential for soil erosion and create a habitat for pollinators. Periodically the crop fields are left fallow (without a crop) for a growing season to increase crop yields for future seasons.

16.1.7. Rural settlements, existing roads, the railway line and rivers and streams are also present amongst the agricultural land. The rural settlements include: Bukojchani, Gorno Strogomishte, Dolno Strogomishte, Oslomej, Osoj, Trapchin Dol, Rashtani, Crvivci, Kolibari, and Zajas. The existing roads include the A2 state road (part of the European E-65 Corridor – Corridor VIII), the P1303 regional road, the P1305 regional road and the R2246 regional road, together with smaller access roads to the rural settlements and agricultural land. The railway line connects Kichevo to Gostivar and has a series of bridges and unofficial surface crossings in the vicinity of the Project alignment.

16.1.8. An example image of the agricultural land interspersed with other landscape features, as viewed from the Project alignment, is shown in Figure 16-2

Figure 16-2 - Example Agricultural Landscape

Woodland – Degraded Forest

16.1.9. This landscape is a common feature of the hilly terrain and has semi-natural and natural features. This landscape is largely present at three sections along the Project alignment:

- In the vicinity the villages Rashtani and Osoj towards the southern end of the Project alignment;
- Between the villages of Kolibari and Crvivci in the centre of the Project alignment; and
- Between the villages of Crvivci and Gorno Strogomishte to the east of the Project alignment (Figure 16-3).

16.1.10. The degraded forests largely consist of oak and pine. The degraded forests include patches of grasslands and in some instances man-made features such as small agricultural buildings.

16.1.11. Despite the fact that forests are degraded, the connectivity in the landscape is high due to the absence of large structures or large natural landscape features.

16.1.12. An example image of the degraded forest surrounded by agricultural land, as viewed from the Project alignment, is shown in Figure 16-3.

Figure 16-3 - Example Degraded Forest Landscape

Woodland – Mature Forest

16.1.13. This landscape is a common feature of the hilly terrain. This landscape feature is largely present in the central section of the Project alignment.

16.1.14. The mature forests largely consist of oak trees with occasional pine trees. These forests are surrounded by agricultural land and degraded forests.

16.1.15. The connectivity in the landscape is high due to the absence of large structures or large natural landscape features.

16.1.16. An example image of a mature forest surrounded by agricultural land, as viewed from the Project alignment, is shown in Figure 16-4.

Figure 16-4 - Example Mature Forest Landscape

Landscape Sensitivity

16.1.17. The sensitivity of each of the landscapes is based upon the visual quality and fragility of each landscape (agricultural land, woodland (degraded forest) and woodland (mature forest)).

16.1.18. A score is assigned to the visual quality of each landscape in the following manner:

- The lowest value judgments are attributed to the areas where the elements have grown in a disordered manner, with spontaneous vegetation inconsistent with the natural vegetation, as well as with presence of anthropogenic features (rural settlements, existing roads and the railway line);
- Higher value judgements are assigned to areas with well organised elements (rural agricultural land) or those with tendency to naturalness (hilly terrains of woodland (both degraded and mature forests)); and
- The aesthetic experience of users of the landscape and their overall visual impression is also taken into account: positive aesthetic experience is expected when the views extend from the user's location to the natural and semi-natural landscapes.

16.1.19. Fragility is associated with their susceptibility to the Project in the baseline pattern of the landscapes. The most fragile landscapes along the Project are likely to be those where the Project alignment passes through the hilly terrain, due to the need for features such as embankments, bridges and viaducts.

16.1.20. In developing the score to be assigned to each landscape, visual quality and fragility have been evaluated separately using the following scoring scale:

- Negligible (1)
- Low (2)
- Medium (3)
- High (4)
- Very high (5)

16.1.21. The scoring of sensitivity has been developed in line with best practice guidance and professional judgement. The sensitivity assigned to the landscapes is presented in Table 16-2.

Table 16-2 - Sensitivity of Landscapes

Landscape	Visual Quality	Fragility	Total Score	Sensitivity
Agricultural Land	1	2	3	Negligible
Woodland – Degraded Forest	2	3	5	Low
Woodland – Mature Forest	3	4	7	Medium

16.1.22. To summarise:

- The woodlands have greater value compared to the anthropogenic agricultural landscape; and
- The mature forests have a greater value than both the agricultural land and the degraded forests due to the greater visual quality and fragility.

Visual

16.1.23. Visual receptors are considered by the extent to which the Project may be visible. By definition, visual impacts and effects can only occur where at least part of the Project alignment is visible from the receptor, herein referred to as viewpoints.

16.1.24. In order to identify the visual receptors a 2 km study area surrounding the Project alignment has been used. The study area is based on professional judgement, experience of similar project and the observations during the site visit; whereby impacts and effects typically decrease with distance from the Project.

Visual Receptors

16.1.25. The key groups of visual receptors identified include:

- Residential receptors:

- Residents on the north western and western extents of Osoj;
- Residents on the eastern and south eastern edge of Trapchin;
- Residents on the north eastern edge of Kolibari;
- Residents on the western periphery of Crvica;
- Residents on the western periphery of Dolno Strogomishte;
- Residents on the western and southern edges of Gorno Strogomishte;
- Residents living in the settlements along the A2 state road, part of the European Corridor VIII, with north and eastern facing views; and
- Isolated farms and farmsteads along the route corridor within 500 m.

▪ Commercial receptors, recreational receptors and visitors to places of worship:

- People visiting the small cemetery and mosque on the south western approach to Crvica;
- People visiting the cemetery to the west of Dolno Strogomishte;
- Commercial receptors within 500m (such as the petrol station adjacent to the A2 state road); and
- People visiting the Albanian Mother Memorial in Zajas.

▪ Transport receptors, including:

- Users of the A2 state road;
- Users of existing roads and trails along the route corridor within 500 m; and
- People travelling along the Kichevo to Gostivar railway line.

16.1.26. To illustrate the typical views from these groups of receptors, a series of representative viewpoints have been identified, and photographs from these viewpoint locations collected. Representative viewpoints illustrate a typical view from an identified receptor or group of receptors to illustrate potential changes to their visual amenity as a result of the Project.

16.1.27. The locations of the key visual receptors and representative viewpoints are marked on Figure 16-5.

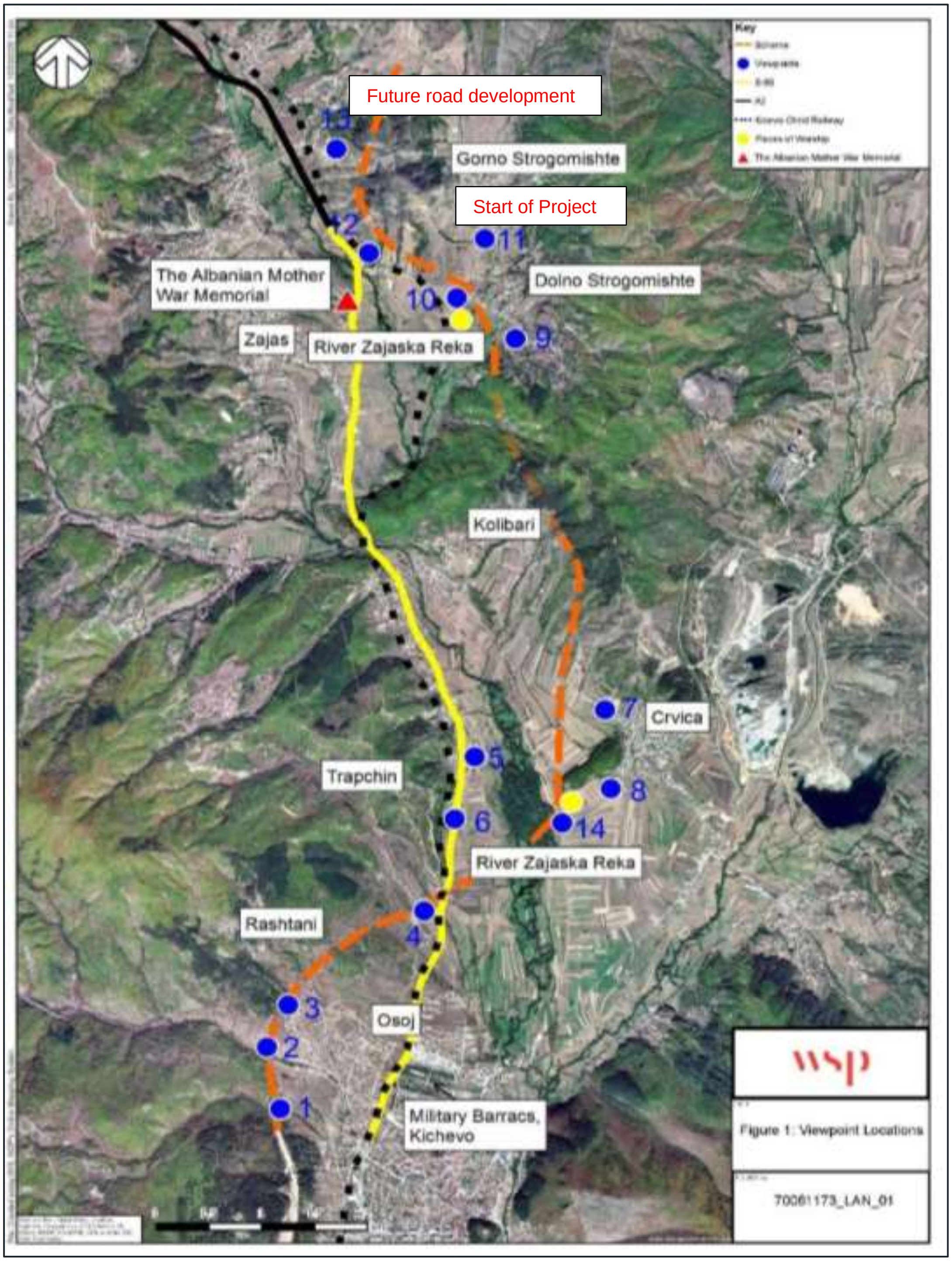

Figure 16-5 - Viewpoint Locations

16.1.28. The following baseline section describes the typical visual amenity of identified receptors and groups of receptors along the Project alignment, and the representative viewpoints.

Residential Receptors

16.1.29. Figure 16-6 illustrates views from the south east, typically from isolated farms and farmsteads, which are largely filtered by intervening vegetation within the foreground and middle distance. The representative view shown in Figure 16-6 shows how the view is channelled along the access track due to framing created by vegetation.

Figure 16-6 - Viewpoint 1: Looking North West from Farm Access Track

16.1.30. Residential dwellings within the western extents of Osoj will have direct and oblique (partial) views of the Project within the foreground and middle distance of eastern facing views. Views are available across the site (open scrub and littered area) towards the adjacent residential dwellings and the wider mountain range beyond, as shown on Figure 16-7.

Figure 16-7 - Viewpoint 2: Looking North from Road Heading West from Osoj

16.1.31. Residential dwellings with western facing views will experience views of the Project. The majority of these views will be limited to the middle ground and background and will be heavily filtered by vegetation. At limited locations on the outskirts of Osoj, direct, close-range views of the Project will be available, as shown on Figure 16-8.

Figure 16-8 - Viewpoint 3: Looking North East from the North Western Edge of Osoj

16.1.32. New build residential dwellings with north eastern facing views will experience clear and direct close-range views of the Project, as shown in Figure 16-9.

Figure 16-9 - Viewpoint 4: Looking North East from Near New Build Residential Dwellings

16.1.33. In the settlement of Trapchin, views towards the east and south east will experience views of the Project, where gaps in intervening riparian vegetation and built form allow, as shown in Figure 16-10.

Figure 16-10 - Viewpoint 5: Looking East from Trapchin

16.1.34. Residents living in dwellings along the eastern and south eastern edge of Trapchin will experience views of the Project. Views towards the Project will be available amongst the wide-open views of the landscape as shown in Figure 16-11.

Figure 16-11 - Viewpoint 6: Looking East from the Petrol Station on the A2 State Road

16.1.35. Residents on north eastern edge of Kolibari will experience views of the Project to the south west beyond the rooflines of adjacent residential dwellings and intervening vegetation.

16.1.36. Residents living in dwellings on the western edge of Crvica will experience views towards the Project. Views of the Project will be available in the middle distance beyond the open farmland and intervening vegetation, as shown in Figure 16-12 and Figure 16-13.

Figure 16-12 - Viewpoint 7: Looking North West from the North Western Edge of Crvica

Figure 16-13 - Viewpoint 8: Looking South West from South Western Edge of Crvica

16.1.37. Residents living in dwellings on the western edge of Dolno Strogomishte will experience views of the Project. Views of the Project will be available in the middle distance amongst the open landscape, as shown in Figure 16-14.

Figure 16-14 - Viewpoint 9: Looking North West from the Edge of Dolno Strogomishte

16.1.38. Residents living in dwellings along an unnamed road west of Dolno Strogomishte will experience views of the Project in proximity beyond the unnamed road and cemetery, as shown on Figure 16-15.

Figure 16-15 - Viewpoint 10: Looking North from Unnamed Road and Cemetery West of Dolno Strogomishte

16.1.39. Residents on the western edge of Gorno Strogomishte will experience views of the Project. The residents will experience views of the Project to the south west and west, depending on the orientation of their dwellings. A portion of the views will be obscured by the intervening ridgeline of the adjacent hill, as shown on Figure 16-16.

Figure 16-16 - Viewpoint 11: Looking West from Residential Dwellings in Gorno Strogomishte

16.1.40. Residents in dwellings north west of the Project near the A2 state road will experience views of the Project. The Project will be visible in the middle ground beyond intervening vegetation and below the crest of the hill, as shown in Figure 16-17. Similarly, further north, views towards the

Project will be available in the middle and long distance where the gaps in vegetation and ridgelines allow, as shown in Figure 16-18.

Figure 16-17 - Viewpoint 12: Looking North from a Rural Small Settlement off the A2 State Road

Figure 16-18 - Viewpoint 13: Looking East from a Rural Settlement off the A2 State Road

Commercial Receptors, Recreational Receptors and Visitors to Places of Worship

16.1.41. People visiting the cemetery and mosque on the south western approach to Crvica will experience views of the Project. Views of the Project will be largely obscured by the intervening woodland vegetation as shown in Figure 16-19.

Figure 16-19 - Viewpoint 14: Looking North West from Small Cemetery and Mosque in Crvica

16.1.42. Where the Project alignment crosses a viaduct, views would be available above the intervening vegetation. For example, views will be available at close proximity from the cemetery to the west of Dolno Strogomishte, as shown previously in Figure 16-15.

16.1.43. To the north west, views of the Project for people visiting the Albanian Mother Memorial are limited by the intervening topography and vegetation. Although they will have direct views of the works to the junction adjacent to the Memorial, and the new link road from the existing A2 state road, to the new A2 Motorway alignment.

16.1.44. There are a number of commercial receptors within 500 m, such as the petrol station located adjacent to the A2 state road, which will also experience views of the Project, as shown previously in Figure 16-11.

Transport Receptors

16.1.45. People travelling along the A2 state road will be travelling at speed and focussed on their route. Road users will experience glimpsed and fleeting views of the Project. Local road users of smaller tracks and roads are likely to be travelling at a lower speed towards local points of interest or residential dwellings, but views will remain glimpsed and fleeting.

16.1.46. People travelling along the Kichevo to Gostivar railway line will experience views of the Project. The railway runs parallel to the existing A2 state road. The railway line is largely on embankment surrounded by vegetation, where gaps in vegetation will enable view of the Project in the middle distance. Similarly, in winter filtered views of the Project will be available. At Ch 02+630m and 09+549.239m views of the Project will be available in close proximity, as part of the intersection crosses the railway at Ch 02+630m and the Project alignment crosses the railway at Ch 09+549.239m.

Receptor Sensitivity

16.1.47. The sensitivity of visual receptors is determined by combining judgements of their susceptibility to the type of change or development proposed and the value attached to the view, as set out below:

- Susceptibility to change refers to the activity of the receptor (people) and the extent to which their interest is focussed in the views and the visual amenity they experience; and
- Value attached to a view considers the value attached to the view for example: in relation to designation/ planning policy (Conservation Areas; national routes, designated routes/landscapes etc.); value of the view attached by visitors (tourist facilities, places in guidebooks etc.); or references in literature or art.

16.1.48. The following approach has been developed in line with best practice guidance.

Table 16-3 - Approach to the Sensitivity of Viewpoints

Sensitivity Factor	Characteristics		
	Low	Medium	High
Susceptibility	Attention is focused on the activity of the receptor and not on the wider views.	Residential / recreational views where views are not solely focussed on the landscape.	Residential / recreational views where views are focussed on the landscape.

Sensitivity Factor	Characteristics		
	Low	Medium	High
	Quick transient views such as from fast moving vehicles. Places of work where attention is not focussed on the landscape.	Users of pedestrian / recreational routes where the views are not solely focussed on the wider landscape (such as commuter routes). People playing or watching sports or formal recreation.	Users of Public Rights of Way, cycle routes, recreational routes (people using routes for leisure where views form part of the experience); Protected / recognised views.
Value	No designations present. Permissive routes not identified on maps.	Locally important views. Views from locally designated landscapes (Conservation Areas etc.) Views from local routes identified on maps	Recognised views identified by policy. Tourist destinations. Users of nationally recognised routes e.g. National Cycle Network Open Access Land.

Source: Adapted from Guidelines for Landscape and Visual Impact Assessment (GLVIA), 3rd Edition (2013).

16.1.49. The information collected and presented above has informed the sensitivity of the visual receptors, shown in Table 16-4. The value attached to all of the visual receptors, with the exception of the Albanian Mother Memorial, is low as there are no designated or locally recognised views present. The value of the Memorial is considered to be high as this is an asset that is regularly visited by Tourists.

Table 16-4 - Sensitivity of Viewpoints

Receptor	Representative Viewpoint	Sensitivity	Description
Residential Receptors			
Local farms and farmsteads.	1	High	Susceptibility is considered to be high as residents in this location will experience views in close proximity and middle distance beyond intervening vegetation.
Residents living in dwellings on the western outskirts of Osoj.	2 and 3	High	Susceptibility is considered to be high as a limited number of residents in this location will experience direct views in close proximity to the Project.

Receptor	Representative Viewpoint	Sensitivity	Description
Residents living in new build dwellings with north eastern facing views.	4	High	Susceptibility is considered to be high as residents in this location will experience clear, direct views in close proximity to the Project.
Residents living in dwellings on the eastern outskirts of Trapchin.	5 and 6	High	Susceptibility is considered to be high as some residents will experience wide open views of the Project in the middle distance.
Residents living in dwellings on the north eastern outskirts of Kolibari.	-	Medium	Susceptibility is considered to be medium as residents in this location will experience views within the middle ground and long distance only. The majority of views will be obscured by rooflines of intervening dwellings an intermittent vegetation.
Residents living in dwellings in the western outskirts of Crvica.	7 and 8	High	Susceptibility is considered to be high as some residents will experience wide open views of the Project in the middle distance.
Residents living in dwellings in the western outskirts of Dolno Strogomishte.	9	High	Susceptibility is considered to be high as a limited number of residents will experience wide open views of the Project in the middle distance.
Residents living in dwellings along an unnamed road west of Dolno Strogomishte.	10	High	Susceptibility is considered to be high as residents in this location will experience clear direct views in close proximity beyond the cemetery.
Residents living in the western outskirts of Gorno Strogomishte.	11	Medium	Susceptibility is considered to be medium as residents in this location will experience views within the middle distance and long distance only. The majority of views will be obscured by vegetation and the ridgeline of the adjacent hill.
Residents living in a rural settlement off the A2 state road.	12 and 13	Medium	Susceptibility is considered to be medium as residents in this location will experience views within the middle distance and long distance only. The majority of views will be obscured by vegetation and intervening ridgelines.
Commercial Receptors, Recreational Receptors and Visitors to Places of Worship			

Receptor	Representative Viewpoint	Sensitivity	Description
People visiting a cemetery and mosque near Crvica.	14	Medium	Susceptibility is considered to be medium as, whilst visitors will be concentrating their activities in the immediate landscape rather than the wider landscape, the tranquillity of the immediate area and visibility of surrounding countryside are important factors for those locations to allow some peace and contemplation.
People visiting the cemetery north of Kichevo	4	Medium	
People visiting a cemetery to the west of Dolno Strogomishte.	10	Medium	
People visiting the Albanian Mother Memorial.	-	High	Susceptibility is considered to be medium as, whilst visitors will be concentrating their activities in the immediate landscape rather than the wider landscape, the tranquillity of the immediate area and visibility of surrounding countryside are important factors for those locations to allow some peace and contemplation. The Albanian Mother Memorial is a tourist destination and therefore is considered to be of High sensitivity.
Commercial receptors within 500 m (such as the petrol station adjacent to the A2 state road)	-	Low	Susceptibility is considered to be low as workers / visitors to commercial premises are focused on the activity at hand and are generally indoor workers.
Transport Receptors			
People travelling along local roads.	-	Low	Susceptibility is considered to be low as road users will be travelling at speed and focussed on the road. Any views towards the Project would be glimpsed and fleeting.
People travelling along the Kichevo to Gostivar railway line.	-	Medium	Susceptibility is considered to be medium as railway users will be travelling at varying speeds, potentially for commuting but also potentially for tourism, with views across the surrounding countryside.

16.2 POTENTIAL IMPACTS AND EFFECTS

16.2.1. The temporal scope of this assessment is considered to be of medium-term duration for the construction phase (i.e. approximately 4 years) and long term for the operational phase (i.e. greater than 30 years duration).

CONSTRUCTION PHASE

Landscape

Description

16.2.2. There is the potential for alterations to the landscapes present due to the construction activities, the construction compounds and the construction workers' accommodation. Prior to the start of works, the location of any construction worker's accommodation will be determined by the Contractor (and approved by the PESR) following an Environmental and Social Screening as outlined in Chapter 23 – ESMP. This will ensure they are located away from environmental and social receptors including residential properties and environmentally sensitive areas.

16.2.3. The key construction activities which have the potential to effect the landscapes include:

- The presence of the Project as it is gradually constructed including;
  - Cuttings and embankments in the areas of mountainous / hilly terrain;
  - Interchanges at Dolno Strogomishte and Kichevo;
  - Bridges over the Zajaska River and the Sushica River;
  - Viaducts at Dolno Strogomishte, over the Kichevo railway line and A2 state road and the Stiborani ravine); and
  - The three disposal sites for the disposal of excavated material, at the northern end of the Project, to the south of the tunnel and to the west of Crvica.
- The presence of the workers, machinery and materials and waste movements along the Project alignment may impair the local landscape, especially for nearby residents;
- The presence of the construction compounds, used for vehicle and machinery storage and maintenance, some construction activities (such as concrete mixing) and the storage of construction materials, may contain tall and large features (such as cranes) which would impair the local landscape; and
- The presence of the construction workers' accommodation, where the structures for offices, toilets and accommodation will occupy previously vacant land. The construction workers' accommodation may be perceived as an impairment of the landscape.

Magnitude and Severity of Impacts

16.2.4. The description of the magnitude thresholds is provided in Table 16-5.

Table 16-5 - Magnitude of Impacts (Landscape)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	The alteration of the landscape occurs because of the presence of the construction activities.
Reversibility	Reversible	The alteration of the landscape be removed upon completion of the construction activities, removal of the construction compounds and removal of the construction workers' accommodation
Geographic Extent	Local	Limited to the Project alignment, construction compounds and construction workers' accommodation, but visible from the surrounding area.
Time when the Impact Occurs	Immediate	The alteration of the landscape upon commencement of the construction activities.
Duration	Medium-term	It will last the time for which the construction activities occur and / or the time for which the construction compounds and construction workers' accommodation are present, and the restoration period.
Likelihood of Appearance	Certain	The impact has a high likelihood of occurring.
Magnitude	Moderate	Moderate change in the landscape.

16.2.5. As described previously in Table 16-2 the value of the surrounding landscapes varies from **Low** (agricultural land), to **Low** (degraded forest) to **Medium** (mature forest).

16.2.6. The magnitude of the impact on the landscapes is anticipated to be **Moderate**, as the construction works will result in changes to these landscapes, including: vegetation clearance, earthworks, storage of materials, embankments and excavations, and site clearance to accommodate construction compounds and construction workers' accommodation.

Significance of Effects

16.2.7. Overall, it is considered that the potential for significant effects on the surrounding landscapes as a result of the construction phase of the Project is **Slight Adverse (not significant) to Moderate Adverse (significant),** without mitigation.

16.2.8. A Landscape and Visual Management Plan (as outlined in Chapter 23 – ESMP) will be implemented during the construction phase to manage effects on the landscape.

Visual

Description

16.2.9. There are the potential visual effects due to the construction activities, construction compounds and the construction workers' accommodation.

16.2.10. The key construction activities which have the potential to cause visual effects include:

- The active change underway as the Project progresses and the gradual emergence of the Project and associate landform;
- Changes to the visual amenity within the Project alignment and the immediate surroundings;
- Views of construction activities, including temporary materials storage, machinery and potentially tall temporary structures, such as cranes, impacting visual amenity;
- Changes in visual perception of the landscape due to noise, dust and visual intrusion (including structure construction and earthworks);
- Introduction of temporary infrastructure, such as traffic management requirements and plant (along main routes and haul roads) and in construction compounds;
- Views of site clearance activities including the removal of hard standing, structures and vegetation; and
- The construction and introduction of a linear and raised features (such as hardstanding, bridges, viaducts and interchanges) within a rural setting.

Magnitude and Severity of Impacts

16.2.11. The description of the magnitude thresholds is provided in Table 16-6.

Table 16-6 - Magnitude of Impacts (Visual)

Receptor	Representative Viewpoint	Sensitivity	Magnitude of Change	Effect (prior to mitigation)	Description
Residential Receptors					
Local farms and farmsteads	1	High	Moderate	**Moderate or Large Adverse (significant)**	Residents will have filtered views of construction activities, including construction plant and machinery, noise, dust and vegetation clearance. The movement of tall plant will be visible above intervening vegetation. The effect will be direct, temporary and medium term.
Residents living in dwellings on the western outskirts of Osoj	2 and 3	High	Major	**Large or Very Large Adverse (significant)**	A limited number of residents will experience clear direct views of construction activities at close proximity. Visible construction activities will include the movement of plant and machinery, the creation of noise, dust and potential increases in traffic and lorries on the access routes. The effect will be direct, temporary and medium term.
Residents living in new dwellings with north eastern facing views	4	High	Major	**Large or Very Large Adverse (significant)**	These residents will experience clear and direct or oblique views towards construction activities. The movement of plant and machinery, creation of noise and dust and potential increases in traffic and lorries will be prominent at close proximity to the rear and side of these residential dwellings unfiltered by vegetation. The effect will be direct, temporary and medium term.
Residents living in dwellings on the eastern outskirts of Trapchin	5 and 6	High	Moderate	**Moderate or Large Adverse (significant)**	A limited number of new build dwellings to the north east of Trapchin will experience clear and direct views of the Project beyond the dwelling boundary. Construction activities will be noticeable within the view. The remaining residents will experience middle distance views of construction activities filtered by vegetation and where gaps allow. The movement of plant and machinery will be visible within the middle distance filtered by and where gaps in vegetation allow. Views of the construction activities will be visible below the skyline only, backed by higher hills / mountains. The effect will be direct, temporary and medium term.
Residents living in dwellings on the north eastern outskirts of Kolibari	-	Medium	Moderate	**Moderate Adverse (significant)**	A limited number of residential dwellings will experience middle- and long-distance views of the Project of the construction activities above and filtered by and where gaps in vegetation allow. Tall machinery will be visible above intervening vegetation. The effect will be direct, temporary and medium term.
Residents living in dwellings in the western outskirts of Crvica	7 and 8	High	Moderate	**Moderate or Large Adverse (significant)**	Construction activities will be visible in the middle and long distance beyond the existing residential edge of Crvica. The movement of plant and machinery, creation of noise and dust and potential increases in traffic and lorries will be noticeable within direct middle- and long-distance views, beyond the residential edge and field boundary vegetation. The effect will be direct, temporary and medium term.
Residents living in dwellings in the western outskirts of Dolno Strogomishte	9	High	Moderate	**Moderate or Large Adverse (significant)**	Construction activities will be visible in the middle and long distance beyond the existing residential edge of Dolno Strogomishte. The movement of plant and machinery, creation of noise and dust, construction of the viaduct and potential increases in traffic and lorries will be noticeable within the view. The effect will be direct, temporary and medium term.
Residents living in dwellings along an unnamed road west of Dolno Strogomishte	10	High	Major	**Large or Very Large Adverse (significant)**	Construction activities will be visible at close proximity in direct open views beyond the cemetery. The movement of plant and machinery, creation of noise and dust and potential increases in traffic and lorries will be prominent within the view. The effect will be direct, temporary and medium term.
Residents living in the western outskirts of Gorno Strogomishte	11	Medium	Moderate	**Moderate Adverse (significant)**	Construction activities will be visible in the middle and long distance beyond intervening vegetation. The movement of plant and machinery, creation of noise and dust and potential increases in traffic and lorries will be perceptible within the view. The effect will be direct, temporary and medium term.

Receptor	Representative Viewpoint	Sensitivity	Magnitude of Change	Effect (prior to mitigation)	Description
Residents living in a rural settlement off the A2 state roads.	12 and 13	Medium	Moderate	**Moderate Adverse (significant)**	Construction activities will be largely obscured by intervening ridgelines and vegetation. The movement of plant and machinery, creation of noise and dust will be visible in available views. The effect will be direct, temporary and medium term.
Commercial Receptors, Recreational Receptors and Visitors to Places of Worship					
People visiting a cemetery and mosque near Crvica.	14	Medium	Moderate	**Moderate Adverse (significant)**	Construction activities will be visible in the middle and longer distance beyond the vegetation surrounding the cemetery and mosque. Visible activities will include the movement of plant and machinery, creation of noise and dust. The effect will be direct, temporary and medium term.
People visiting the cemetery to the north of Kichevo.	4	Medium	Major	**Moderate or Large Adverse (significant)**	Construction activities will be visible in the short and middle distance. Visible activities will include the movement of plant and machinery, creation of noise and dust. The effect will be direct, temporary and medium term.
People visiting a cemetery to the west of Dolno Strogomishte.	10	Medium	Major	**Moderate or Large Adverse (significant)**	Construction activities will be visible in the short and middle distance beyond the vegetation surrounding the cemetery. Visible activities will include the movement of plant and machinery, creation of noise and dust. The effect will be direct, temporary and medium term.
People visiting the Albanian Mother Memorial.	-	High	Major	**Large Adverse (significant)**	Construction activities will be visible in short and middle-distance views beyond the vegetation surrounding the memorial. Visible activities will include the movement of plant and machinery, creation of noise and dust particularly during construction of the prominent viaduct. The effect will be direct, temporary and medium term.
Commercial receptors within 500 m (such as the petrol station adjacent to the A2 motorway)	-	Low	Moderate	**Slight Adverse (not significant)**	Workers / visitors to the facilities will be affected by view of the construction activities, which will include the movement of plant and machinery, noise dust, increase in traffic and lorries along roads with traffic management controls in place. However, workers / visitors to commercial premises are focused on the activity at hand and are generally indoor workers. The effect will be direct, temporary and medium term.
Transport Receptors					
People travelling along local roads.	-	Low	Major	**Moderate Adverse (significant)**	Users of the existing state road A2 will be affected by traffic management and temporary access routes. Road users will have close proximity views at limited locations along their routes. Visible construction activities will include movement of plant and machinery, noise dust, increase in traffic and lorries along roads with traffic management controls in place. The effect will be direct, temporary and medium term.
People travelling along the Kichevo to Gostivar railway line.	-	Medium	Moderate	**Moderate Adverse (significant)**	People travelling along the railway will have limited views of the Project. At the two locations where the Project will cross the railway, the construction activities such as vegetation clearance and construction of the structure will be visible at close proximity. The effect will be direct, temporary and medium term.

Significance of Effects

16.2.12. The significance of effects for each visual receptor is depicted in Table 16-5. Overall, it is considered that the potential for significant effects on the surrounding visual receptors as a result of the construction phase of the Project varies from Slight Adverse (not significant) to Large or Very Large Adverse (significant), without mitigation.

16.2.13. A Landscape and Visual Management Plan (as outlined in Chapter 23 – ESMP) will be implemented during the construction phase to manage effects on the visual receptors.

OPERATIONAL PHASE

Landscape

Description

16.2.14. There is the potential for alterations to the landscapes present once the Project is operational, due to:

- The appearance of new linear and geometric forms within the landscapes; and
- Changes in the textures and colours of the landscapes due to the removal of vegetation, cuttings and embankments, creation of interchanges and structures, and the presence of hardstanding. Such textures and colours will be different to those from the surrounding landscapes.

Magnitude and Severity of Impacts

16.2.15. The magnitude and severity of the impact has been determined based upon the value, visibility and intensity of the Project on the landscapes.

16.2.16. As described previously in Table 16-2 the value of the surrounding landscapes varies from **Negligible** (agricultural land), to **Low** (degraded forest) to **Medium** (mature forest). Visibility and intensity have been evaluated separately using the following scale:

- Negligible
- Low
- Medium
- High
- Very high

16.2.17. The scale approach has been developed in line with best practice guidance. The sensitivity assigned to the landscapes is presented in Table 16-7.

Table 16-7 - Visibility, Intensity and Magnitude of Impacts on Landscapes

Landscape	Visibility	Intensity	Magnitude
Agricultural Land	Medium	Medium	Moderate
Woodland – Degraded Forest	Low	Low	Minor
Woodland – Mature Forest	Low	Low	Minor

16.2.18. The visibility is considered to be low for most of the Project alignment, given the population density in the surrounding rural settlements is relatively low. It is expected that only the areas around the rural settlements of Chelopeci, Dolno Strogomishte and Osoj will have a visibility of medium as these settlements are more densely populated.

16.2.19. The intensity (size and frequency of features such as cuttings and embankments, interchanges and structures) is considered to be low for most of the Project alignment. It is expected that that only Bridge No. 1 (over the River Zajaska) and the viaducts will be of medium intensity to the surrounding landscapes.

16.2.20. Further to Table 16-7 the description of the magnitude thresholds is provided in Table 16-8.

Table 16-8 - Magnitude of Impacts (Landscape)

	Assessment Thresholds	
Criteria	**Threshold**	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	The landscapes will be impacted due to the alternations to landscape as a result of the Project.
Reversibility	Irreversible	The impact is irreversible. Structures such as the bridges and viaducts cannot be hidden by the vegetation in the surrounding landscapes.
Geographic Extent	Local	Limited to the Project alignment.
Time when the Impact Occurs	Immediate	The alteration of the landscapes will occur upon completion of Project.
Duration	Long-term	It will last throughout the operational life of the Project.
Likelihood of Appearance	Certain	The presence of the Project will be observable at several locations, as assessed within the visual assessment.
Magnitude	Moderate	As explained in Table 16-7

16.2.21. The magnitude of the impact on the landscapes is anticipated to be **Minor to Moderate**, with the greatest impact upon the agricultural landscape.

Significance of Effects

16.2.22. Overall, it is considered that the potential for significant effects on the surrounding landscapes as a result of the operational phase of the Project is Moderate Adverse (significant), without mitigation. An Operational Maintenance Plan (as outlined in Chapter 23 – ESMP) will be implemented during the operational phase to manage effects on the landscape.

Visual

Description

- Foreshortened views of the open landscape where the Project is located in short and medium-distance views.

Magnitude and Severity of Impacts

16.2.23. The description of the magnitude thresholds is provided in Table 16-9.

Table 16-9 - Magnitude of Impacts (Visual)

Receptor	Representative Viewpoint	Sensitivity	Magnitude of Change	Effect (prior to mitigation)	Description
Residential Receptors					
Local farms and farmsteads.	1	High	Moderate	**Moderate or Large Adverse (significant)**	Residents will have close proximity views of the Project, which will remain noticeable in the view. This effect will be direct, permanent and long term.
Residents living in dwellings on the western outskirts of Osoj.	2 and 3	High	Moderate	**Moderate or Large Adverse (significant)**	A limited number of residents will experience clear, direct views of the Project at close proximity. Views of the Project will replace views of open scrubland adjacent. The additional infrastructure will add to the existing built elements within the view. The Project will be of a similar style and scale to the existing road network, thus extending the urban influence within the view. This effect will be direct, permanent and long term.
Residents living in new dwellings with north eastern facing views.	4	High	Moderate	**Moderate or Large Adverse (significant)**	Residents will experience clear, direct views of the Project at close proximity. The Project will extend the urban influence within the view closer to the dwellings. This effect will be direct, permanent and long term.
Residents living in dwellings on the eastern outskirts of Trapchin.	5 and 6	High	Minor	**Slight Adverse (not significant) or Moderate Adverse (significant)**	A limited number of residents will experience middle distance views of the Project where gaps in vegetation allow. The Project will be perceptible within the middle distance, but new planting will over time help to provide some integration and further screening for the residents. This effect will be direct, permanent and long term.
Residents living in dwellings on the north eastern outskirts of Kolibari.	-	Medium	Minor	**Slight Adverse (not significant)**	Residents will experience middle- and long-distance views of the Project below the skyline. This effect will be direct, permanent and long term.
Residents living in dwellings in the western outskirts of Crvica.	7 and 8	High	Minor	**Slight Adverse (not significant) or Moderate Adverse (significant)**	Residents will experience middle- and long-distance views of the Project below the skyline and existing residential edge of Crvica. The Project will extend the urban influence within the view, but all infrastructure will only be visible below the skyline, resulting in limited change to the view. This effect will be direct, permanent and long term.
Residents living in dwellings in the western outskirts of Dolno Strogomishte.	9	High	Minor	**Slight Adverse (not significant) or Moderate Adverse (significant)**	The Project will be visible in the middle and long distance beyond the existing residential edge of Dolno Strogomishte. Views of the Project will be available below the skyline and beyond the intervening vegetation but will be seen as an extension to the urban edge and of similar character. This effect will be direct, permanent and long term.
Residents living in dwellings along an unnamed road west of Dolno Strogomishte.	10	High	Major	**Large or Very Large Adverse (significant)**	The Project will be visible at close proximity beyond the cemetery. The Project will be visible at higher level (viaduct) foreshortening views of the wider landscape. This effect will be direct, permanent and long term.
Residents living in the western outskirts of Gorno Strogomishte.	11	Medium	Minor	**Slight Adverse (not significant)**	The majority of views will be obscured by the intervening ridgelines. Where gaps in vegetation and ridgelines allow views of the Project will be available in the middle distance. This effect will be direct, permanent and long term.
Residents living in a rural settlement off the A2 state roads.	12 and 13	Medium	Minor	**Slight Adverse (not significant)**	Views of the Project will be largely obscured by intervening ridgelines and vegetation. Views of the Project will be visible at a lower level to the surrounding residential edge, the Project will be viewed as a feature within the wider landscape. This effect will be direct, permanent and long term.
Commercial Receptors, Recreational Receptors and Visitors to Places of Worship					
People visiting a cemetery and mosque near Crvica.	14	Low	Moderate	**Slight Adverse (not significant)**	Views of the Project will be visible within the middle distance beyond the vegetation surrounding the cemetery. Additionally, a portion of the views will be obscured by the ridgeline of the small hill adjacent to the cemetery. This effect will be direct, permanent and long term.

Receptor	Representative Viewpoint	Sensitivity	Magnitude of Change	Effect (prior to mitigation)	Description
People visiting a cemetery to the north of Kichevo.	4	Medium	Major	**Moderate or Large Adverse (significant)**	The Project will be visible at close proximity beyond and above the cemetery. The Project will be visible at higher level (viaduct) foreshortening views of the wider landscape. The cemetery will experience a reduction in tranquillity due to the increase in noise levels and light pollution from passing cars. This effect will be direct, permanent and long term.
People visiting a cemetery to the west of Dolno Strogomishte.	10	Medium	Major	**Moderate or Large Adverse (significant)**	The Project will be visible at close proximity beyond and above the cemetery. The Project will be visible at higher level (viaduct) foreshortening views of the wider landscape. The cemetery will experience a reduction in tranquillity due to the increase in noise levels and light pollution from passing cars. This effect will be direct, permanent and long term.
People visiting the Albanian Mother Memorial.	-	High	Moderate	**Moderate Adverse (significant)**	Views of the main Motorway alignment will be visible within the middle distance beyond the vegetation surrounding the memorial. The junction improvements will be visible at close proximity, together with the new link from the existing A2 state roads to the new A2 Motorway. This effect will be direct, permanent and long term.
Commercial receptors within 500 m (such as the petrol station off the A2 state road)	-	Low	Moderate	**Slight Adverse (not significant)**	Views of the Project will be visible within the middle distance. This effect will be direct, permanent and long term.
Transport Receptors					
People travelling along local roads.	-	Low	Minor	**Neutral or Slight Adverse (not significant)**	Users of the existing state road will have enhanced journeys, accessibility and movement. Views will be glimpsed and fleeting and in the context of the existing road network. This effect will be direct, permanent and long term.
People travelling along the Kichevo to Gostivar railway line.	-	Medium	Minor	**Slight Adverse (not significant) or Moderate Adverse (significant)**	People travelling along the railway will have limited views of the Project. At limited locations where the Project will cross the railway; the Project will be visible at close proximity. Views will be glimpsed, and fleeting filtered by new planting. New planting over time will reduce the views. The effect will be direct, temporary and medium term.

Significance of Effects

16.2.24. The significance of effects for each visual receptor is depicted in Table 16-9. Overall, it is considered that the potential for significant effects on the surrounding visual receptors as a result of the operational phase of the Project varies from Neutral (not significant) to Large or Very Large Adverse (significant), without mitigation. An Operational Maintenance Plan (as outlined in Chapter 23 – ESMP) will be implemented during operation to manage effects on visual receptors.

16.3 SUMMARY OF EFFECTS

16.3.1. The following effects are anticipated during the construction phase, before the implementation of mitigation:

- The potential for significant effects on the surrounding landscape as a result of the Project is **Moderate Adverse (significant).**
- The potential for significant effects to visual receptors as a result of the Project is **Slight Adverse (not significant) to Very Large Adverse (significant).**

16.3.2. The following effects are anticipated during the operational phase, before the implementation of mitigation:

- The potential for significant effects on the surrounding landscape as a result of the Project is **Slight Adverse (not significant) to Moderate Adverse (significant).**
- The potential for significant effects to visual receptors as a result of the Project is **Neutral (not significant) to Very Large Adverse (significant).**

16.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

16.4.1. The detailed design of the Project will incorporate the following measures to minimise potential landscape and visual effects:

- Minimising the extent of earthworks, where practicable;
- Minimising the use of artificial lighting along the Project alignment and where needed, use directional lighting;
- Reflecting the nature of the existing landforms within the earthworks, where practicable, such as through:
    - Aesthetic integration of the structural parts of the viaducts and the bridges (e.g. the decks and piers), through the use of construction materials with colours and textures that blend well with those of the surrounding landscapes;
    - Designing the three disposal sites for the disposal of excavated material so that they are integrated with the surrounding landscapes;
- Retention of mature vegetation, where practicable;
- Planting of native vegetation along sections of the Project alignment which is complementary to the surrounding landscapes in order to provide visual screening;
- The height and dominance of the retaining wall associated with viaduct approaches adjacent to the cemetery should be visually softened through the use of planting, appropriate facing materials (such as natural, locally occurring stone or appropriate textures and materials) and/ or through considered use of colour (such as camouflage colours, muted, pastel) or art (such as painting or

creating a mural to depict a local scene, local heritage, or abstract art). The choice of material for the wall facing, its textures, colours or art mural should be as desired by and agreed with the local residents;

- Planting of tree and shrub vegetation in front of retaining walls (where space allows) associated with viaduct approaches adjacent to the cemetery; and/ or planting of climbing plants to cover the retaining wall with vegetation (where the climbing plant system will need to be constructed so as not to interfere with the structural integrity of the wall); and
- Provision of native boundary vegetation or fencing to provide screening for the affected cemeteries, and screening of middle-distance views of the main alignment from the Albanian Mother War Memorial.

16.4.2. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the Contractor will prepare a **Landscape and Visual Management Plan**, which will form part of the Construction Environmental and Social Management Plan (CESMP). The **Landscape and Visual Management Plan** will provide details on each of the measures listed in Paragraph 16.4.1. During the construction phase of the Project the Plan will be reviewed, as a minimum quarterly, and with changes to international and national legislation, as appropriate.

16.4.3. It should be noted that, where planting, colour, artwork or screening of retaining walls associated with viaduct approaches adjacent to the cemetery are not considered sufficient by the local residents, and given the scale, dominance and proximity of residential properties to the proposed retaining wall and viaduct, then the opportunity for expropriation of the affected residents should be given.

OPERATIONAL PHASE

16.4.4. In order to minimise potential landscape and visual effects during the operational phase of the Project an **Operational Maintenance Plan** will be prepared. The Plan will include:

- Measures to maintain the earthworks;
- Measures for monitoring the vegetation to ensure suitable establishment;
- Measures to maintain the quality of the junction with the A2 state road in Zajas, such as vegetation monitoring and litter removal, to maintain the setting of the Albanian Mother Memorial;
- Measures to maintain the vegetation or artwork on the retaining wall associated with the viaduct approaches adjacent to the cemetery; and
- Measures to maintain the vegetation to maximise screening to visual receptors.

16.4.5. Further details on the **Operational Maintenance Plan** are provided in Chapter 23.

16.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Landscape

16.5.1. Prior to mitigation, the effect on landscape will be Moderate Adverse (significant) With mitigation in the form of a Landscape and Visual Management Plan in place, it is anticipated that effects on the surrounding landscape as a result of the Project will be **Slight Adverse (not significant).**

Visual

16.5.2. Prior to mitigation, the effects on visual receptors will be Slight Adverse to Very Large Adverse. With mitigation in the form of a Landscape and Visual Management Plan in place, it is anticipated that effects on the visual receptors as a result of the Project will be **Slight Adverse (not significant) to Large Adverse (significant).**

16.5.3. The effects upon each visual receptor as presented in Table 16-10.

Table 16-10 - Residual Visual Effects (Construction)

Receptor	Representation Viewpoint	Residual Effect (following mitigation)
Residential Receptors		
Local farms and farmsteads.	1	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in dwellings on the western outskirts of Osoj.	2 and 3	**Large Adverse (significant)** The Project will create a prominent change in the view.
Residents living in new dwellings with north eastern facing views.	4	**Large Adverse (significant)** The Project will create a prominent change in view.
Residents living in dwellings on the eastern outskirts of Trapchin.	5 and 6	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in dwellings on the north eastern outskirts of Kolibari.	-	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Residents living in dwellings in the western outskirts of Crvica.	7 and 8	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in dwellings in the western outskirts of Dolno Strogomishte.	9	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in dwellings along an unnamed road west of Dolno Strogomishte.	10	**Large Adverse (significant)** The Project will create a prominent change in view.
Residents living in the western outskirts of Gorno Strogomishte.	11	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.

Receptor	Representation Viewpoint	Residual Effect (following mitigation)
Residents living in a rural settlement off the A2 state road.	12 and 13	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Commercial Receptors, Recreational Receptors and Visitors to Places of Worship		
People visiting a cemetery and mosque near Crvica.	14	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
People visiting a cemetery to the west of Dolno Strogomishte.	10	**Large Adverse (significant)** The Project will create a prominent change in view.
People visiting the Albanian Mother Memorial.	-	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Commercial receptors within 500 m (such as the petrol station off the A2 state road)	-	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Transport Receptors		
People travelling along local roads.	-	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
People travelling along the Kichevo to Gostivar railway line.	-	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.

OPERATIONAL PHASE

Landscape

16.5.4. Prior to mitigation, the effect on the landscape will be Slight Adverse (not significant) and Moderate Adverse (significant) With mitigation in the form of the detailed design and an **Operational Maintenance Plan** in place, it is anticipated that residual effects will be **Slight Adverse (not significant).**

Visual

16.5.5. Prior to mitigation, the effects on visual receptors will be Neutral (not significant) to Very Large (adverse). With mitigation in the form of the detailed design and an **Operational Maintenance Plan** in place, it is anticipated that the residual effects will be **Neutral (not significant)** to **Large Adverse (significant).** The effects upon each visual receptor as presented in

16.5.6.

16.5.7. Table 16-11.

Table 16-11 - Residual Visual Effects (Operation)

Receptor	Representation Viewpoint	Residual Effect (following mitigation)
Residential Receptors		
Local farms and farmsteads.	1	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Residents living in dwellings on the western outskirts of Osoj.	2 and 3	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in new dwellings with north eastern facing views.	4	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
Residents living in dwellings on the eastern outskirts of Trapchin.	5 and 6	**Neutral (not significant)** The Project will create no perceptible change in the view.
Residents living in dwellings on the north eastern outskirts of Kolibari.	-	**Neutral (not significant)** The Project will create no perceptible change in the view.
Residents living in dwellings in the western outskirts of Crvica.	7 and 8	**Neutral (not significant)** The Project will create no perceptible change in the view.
Residents living in dwellings in the western outskirts of Dolno Strogomishte.	9	**Neutral (not significant)** The Project will create no perceptible change in the view.
Residents living in dwellings along an unnamed road west of Dolno Strogomishte.	10	**Large Adverse (significant)** The Project will create a prominent change in view.
Residents living in the western outskirts of Gorno Strogomishte.	11	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Residents living in a rural settlement off the A2 state road.	12 and 13	**Neutral (not significant)** The Project will create no perceptible change in the view.
Commercial Receptors, Recreational Receptors and Visitors to Places of Worship		
People visiting a cemetery and mosque near Crvica.	14	**Slight Adverse (not significant)** The Project will create a limited change in the view.

Receptor	Representation Viewpoint	Residual Effect (following mitigation)
People visiting a cemetery to the north of Kichevo	4	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
People visiting a cemetery to the west of Dolno Strogomishte.	10	**Moderate Adverse (significant)** The Project will create a noticeable change in the view.
People visiting the Albanian Mother Memorial.	-	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Commercial receptors within 500 m (such as the petrol station off the A2 state road)	-	**Slight Adverse (not significant)** The Project will create a limited change in the view.
Transport Receptors		
People travelling along local roads.	-	**Neutral (not significant)** The Project will create no perceptible change in the view.
People travelling along the Kichevo to Gostivar railway line.	-	**Slight Adverse (not significant)** The Project will create a limited change in the view.

16.6 SUMMARY

Table 16-12 – Summary of Residual Effects

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
Landscape and Visual	Construction	Landscape	Moderate Adverse (significant)	Detailed Design **Landscape and Visual Management Plan**	Slight Adverse (not significant)
		Visual	Slight Adverse (not significant) to Very Large Adverse (significant)		Slight Adverse (not significant) to Large Adverse (significant)
	Operation	Landscape	Slight Adverse (not significant) to Moderate Adverse (significant)	Detailed Design **Operational Maintenance Plan**	Slight Adverse (not significant)
		Visual	Neutral (not significant) to Very Large Adverse (significant)		Neutral (not significant) to Large Adverse (significant)

17 SOCIAL AND COMMUNITY

17.1 BASELINE CONDITIONS

17.1.1. The baseline data has been obtained through a combination of observations during a site visit, and the desk-based review of third-party information. Informal discussions were undertaken in early 2019 with residents of Osoj (Pevci) and Rashtani.

POPULATION TRENDS

17.1.2. The City of Kichevo, located at the southern end of the Project alignment, is the largest urban settlement in the surrounding area. The City of Kichevo and has experienced population growth in recent decades, mostly as a result of migration from rural areas. Some of the rural settlements in the surrounding area have also recorded continual growth in population. The rural settlements within the surrounding area include: Bukojchani, Gorno Strogomishte, Dolno Strogomishte, Oslomej, Osoj, Trapchin Dol, Rashtani, Crvivci, Kolibari, and Zajas.

17.1.3. The following figure depicts the population growth in the Municipality of Kichevo, the City of Kichevo and the rural settlements between 1948 and 2002.

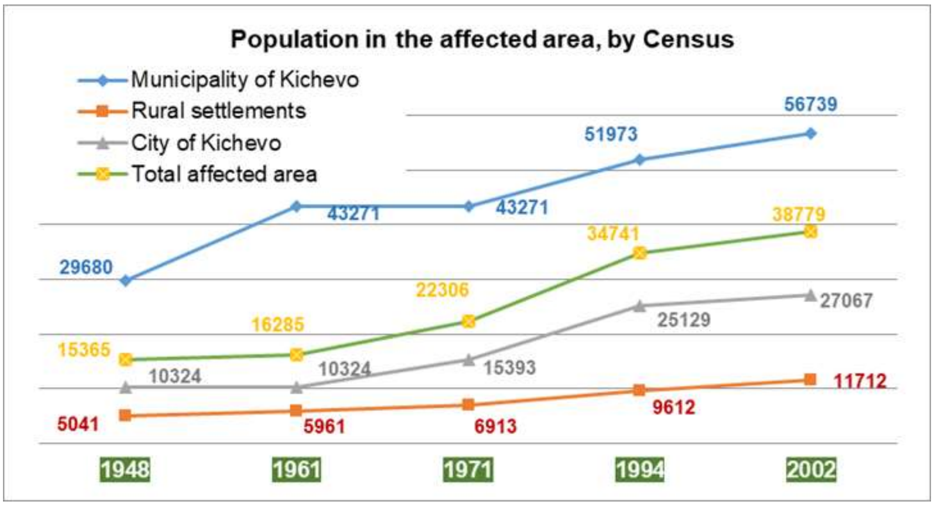

Figure 17-1 - Population in the Affected Area, by year of Census [100]

17.1.4. For the last 50 years the population in the surrounding rural settlements has grown by approximately 130%, for City of Kichevo the population has increased by approximately 160%, and for the Municipality of Kichevo the population has increased by approximately 90%.

[100] Source: Website of State Statistical Office, MAKStat Database.

17.1.5. The rural-urban migration is as a result of industrialisation which largely occurred in the 1960's and 1970s. The rural-urban migration was most prominent from the most rural settlements south, southeast and southwest of the City of Kichevo to the City itself.

17.1.6. There is a significant difference in the ethnic distribution of population between the rural settlements, the City of Kichevo and throughout the Municipality of Kichevo, as depicted in the below figure. During the period of industrialisation residents of Macedonian ethnicity who were located within the rural settlements largely moved to the City of Kichevo. Residents of Albanian ethnic origin have largely remained in the rural settlements.

17.1.7. The following figure shows the ethnic composition of populations in the rural settlements, the City of Kichevo, the Municipality of Kichevo and the Project affected area.

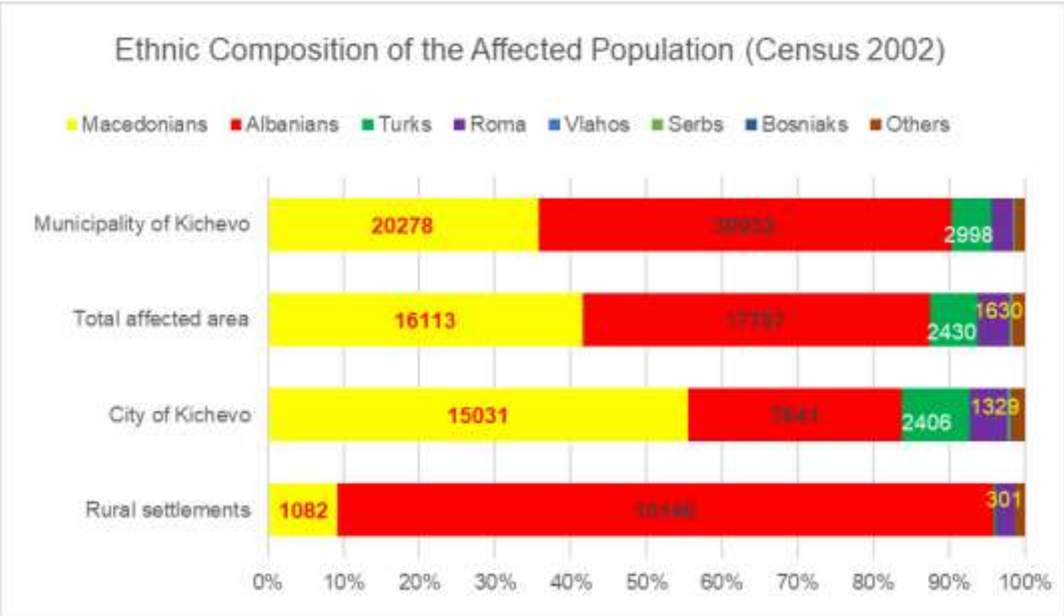

Figure 17-2 - Ethnic Composition of the Affected Population, Census 2002[101]

CURRENT POPULATION

17.1.8. The current population estimates in the Republic of North Macedonia and the Municipality of Kichevo are presented in the following table. The data for 2017 are from the population estimates from the State Statistical Office and those from 2002 (as also shown in Figure 17-1 and Figure 17-2) are from the last official census in the Republic of Macedonia undertaken by the from the State Statistical Office.

[101] Source: Website of State Statistical Office, MAKStat Database.

Table 17-1 - Current Population in the Republic of North Macedonia and the Municipality of Kichevo[102]

Factor	Municipality of Kichevo	Republic of North Macedonia
Population Estimation (2017)	56,814	2,075,301
Population Census (2002)	56,734	2,022,547
Number of Dwellings (all residential properties) (2002)	20,151	698,143
Number of Households (houses) (2002)	15,693	564,296
Area (km^2)	814.3	25,713
Population Density (2017)	70	81
Population Density (2002)	70	79
Population Growth (2002 – 2017)	80	52,754

17.1.9. Population growth in the municipality of Kichevo and the Republic of North Macedonia is expected to be minimal between 2002 and 2017, at less than 3%.

17.1.10. The State Statistical Office has also published granular birth and death rate data for 2014 to 2017, as presented in the table below. Whilst Table 17-1 depicts an overarching population increase between 2002 and 2017, albeit minimal, the data in Table 17-2 represents a population decrease over the last four years with death rates consistently higher than birth rates (2014 to 2017).

Table 17-2 - Birth and Death Rate in the Municipality of Kichevo (2014 – 2017)[103]

Year	Number of Births	Number of Deaths	Trend in Birth and Death Rate
2017	427	489	-13%
2016	433	510	-15%

[102] Website of State Statistical Office, MAKStat Database.
[103] Website of State Statistical Office, MAKStat Database.

Year	Number of Births	Number of Deaths	Trend in Birth and Death Rate
2015	452	506	-11%
2014	474	500	-5%

Note: Numbers rounded to the nearest integer.

RECENT POPULATION MIGRATION

17.1.11. The table below depicts the population migration balance (the difference between population inflow and outflow) for the Municipality of Kichevo between 2013 and 2017.

Table 17-3 - Municipality of Kichevo Population Migration Balance (2013 – 2017)[104]

Type of Migration	2013	2014	2015	2016	2017	Total
Immigration						
Total	239	120	112	107	97	675
From Another Municipality (outside of the Municipality of Kichevo)	77	78	88	75	67	385
From Rural Settlements in the Municipality of Kichevo	0	2	0	0	0	2
In the Republic of North Macedonia	162	42	24	32	30	290
Emigration						
Total	111	128	151	153	158	701
To Another Municipality (outside of the Municipality of Kichevo)	111	128	151	153	158	701
To Rural Settlements in the Municipality of Kichevo	0	0	0	0	0	0

[104] State Statistical Office, Skopje. Series on Migration.

Type of Migration	2013	2014	2015	2016	2017	Total
To the Republic of North Macedonia	0	0	0	0	0	0
Migration Balance	**-34**	**-50**	**-63**	**-78**	**-91**	**-316**

17.1.12. Total net migration for the Municipality of Kichevo between 2013 and 2017 was a reduction of 316 people. Approximately 71% of people were female, and approximately 61% aged over 30 years old.

17.1.13. Historically rural-urban migration occurred as a result of industrialisation. There was a shift in employment trends from agriculture and forestry to factories and the public sector (for examples in schools, hospitals, etc.).

17.1.14. Currently the dominant type of migration is external migration outside of the Municipality of Kichevo. The main reason for this is marriage, family and employment. The loss of educated professionals had the potential to affect the economic development of the Municipality of Kichevo.

GENDER AND AGE

17.1.15. The State Statistical Office estimates that approximately 50.5% of the Municipality of Kichevo’s population is male and approximately 49.5% of the population is female. The population age structure in the Municipality of Kichevo is considered to be ‘constrictive’, whereby there are fewer younger people, and a declining birth rate.

17.1.16. The distribution of the population by gender and age group is presented in the Figure 17-3.

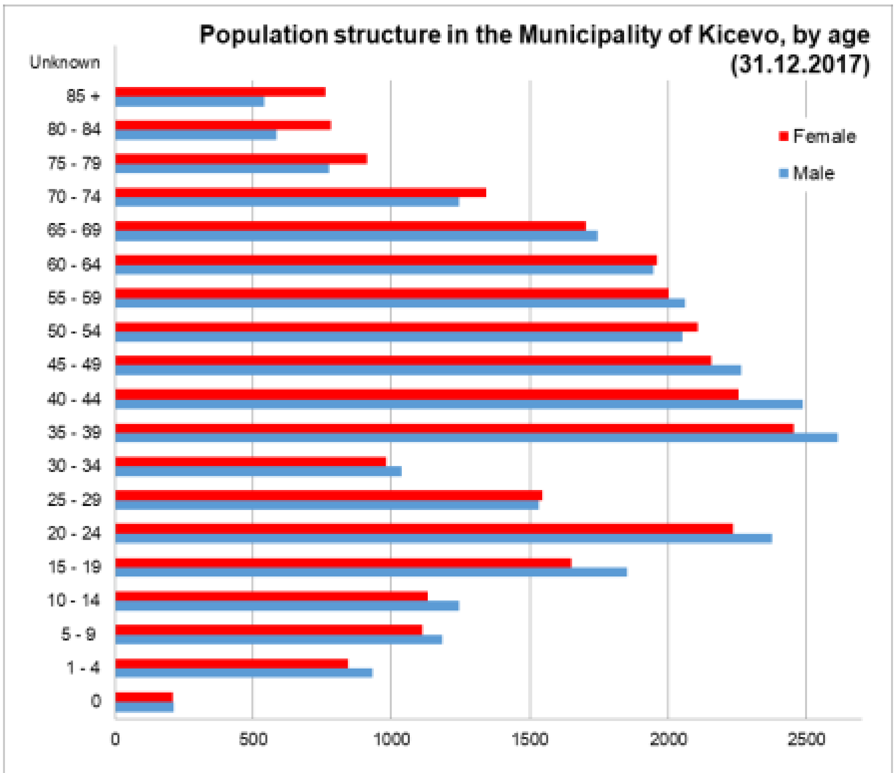

Figure 17-3 - Population and Gender Structure in the Municipality of Kichevo[105]

17.1.17. The figure above depicts that the population of the Municipality of Kichevo is aging, with approximately 56% of population being aged 40 years' and over. Furthermore, approximately 25% of the population are aged 60 years' and over.

SOCIAL WELFARE AND VULNERABLE GROUPS

17.1.18. Table 17-4 provides an overview of the social welfare provision in the Municipality of Kichevo for both children and adults. In total there are five institutions across the Municipality of Kichevo providing social welfare support facilities.

[105] Website of State Statistical Office, MAKStat Database.

Table 17-4 - Social Welfare Provision in the Municipality of Kichevo (2017)[106]

Type of Vulnerable Persons	Number of Children Recipients	Adult Recipients
Persons Lacking Parental Care	22	0
Persons with Marriage and Family Difficulties	41	0
Persons with Educational and Social Difficulties	12	0
Persons with Physical Disabilities	11	330
Persons with Visual Impairment	1	90
Persons with Hearing Impairment	0	106
Persons with Voice and Speech Disorders	0	0
Persons with Combined Disabilities	5	0
Persons with Intellectual Disabilities	2	609
Persons with Autism	0	0
Persons with Combined Disabilities	3	0
Persons Socially Excluded	0	27
Persons Financially Unprotected	0	56
Elderly Persons	0	3
Other	18	0
Total	**115**	**1221**

[106] State Statistical Office, Social Welfare for Children and Adults in the Republic of Macedonia, 2017.

POLITICAL POSITION

17.1.19. The Council of the Municipality of Kichevo is composed of 23 members. The current Council runs from 2017 to 2021. The Council of the Municipality of Kichevo is active in the Centre for Development of South-west Planning Region.

EDUCATION

17.1.20. The Municipality of Kichevo has a developed system of educational institutions including pre-school, primary and secondary education.

17.1.21. There are two pre-schools with the Municipality. The JUDG "Olga Miceska" pre-school incorporates health and nutritional care.

17.1.22. There are nine primary schools in the Municipality. Three of these are located in the City of Kichevo (Sande Shterjoski, Dr. Vladimir Polezhinoski and Kuzman Josifoski Pitu), while the remaining six (Milto Gurra, Gjergj Kastrioti Skënderbeu, Faik Konica, Naim Frashëri, Rexhë Rushit Zajazi, Hristo Uzunov) are located within rural settlements. With regards to primary schools within the Project study area, these are located in Gorno Strogomishte and Dolno Strogomishte, Zajas,Trapchin Dol, and Crvivci.

17.1.23. There are two secondary schools in the Municipality of Kichevo. They are both located in the City of Kichevo (Mirko Mileski and Drita). The Drita secondary school also has local facilities in the rural settlement of Zhitoshe in the Municipality of Dolneni.

17.1.24. The following table details the number of students in education in the Municipality of Kichevo.

Table 17-5 - Students in the Educational system of the Municipality of Kichevo (2012-2017)[107]

Year	Pre-school	Primary School	Secondary School
2012/2013	159	2,605	2,327
2013/2014	179	3,908	2,169
2014/2015	185	3,803	2,011
2015/2016	188	3,695	1,838
2016/2017	190	3,725	1,628
2017/2018	216	3,730	1,530

[107] Website of State Statistical Office, MAKStat Database.

17.1.25. The table depicts that pre- and primary schools experienced an increase in the number of students enrolled between 2012 and 2017. Whereas, the secondary schools experienced a decrease in the number of students registered between 2012 and 2017.

HEALTH

17.1.26. The healthcare system in the Republic of North Macedonia consist of three categories: primary, secondary and tertiary healthcare. The primary healthcare is based on a network of private and public facilities, notably clinics and health centres. Primary healthcare covers preventative, promotional and curative services, which are provided by doctors, specialist and dentists. Secondary healthcare covers specialist advice services. Tertiary healthcare covers clinical services which are provided in hospitals and within the University Clinical Centre in Skopje.

17.1.27. The healthcare system is largely financed through mandatory healthcare insurance, which gives an option for all citizens to have healthcare insurance. The mandatory healthcare insurance is financed by salary allocations. For citizens whose healthcare is not provided by salary allocations, their healthcare is financed by the State budget, such citizens include those aged under 18 (26 if they are students), pregnant women and those aged over 65.

17.1.28. The healthcare system is monitored by the Institute of Public Health. The latest information is available in the 2017 the Health Report for the population of Republic of North Macedonia.

17.1.29. Healthcare facilities in the Municipality of Kichevo are located in the City (Health Centre Kichevo and the General Hospital). The two facilities have a total of 66 patient beds.

17.1.30. The northern end of the Project alignment is approximately 12 km by road from the nearest general hospital, while the southern end of the Project alignment is approximately 3 km from the nearest general hospital.

UTILITIES

17.1.31. Potable water for the City of Kichevo and the larger settlements in the Municipality is provided via a water supply system which uses water from Studenchica River. Studenchica River is located on the eastern side of Mountain Bistra close to the village of Gorno Dobrenoc. The water supply system is maintained by the public enterprise "Komunalec". The water supply system is capable of supporting a flow of 1,500 litres per second along the main 110-km supply pipeline. In addition, the water supply system also provides potable water to the following municipalities: Plasnica, Makedonski Brod, Dolneni, Krushevo and Prilep. Water is also supplied to the thermal power plant located next to the village of Oslomej.

17.1.32. Public enterprise "Komunalec" are also responsible for waste water provisions within the Municipality. The water system within the City of Kichevo is provided via 53 km of pipelines. Public enterprise "Komunalec" together with the Municipality of Kichevo are planning to provide waste water pipelines to the rural settlements, the timeframe for such provision is currently unknown.

17.1.33. Waste management in the Municipality of Kichevo is also undertaken by the public enterprise "Komunalec". The public enterprise collects, transports and disposes of municipal waste arisings.

17.1.34. All residential dwelling in the Municipality of Kichevo have an electricity supply.

17.1.35. Telephone reception is provided in every settlement within the Municipality of Kichevo and landline telephone connections, inclusive of internet connections, are available upon request.

TRANSPORTATION INFRASTRUCTURE

Highways

17.1.36. The City of Kichevo and the wider Municipality is well connected with regards to road infrastructure. Within the Municipality, the A2 state road, part of the European E-65 Highway, connects to Gostivar in the north, and to Ohrid in the southwest. Additionally, the Municipality of Kichevo is connected to the Municipality of Makedonski Brod located to the east by the P1303 regional road, the Municipality of Demir Hisar located to the southeast by the P1305 regional road and the municipalities of Mavrovo and Rostusha and Debar by the R2246 regional road.

17.1.37. With the exception of the A2 state road and regional roads, the road infrastructure is maintained by the Municipality of Kichevo. The A2 state road and regional roads are maintained by the Public Enterprise for State Roads.

17.1.38. Most settlements in the Municipality of Kichevo are connected with asphalt or paved roads, as opposed to macadam roads (those made of crushed stones and aggregates). There are a few macadam and earth roads, that connect to only a small number of rural settlements. The following table gives overview of the type of roads in the Municipality of Kichevo.

Table 17-6 - Road infrastructure in the Municipality of Kichevo (2017)[108]

Road Infrastructure	Republic of North Macedonia (km)	Municipality of Kichevo (km)
Total Road Infrastructure	9,733	294
Asphalt and Paved Roads	5,232	195
Macadam Roads	807	21
Earth Roads	2,558	28
Designed Roads	1,136	50

Rail

17.1.39. The Municipality of Kichevo is connected throughout the Polog Region by the Kichevo to Gostivar railway line. Rail is not the preferred method of transport by the population.

17.1.40. The rail network crosses the existing road network, largely via bridges. There are also reports of unofficial surface crossings being used to cross the rail line. An example of a rail bridge, at the

[108] Website of State Statistical Office, MAKStat Database.

interchange of “Strogomishte”, is shown in Figure 17-4. With regards to the unofficial surface crossings, they are not purpose built, and there are no safety measures in place to prevent collisions with vehicles or pedestrians, and as such the existing risk of accidents is high.

Figure 17-4 - Rail Bridge (at the interchange of “Strogomishte”)

CULTURAL HERITAGE

17.1.41. The baseline conditions and the assessment of cultural heritage, including heritage features such as cemeteries and memorials, is covered in Chapter 20 – Cultural Heritage.

17.2 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Construction Community Cohesion and Wellbeing

Description

17.2.1. The presence of construction workers and the undertaking of construction activities may result in friction with the local community, hence affecting community cohesion. The potential adverse effects on the local community due to possible need to undertake construction works in the Cemetery at Dolno Strogmishte is assessed in detail in Chapter 20 Cultural Heritage. The reason for such impacts could be due to:

- Increased frustration among the locals due to the newcomers’ construction workers having a different lifestyle, and potentially culture, language or ethnicity;
- Potential tensions due to proximity of workers accommodation to existing settlements (Kichevo and or Zajas);
- Potential rivalry between the locals and newcomers’ competing for construction employment;
- Workers and construction vehicles movements along the Project alignment and in the surrounding areas causing disturbance to local residents; and

- Lack of full awareness about the Project construction activities, the timing and duration, together with noise and air quality impacts, may create negative emotions towards, or concerns about construction workers and therefore could reduce local community's trust.

Magnitude and Severity of Impacts

17.2.2. The description of the magnitude thresholds is provided in Table 17-7 below.

Table 17-7 - Magnitude of Impacts (Construction Community Cohesion and Wellbeing)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	The impact creates a negative opinion about the Project.
Type of Impact	Direct	Impact is a result of direct interaction during the construction activities.
Reversibility	Reversible	The impact is reversable if mitigation measures are implemented.
Geographic Extent	Local	Limited to the Project alignment, any construction compounds or construction workers' accommodation.
Time when the Impact Occurs	Delayed	There may be a short-term lag in the impact following the commencement of the construction activities.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Moderate	A number of local communities may become frustrated and have negative opinions towards the Project.

17.2.3. The sensitivity of the local community is considered to be High.

17.2.4. The construction phase of the Project will be limited in time and physical extent. However, there is potential for large impacts, should the construction workers and construction activities cause friction with the local community and disrupt unity. This has the potential to have adverse impacts on community cohesion. Therefore, the magnitude of impact is considered to be Moderate.

Significance of Effects

17.2.5. Overall, it is considered that the potential for significant effects on community cohesion and wellbeing as a result of the presence of construction workers and the undertaking of construction activities is Moderate or Large Adverse (significant), without mitigation.

17.2.6. The direct effects on cemeteries and memorials along the Project alignment are assessed in Chapter 20 – Cultural Heritage.

Construction Local Community Health Impacts and Accidents

Description

17.2.7. The Project is located within an area of mountainous / hilly terrain and consists of a variety of land uses such as: agricultural land, woodland areas, residential dwellings, existing roads, cemeteries and rivers and streams. During the construction phase of the Project, the construction compounds and construction workers' accommodation will be fenced as a security provision. The use of fencing may prohibit or reduce the local communities' access to these areas.

17.2.8. There is a risk that the local communities may try access the active construction area, which poses the risk of incidents and accidents involving the local community. The risks will be greatest where major construction works are to take place, for example in the vicinity of the existing informal railway crossing, and the areas surrounding the bridges, viaducts and embankments. There is a risk of accidents occurring at access roads and areas where construction works are in the vicinity of local settlements and roads. The most at risk group is children, as they are likely to be curious about the works and will not be fully aware of the risk associated with a live construction site.

17.2.9. Health impacts are also likely to occur in locations where construction works take place in close proximity to settlements, such as at Dolno Strogomishte and Kichevo. Health effects could occur as a result of noise and vibration, dust and emissions and artificial lighting.

17.2.10. If an non-local workforce is utilised by the Contractor, there is the potential for health issues for the local community to arise due to the influx of workers. Issues such as an increase in sexually transmitted diseases may occur. This has the potential to impact local health services. There is also the potential for Gender Based Violence and Harassment to occur which will cause significant tension with the local population. Mitigation will need to be put in place to address these issues ahead of the start of works.

17.2.11. As outlined in Chapter 2 – Description of the Project, the Project will provide a permanent crossing over the railway line near Dolno Strogmishte, which will be an improvement over the baseline situation, as the current rail underpass is not suitable for emergency vehicles. During construction, these crossing points are likely to be high risk locations for accidents involving the local population, construction workers and rail traffic. This risk will be managed though the measures set out in the ESMP (Chapter 23).

Magnitude and Severity of Impacts

17.2.12. The description of the magnitude thresholds is provided in Table 17-8 below.

Table 17-8 - Magnitude of Impacts (Construction related Local Community Health Impacts and Accidents)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	The impact has the potential to result in harm to the local community.
Type of Impact	Indirect	The potential for health impacts, incidents and accidents is an indirect result of the construction activities.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Reversibility	Reversible	The impact is reversable if mitigation measures are implemented.
Geographic Extent	Local	The fenced areas where construction is taking place, railway crossings, and location where there are sensitve receptors adjacent to the construction area.
Time when the Impact Occurs	Delayed	There may be a short-term lag in the impact following the commencement of the construction activities.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Moderate	Without mitigation there is risk of health impacts, incidents and accidents, with the potential to cause, injury and death.

17.2.13. The sensitivity of the local community is considered to be High.

17.2.14. The construction phase of the Project will be limited in time and physical extent. However, there is potential for large impacts, should the local communities enter the construction area, construction compounds and construction workers' accommodation. There are key locations and pinch points where the construction works and local community will be in close proximity to each other, such as during the construction of the Strogomishte interchange. This poses the risk of health impacts, incidents and accidents, with the potential to cause injury and death. Therefore, the magnitude of impact from the potential for health impacts, incidents and accidents involving the local community is considered to be Moderate.

Significance of Effects

17.2.15. Overall, it is considered that the potential for significant effects on the local community as a result of health impacts, incidents and accidents as a result of the construction works is Moderate or Large Adverse (significant), without mitigation.

Construction Traffic

Description

17.2.16. There will be increased traffic movements (both on-site and off-site), particularly by heavy vehicles, during the construction phase of Project. There is increased potential for incidents and accidents involving pedestrians, other vehicles, and the potential for damage to the local roads, decreasing their safety. Some of the local roads that will be required to provide access to the construction areas are single track, which is likely to increase the disruption caused by construction traffic. Impacts associated with the temporary loss of access to properties are considered in Chapter 19: Property and Livelihood.

17.2.17. Table 17-9 presents the level of risk of accidents in the surrounding areas of residential dwellings during the construction phase of the Project.

Table 17-9 - Level of Traffic Risk

Areas of Residential Dwellings	Level of risk
Bukojchani	Moderate
Chelikovci	High
Zajas	Moderate
Gorno Strogomishte	Low
Dolno Strogomishte	High
Kolibari	Moderate
Trapchin Dol	Low
Crvivci	Low
Rashtani	Moderate
Osoj (Pevci)	High
City of Kichevo	Moderate

Magnitude and Severity of Impacts

17.2.18. The description of the magnitude thresholds is provided in Table 17-10 below.

Table 17-10 - Magnitude of Impacts (Construction Traffic)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Impacts are the result of direct (immediate) interaction between construction activities and pedestrians, other vehicles, and the local roads.
Reversibility	Reversible	The impact is reversable if mitigation measures are implemented.
Geographic Extent	Local	Greatest in the vicinity of the Project alignment however the extent could extent to the departure location of the construction vehicle.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Time when the Impact Occurs	Immediate	Impact occurs immediately.
Duration	Short-term	The impact will last as long as the construction activities last at that location.
Likelihood of Appearance	Certain	The impact has a high likelihood of occurring.
Magnitude	Moderate	Increase in construction generated traffic on the local roads.

17.2.19. The sensitivity of the local community is considered to be High.

17.2.20. The construction phase of the Project will be limited in time and physical extent. Due to the anticipated increase in construction generated traffic on the local roads the magnitude of the impact is considered to be Moderate. However, it should be noted that the magnitude of the impact will vary along the Project alignment and is likely to be greatest in areas with residential dwellings.

Significance of Effects

17.2.21. Overall, it is considered that the potential for significant effects associated with incidents and accidents involving pedestrians and vehicles, together with the potential for disruption and damage to local roads, as a result of increased construction traffic, is Moderate or Large Adverse (significant), without mitigation.

Access to Education Facilities, Social Welfare Support Facilities and Healthcare Facilities

Description

17.2.22. Construction activities, notably the closure of other roads in the vicinity of the Project alignment, may reduce or prohibit access to education facilities, social welfare support facilities and healthcare facilities.

Magnitude and Severity of Impacts

17.2.23. The description of the magnitude thresholds is provided in Table 17-11 below.

Table 17-11 - Magnitude of Impacts (Access to Education Facilities, Social Welfare Support Facilities and Healthcare Facilities)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Indirect	The potential for reduced or prohibited access is an indirect result of the construction activities.

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Reversibility	Reversible	After competition of construction activities access routes will be re-established.
Geographic Extent	Local	The impact will be limited to the communities within close proximity to the Project alignment.
Time when the Impact Occurs	Immediate	Impact will occur with commencement of construction activities nearby to a local community or residential area.
Duration	Short-term	During construction activities reducing or prohibiting certain local road access.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Moderate	Without mitigation there will be a reduction or prohibition of access to education facilities, social welfare support facilities and healthcare facilities.

17.2.24. The sensitivity of the local community is considered to be **High**.

17.2.25. The construction phase of the Project will be limited in time and physical extent. However, there is the potential that the temporary reduction or prohibition of access to specific local communities or residential areas could have an adverse impact on those requiring urgent access to healthcare facilities and to the vulnerable groups described previously. The most affected settlements would be Dolno Strogmishte and Gorno Strogmishte as there are few alternative routes from these settlements. Therefore, the magnitude of the impact is considered to the Moderate, without mitigation.

Significance of Effects

17.2.26. Overall, it is considered that the potential for significant effects on the local community as a result of reduced or prohibited access to education facilities, social welfare support facilities and healthcare facilities is Large Adverse (significant), without mitigation.

OPERATION PHASE

Operational Community Cohesion and Wellbeing

Description

17.2.27. The operation of the Project has the potential to result in fractions in the local community's interactions and disrupt unity, which has the potential to affect community cohesion. The reason for such impacts would be due to a lack of awareness about the process for raising issues and concerns regarding the Project. Operational concerns may arise in relation to: maintenance, safety, severance, effectiveness of mitigation, and can be expected to be greater the longer they remain unaddressed.

Magnitude and Severity of Impacts

17.2.28. The description of the magnitude thresholds is provided in Table 17-12 below.

Table 17-12 - Magnitude of Impacts (Operational Community Cohesion and Wellbeing)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	The impact creates a negative opinion about the Project.
Type of Impact	Direct	Impact is a result of direct interactions.
Reversibility	Reversible	The impact is reversable if mitigation measures are implemented.
Geographic Extent	Local	The impact will be limited to the communities within close proximity to the Project alignment.
Time when the Impact Occurs	Delayed	There may be a short-term lag in the impact following the commencement of operation.
Duration	Long-term	Throughout the operation of the Project.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Minor	A small number of the local communities may become frustrated and have negative opinions towards the Project.

17.2.29. The sensitivity of the local community is considered to be **Medium**.

17.2.30. The impacts would be limited in extent and the impact reduced though operational measures, set out in the OEMP, including a grievance mechanism, therefore the magnitude of impacts is expected to be **Minor**.

Significance of Effects

17.2.31. Overall, it is considered that the potential for significant effects on community cohesion and wellbeing as a result of issues and concerns of the local communities during the operational phase of the Project is Slight Adverse (not significant) or Moderate Adverse (significant), without mitigation.

17.2.32. Operational related Local Community Incidents and Accidents

Description

17.2.33. There are fourteen road crossing and two parallel roads planned along the route of the Project. Two of the road crossings go over the motorway (overpasses), and the other twelve will pass under it (underpasses). One of the overpasses is for the Kichevo – Gostivar railway line, which runs the entire length of the Project alignment.

17.2.34. The overpasses and underpasses will maintain access to community facilities, preventing severance, and together with the new A2 Motorway, they are expected to improve access to emergency services. These overpasses and underpasses will allow some local traffic to avoid using the Project (i.e. cross roads) for local trips. All new junctions will be designed in accordance with current standards and will be subject to a Road Safety Audit.

17.2.35. The Project will be the preferred route for long distance travel, and it is likely to reduce the amount of heavy goods vehicles and drivers unfamiliar with the roads on the local road infrastructure (including the existing A2). This has the potential to reduce the risk of accidents on the local road network.

17.2.36. There is the potential that the local community will not be used to the new infrastructure and so there is the potential for a greater risk of accidents as a result of the local community interacting with the new motorway. Children at higher risk of this as they will not be as aware of road safety. However, this risk can be reduced through communication with the local community.

Magnitude and Severity of Impacts

17.2.37. The description of the magnitude thresholds is provided in Table 17-13 below.

Table 17-13 - Magnitude of Impacts (Operational Local Community Incidents and Accidents)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Positive	Desirable outcome of the Project.
Type of Impact	Direct	The impact is generated by the Project.
Reversibility	Irreversible	The impact is not reversible.
Geographic Extent	Local	The impact will be limited to the Project alignment.
Time when the Impact Occurs	Immediate	Impact will occur upon commencement of the overpasses and underpasses becoming operational.
Duration	Permanent	The impact is permanent.
Likelihood of Appearance	Certain	The impact has a high likelihood of occurring.
Magnitude	Major	Large improvement over the existing infrastructure.

17.2.38. The sensitivity of the local community is considered to be Medium.

17.2.39. There is potential for large positive impacts, once the local communities commencing usage of the overpasses and underpasses. The new overpass over the railway line that forms part of the Strogmishte interchange will be a significant improvement over the baseline conditions, as it will be suitable for emergency vehicles and will remove the need to use the current width restricted underpass and informal crossing. There are also likely to be fewer accidents and incidents as vehicles are transferred from the existing A2 state road, that was designed to a lower standard, to the new higher standard A2 Motorway. This will reduce the risk of incidents and accidents when compared to the baseline situation. Therefore, the magnitude of the positive impact from the potential for reduction in incidents and accidents involving the local community is considered to be Major.

Significance of Effects

17.2.40. Overall, it is considered that the potential for significant effects on the local community as a result of the local communities using the overpasses and underpasses, and vehicles transferring to the new A2 Motorway, is Moderate or Large Beneficial (significant), without mitigation.

17.3 SUMMARY OF EFFECTS

17.3.1. The following effects are anticipated in the construction phase, before the implementation of mitigation:

- The potential for significant effects on potential for significant effects on community cohesion and wellbeing as a result of the presence of construction workers and the undertaking of construction activities is Moderate or Large Adverse (significant).
- The potential for significant effects on the local community as a result of accessing fenced areas where construction activities are taking place and construction compounds and construction workers' accommodation are located is Moderate or Large Adverse (significant).
- The potential for significant effects associated with the community's health and accidents involving pedestrians, other vehicles, and the potential for disruption and damage to local roads as a result of increased construction traffic is Moderate or Large Adverse (significant).
- The potential for significant effects on the local community as a result of reduced or prohibited access to education facilities, social welfare support facilities and healthcare facilities is Large Adverse (significant).

17.3.2. The following effects are anticipated in the operational phase, before the implementation of mitigation:

- The potential for significant effects on community cohesion and wellbeing as a result of unaddressed issues and concerns, experience by the local communities during the operational phase of the Project is Slight Adverse (not significant) or Moderate Adverse (significant).
- The potential for significant effects on the local community as a result of the local communities using the overpasses and underpasses, and vehicles transferring to the new A2 Motorway alignment, is Moderate or Large Beneficial (significant).

17.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION

17.4.1. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the following Plans will be prepared, which will form part of the Construction Environmental and Social Management Plan (CESMP):

- A Code of Conduct for Construction Workers, which will set out practice measures that the construction workers will have to adhere to ensure a positive relationship is built and maintained with the local communities. A specific training session will be delivered as part of the Code of Conduct on sexual harassment, abuse and exploitation.
- A Community Health, Safety and Security Plan, which will outline health and safety procedures for the protection of the local community and their livestock. Procedures will include the prevention of unauthorised access to the construction sites, construction compounds and the

construction workers' accommodation. The plan will also outline a health and safety campaign for the local communities, with measures to target the safety and risk education of children. The Community Health, Safety and Security Plan will cross reference the Noise and Vibration Management Plan and Air Quality Management Plan.

- A Community Access and Infrastructure Plan will outline the specifications for a temporary railway crossing, that will be constructed prior to the commencement of the construction of the Strogmishte interchange. The temporary crossing will be designed through consultation with the railway operator, safety auditors and the local community, prior to the commencement of construction. This will either be in the form of a temporary level crossing or a temporary bridge structure. The existing informal crossing will be closed off permanently, as both the temporary crossing and the overpass that form part of the Project will provide safer alternatives. The Contractor will be required to create safe pedestrian and traffic corridors through the construction site, at the request of the local community and residents. The same corridors will be marked with visible signs, but also communicated with the representatives of local communities, as well as local schools.
- An Emergency Preparedness and Response Plan, which will include the identification of risks, a process for responding to and recording incidents and accidents.
- A Construction Traffic Management Plan, which provide details of safety measures which will be put in place to reduce effects associated with construction traffic. The plan will cover both on-site and off-site traffic movements. The Plan shall identify traffic diversions and management provisions, traffic schedules, signalling modifications, necessary closures, signage, lighting, and other provisions to ensure that adequate and safe access for motorists and other road users along the Project alignment. As part of the Plan development, the Contractor shall consult with local residents to establish processes and locations for safe livestock crossing of the proposed access roads.
- A Blasting Management Plan will be prepared and implemented by the Contractor. Communities (within the area impacted by blasting related impacts) will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule. Blasting activities will not be allowed on Fridays, which is a day of prayer for the local Muslim population
- A Construction Workers' Accommodation Management Plan, which will set out best practice measures, with a particular focus on the prevention of gender-based violence and the promotion of a gender-sensitive working environment. Prior to the start of site works, an Environmental and Social Screening of potential camp locations will be undertaken to identify any sensitive environmental and social receptors and to ensure the camps are of sufficient distance from villages and local communities. During the construction phase of the Project these plans will be reviewed, as a minimum quarterly, and with changes to international and national legislation, as appropriate.

17.4.2. In addition, the Contractor will implement the Stakeholder Engagement Plan (SEP). The SEP will be a live document, which will set out the implementing bodies' commitments in relation to stakeholder engagement, consultation and disclosure activities in connection with the Project. The SEP details engagement undertaken with stakeholders during the Project and serves as a guide for future phases. The SEP includes a formal grievance procedure, which will be implemented during the pre-construction and construction phases of the Project to receive the affected communities' concerns and views. The SEP includes measures to ensure engagement with local schools and communities to inform them of the risk associated with a live construction site.

Construction Traffic

17.4.3. The Contractor shall provide information to the local communities about the scope and schedule of construction activities, expected disruption and access restrictions at least 24 hours before commencement. Construction site access roads which are also used by local traffic shall include safe passing places every 200 m where the roads are narrow.

Construction Workers' Accommodation

17.4.4. Prior to construction workers' accommodation being provided a screening process of suitable sites will be undertaken. The screening process will consider sensitive environmental and social receptors in addition to national requirements and permits. The screening process will be undertaken in parallel with consultations with the local communities. As a minimum the construction workers' accommodation will be:

- Located at least 1 km away from any residential dwellings;
- Located at least 50 m away from any rivers or streams; and
- Located at least 2 km away from any protected areas.

17.4.5. Any deviation from the above distances must be supported by sufficient justification and additional mitigation measures, where appropriate.

17.4.6. The construction workers' accommodation will be staffed and equipped with healthcare facilities for all workers, to avoid straining the available healthcare facilities that are serve the local communities.

17.4.7. The Contractor will be responsible for maintenance of the construction workers' accommodation and ensuring that the land is returned to its original state (pre-construction) following the completion of the construction phase of the Project.

OPERATION

17.4.8. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of the operational phase the following Plans will be prepared, which will form part of the Operational Environmental and Social Management Plan (OESMP):

- An Operational Community Health, Safety and Security Management Plan, which will inform the community of any hazards or restrictions along the Project alignment.
- An Operational Worker Health and Safety Management Plan, which will set out best practice measures to be followed by operational workers undertaking maintenance and inspection activities.
- Road Safety Audits, which will include accident logs which will be reviewed, and corrective measures put in place, where appropriate.
- An Emergency Preparedness and Response Plan (including a Tunnel Emergency Response Plan), which will outline roles, responsibilities and resource requirements to deal with various types of incidents.
- A Tunnel Operational Management Plan will set out the maintenance requirements for the tunnel and will outline training requirements for personnel. This will ensure the tunnels are safe for road users.

17.4.9. In addition, an Operational Stakeholder Engagement Plan (SEP) with a Grievance Mechanism will be prepared. The Plan will outline community consultation activities to ensure public feedback on the Project is recorded and addressed. The Operational SEP will include a road safety campaign for children to ensure they are aware of the risks of the new infrastructure.

17.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Construction Community Cohesion and Wellbeing

17.5.1. With the mitigation measures in place, it is anticipated that effects on community cohesion and wellbeing as a result of the presence of construction workers and the undertaking of construction activities will be Slight Adverse (not significant).

Construction related Local Community Health Impacts and Accidents

17.5.2. With the mitigation measures in place, it is anticipated that effects on local community as a result of accessing fenced areas where construction activities are taking place and construction compounds and construction workers' accommodation are located will be Slight Adverse (not significant).

Construction Traffic

17.5.3. With the mitigation measures in place, it is anticipated that effects associated with incidents and accidents involving pedestrians and vehicles, and the potential for disruption and damage to local roads as a result of increased construction traffic will be Slight Adverse (not significant).

Access to Education Facilities, Social Welfare Support Facilities and Healthcare Facilities

17.5.4. With the mitigation measures in place, it is anticipated that effects on the local community as a result of reduced or prohibited access to education facilities, social welfare support facilities and healthcare facilities will be Slight Adverse (not significant).

OPERATION PHASE

Operational Community Cohesion and Wellbeing

17.5.5. With the mitigation measures in place, it is anticipated that effects on community cohesion and wellbeing as a result of issues and concerns, experience by the local communities during the operational phase of the Project will be Slight Adverse (not significant).

Operational related Local Community Incidents and Accidents

17.5.6. With the mitigation measures in place, it is anticipated that effects on the local community as a result of the local communities using the overpasses and underpasses, and vehicles transferring to the new A2 Motorway, will be Large Beneficial (significant).

17.6 SUMMARY

Table 17-14 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
Social and Community	Construction	Construction Community Cohesion and Wellbeing	Moderate or Large Adverse (significant)	A Code of Conduct for Construction Workers. A Community Health, Safety and Security Plan. A Community Access and Infrastructure Plan. An Emergency Preparedness and Response Plan. A Traffic Management Plan. A Construction Workers' Accommodation Management Plan. A SEP.	Slight Adverse (not significant)
		Construction related Local Community Health and Accidents	Moderate or Large Adverse (significant)		Slight Adverse (not significant)
		Construction Traffic	Large Adverse (significant)		Slight Adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
		Access to Education Facilities, Social Welfare Support Facilities and Healthcare Facilities	Large Adverse (significant)		Slight Adverse (not significant)
	Operation	Operational Community Cohesion and Wellbeing	Slight Adverse (not significant) or Moderate Adverse (significant)	An Operational Community Health and Safety Management Plan. An Operational Worker Health and Safety Management Plan. Road Safety Audits. An Emergency Preparedness and Response Plan. A SEP.	Slight Adverse (not significant)
		Operational Local Community Incidents and Accidents	Moderate or Large Beneficial (significant)		Large Beneficial (significant)

18 OCCUPATIONAL HEALTH, SAFETY AND SECURITY INTRODUCTION

18.1 BASELINE CONDITIONS

18.1.1. The baseline conditions for Occupational Health Safety and Security have been considered in relation to relevant Macedonian legislation. This chapter considers Occupational Health Safety and Security impacts on Construction workers.

18.1.2. Employers, under primary and secondary Macedonian laws on occupational health and safety are required to take all necessary measures to provide and maintain a safe and healthy workplace taking in account into account inherent risks in its particular sector and specific classes of hazards that may be present. Employees are also required to obey and observe all measures taken to ensure acceptable occupational health and safety. Other occupation health and safety matters addressed in primary and secondary Macedonian laws are inclusive of but not limited to, trade union provisions, working hours, pensions, disabilities, salaries, healthcare and discrimination.

18.1.3. Employers must inform the employees of the occupational risks and preventative measures that must be taken to address said risks. The employer must take all necessary measures to prevent occupational illnesses.

18.1.4. The employer must inform employees of their legal rights and obligations and must provide the employees with the necessary training on occupational health and safety.

18.1.5. The employer is responsible for the provision of a safe working environment and must provide workers all the required Personal Protective Equipment (PPE), without any cost to them. The employer must regularly inspect, and audit PPE provided, along with all other health and safety equipment, to ensure that they are in good working order.

18.1.6. With specific regard to construction activities, the primary and secondary Macedonian laws require employers to prepare a health and safety plan (or equivalent) prior to the commencement of any construction activities.

18.1.7. Further details regarding the primary and secondary Macedonian laws are provided in Section 3.4 of **Chapter 3: ESIA Legislation and Requirements**.

18.2 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Construction Workers Employment Rights and Working Conditions

Description

18.2.1. There is a risk that employed construction workers may not be provided with adequate working conditions, and that the Contractor (and sub-contractors) may not follow national legislation in relation to workers' rights, HSE and relevant entitlements.

Magnitude and Severity of Impacts

18.2.2. The description of the magnitude thresholds is provided in Table 18-1 below.

Table 18-1 - Magnitude of Impacts (Labour and Working Conditions)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Direct impacts to employees and workers
Reversibility	Reversible	Impact is reversible if relevant workers rights and HSE requirements are put in place.
Geographic Extent	Local	Limited to the workers on the Project.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Medium term	It could last for the entire construction phase unless appropriate measures are in place.
Likelihood of Appearance	Unlikely	The impact can be considered to be unlikely to occur, as any contractor will need to comply with national employment legislation and works will be undertaken under continued and appropriate supervision.
Magnitude	Moderate	Likely to be limited due to presence of national employment legislation.

18.2.3. The sensitivity of the workforce is considered to be **Medium**.

18.2.4. The construction phase of the Project will be limited in time and physical extent; however, the consequences could extend beyond the construction phase. The anticipated magnitude of the impact is **Moderate**.

Significance of Effects

18.2.5. Overall, it is considered that the potential for significant effects associated with workers' rights and employment conditions is **Moderate Adverse** (**significant**), but this risk will be mitigated.

18.2.6. HSE Management on-site and HSE training among workers

Description

18.2.7. There is also a risk that contractors could hire people without the appropriate training and / or qualifications. Construction workers without the appropriate training and / or qualification pose risks to the safety and quality of the Project, as well as an inherent risk to the local communities.

Magnitude and Severity of Impacts

18.2.8. The description of the magnitude thresholds is provided in Table 18-2 below.

Table 18-2 - Magnitude of Impacts (HSE Management on-site and HSE training among workers)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Direct impacts caused by untrained / unskilled construction workers.
Reversibility	Reversible	Impact is reversible if training and / or qualifications are provided.
Geographic Extent	Local	Limited to the Project alignment and any construction compounds.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Short-term	It will last the time for which the construction activities occur or until training and / or qualifications are provided.
Likelihood of Appearance	Unlikely	The impact can be considered to be unlikely to occur, as there are suitably trained and qualified construction workers within the Municipality and the Republic of North Macedonia, and the contrators and subconstractors will be required to engage suitable qualified personel.
Magnitude	Major	Potential for severe safety and quality risks to the Project, as well inherent risk to the local communities.

18.2.9. The sensitivity of the Project and the local community is considered to be High due to the rural nature of the Project and scale and importance of the Project itself (accidents / poor workmanship could cause significant delays on a nationally significant infrastructure project for example).

18.2.10. The construction phase of the Project will be limited in time and physical extent, however, the consequences of using construction workers without the appropriate training and / or qualifications could be severe. Therefore, the anticipated magnitude of the impact is Major.

Significance of Effects

18.2.11. Overall, it is considered that the potential for significant effects associated with construction workers without the appropriate training and / or qualifications is Large or Very Large Adverse (significant), and this risk will be mitigated.

Construction Worker Incidents and Accidents

Description

18.2.12. While it is expected that the contractor and their sub-contractors (if applicable) will undertake the required checks to ensure they employ construction workers with the appropriate training and / or qualifications, construction activities have inherent risks of incidents and accidents. The contractor and subcontractors (if applicable) must provide workers with relevant information, instruction and training relating to health and safety hazards, risks, protective and preventive measures and emergency arrangements that are necessary for their health and safety throughout the Project. Such risks are associated with activities such as working at heights, excavations, quarrying, drilling and blasting, crossing roads and the railway line, excavation of contaminated soils, and the use of Heavy Good Vehicles (HGVs) and machinery.

18.2.13. Incidents and accident associated with construction activities may cause harm, severe injury, or death, to construction workers, and in some situations also to the local community (see Chapter 17).

Magnitude and Severity of Impacts

18.2.14. The description of the magnitude thresholds is provided in Table 18-3 below.

Table 18-3 - Magnitude of Impacts (Construction Worker Incidents and Accidents)

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Direct impacts to construction workers.
Reversibility	Reversible	Impact is reversible.
Geographic Extent	Local	Limited to the Project alignment and any construction compounds.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Unlikely	The impact can be considered to be unlikely to occur, as there are suitably trained and qualified construction workers within the surrounding area. All new workers (including those that are unskilled / have not worked on construction projects before) will be provided with relevant instruction and training prior to being allowed to start work. All workers will be inducted on site.
Magnitude	Major	Incidents and accident associated with construction activities may cause harm, severe injury or death to construction workers.

18.2.15. The sensitivity of the construction workers is considered to be Medium, as although it is anticipated that they will be provided with suitable training, this will only reduce the likelihood of events occurring, and not their sensitivity.

18.2.16. The construction phase of the Project will be limited in time and physical extent, however potential consequences of an incident or accident could be severe. Therefore, the anticipated magnitude of the impact is Major.

Significance of Effects

18.2.17. Overall, it is considered that the potential for significant effects associated with incidents and accidents involving construction worker is Moderate or Large Adverse (significant), and mitigation has been proposed to reduce this to an acceptable level.

Construction Workers' Accommodation

18.2.18. Construction workers' accommodation will be provided as part of the Project. As explained in Chapter 2: Description of the Project, prior to construction workers' accommodation being provided a screening process of suitable sites will be undertaken.

18.2.19. It is not expected that the construction workforce will be larger than the local population. However, it is likely that the construction workers will use components of the existing social infrastructure and utilities. The use of the existing social infrastructure may place pressure on local resources, which could cause tension between the local community and the workforce and pose risks to the safety of the construction workers using the construction workers' accommodation. These workers could also benefit the local economy, and this is considered in Chapter 19 – Property and Livelihood.

18.2.20. If the Construction Worker's Accommodation is of poor design or is not appropriately cleaned and maintained, there is a risk that workers may become ill due to environmental factors (cold, damp conditions for example) or through the spread of infectious diseases. This risk will be mitigated as set out in section 18.4.

18.2.21. If the Project uses an internationally sourced workforce, as per the M4 Kichevo – Ohrid, motorway project to the south, there may be cultural differences between the international workforce and local community which may cause issues. This risk will be mitigated as set out in section 18.4.

Magnitude and Severity of Impacts

18.2.22. The description of the magnitude thresholds is provided in Table 18-4 below.

Table 18-4 - Magnitude of Impacts (Construction Workers' Accommodation)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Direct impacts to construction workers.
Reversibility	Reversible	Impact is reversible.
Geographic Extent	Local	Limited to the local communities in close proximity to the Project.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Short-term	It will last the time for which the construction activities

Criteria	Assessment Thresholds	
	Threshold	Descriptions
		occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Minor	Use of social infrastructure within the local community is expected to be limited as the Contractor will be required to provide all necessary in-house facilities (for recreation, health and fitness and for minor accident and emergencies) . The camps will be located in urban locations, so will have access to utilities, use of utilities will be agreed with utility providers in advance.

18.2.23. The sensitivity of the local community is considered to be **High**.

18.2.24. The construction phase of the Project will be limited in time and physical extent, and the use of social infrastructure within the local community is expected to be limited and the use of utilities, such as electricity and water, will be agreed in advance with the relevant utility providers. Therefore, the anticipated magnitude of the impact is **Minor**.

Significance of Effects

18.2.25. Overall, it is considered that the potential for significant effects associated with the safety of the construction workers, and the effect on social infrastructure due to the construction workers' accommodation is **Slight Adverse** (**not significant**) or **Moderate Adverse** (**significant**).

OPERATIONAL PHASE

Subsequent Employment of Construction Workers

Description

18.2.26. It is understood that there are suitably trained, and qualified construction workers are available within the Municipality due to the presence of the adjacent motorway project (comprising an internationally sourced workforce). Following the completion of the construction phase of the Project, Macedonian construction workers will need to find alternative employment opportunities, their employability will be enhance via the measures set out in the mitigation section. An internationally sourced workforce is likely to seek international employment options.

18.2.27. The training, qualifications and experience of the construction workforce will be valuable to the Republic of North Macedonia and its economy. Macedonian construction workers will benefit from working on a project aligned to EU and EBRD requirements which will improve their skills in regard to H&S and their employability.

Magnitude and Severity of Impacts

18.2.28. The description of the magnitude thresholds is provided in Table 18-5 below.

Table 18-5 - Magnitude of Impacts (Subsequent Employment of Construction Workers)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Positive	Impact will improve current situation.
Type of Impact	Indirect	In direct impacts to the construction workers and subsequently the local community and the local economy.
Reversibility	Irreversible	The training, qualifications and experience of the construction workforce will have been gained and as such it is irreversible.
Geographic Extent	National	Impacts have the potential to extend across the Republic of North Macedonia.
Time when the Impact Occurs	Immediate	Effect will occur immediately following completion of the construction activities.
Duration	Long-term	The training, qualifications and experience of the construction workforce will sit with the workers and will cascade to future workforces.
Likelihood of Appearance	Certain	The impact can be considered to have a high likelihood of occurring.
Magnitude	Moderate	Large improvement over the existing workforce.

18.2.29. The sensitivity of the construction workers is considered to be **Medium.**

18.2.30. There is the potential for large positive impacts once the training, qualifications and experience of the construction workforce cascades throughout the Republic of North Macedonia and to future construction workforces. Therefore, the magnitude of the positive impact is considered to be **Moderate**.

18.2.31. If a mainly internationally sourced workforce is used, the direct benefits to the workforce of the Republic of North Macedonia will be reduced to Minor levels as the workforce will likely return to their home country or work on another international project rather than remain in country. However, this reduction in benefit is considered unlikely to occur following the implementation of the Local Employment and Procurement Plan in the ESMP (Chapter 23).

Significance of Effects

18.2.32. Overall, it is considered that the potential for significant effects to the Republic of North Macedonia and its economy as a result of the training, qualifications and experience gained by the construction workforce is between **Slight** to **Moderate Beneficial** (**non-significant** and **significant**), without mitigation.

18.3 SUMMARY OF EFFECTS

18.3.1. The following effects are anticipated during the construction phase, before the implementation of mitigation:

- The potential for significant effects associated with workers' rights is **Moderate Adverse** (**significant**).
- The potential for significant effects associated with construction workers without the appropriate training and / or qualifications is **Large** or **Very Large Adverse** (**significant**).
- The potential for significant effects associated with incidents and accidents involving construction worker is **Major Adverse** (**significant**).
- The potential for significant effects associated with the safety of the construction workers using the construction workers' accommodation is **Slight Adverse** (**not significant**) or **Moderate Adverse** (**significant**).

18.3.2. The following effects are anticipated during the operational phase, before the implementation of mitigation:

18.3.3. Potential for significant effects to the Republic of North Macedonia and its economy as a result of the training, qualifications and experience gained by the construction workforce is **Slight** (**not significant**) to **Moderate Beneficial** (**significant**).

18.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

18.4.1. The PESR, will establish a PIU, who will Prepare and implement an Environmental and Social Management System (ESMS), aligned to the principles of ISO 14001:2015 and EBRD Performance Requirements. The Contractor will be required to ensure their ESMS is aligned with the PIU's ESMS.

18.4.2. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the following Plans will be prepared, which will form part of the Construction Environmental and Social Management Plan (CESMP):

- A **Health and Safety Management System**, that is aligned with the PIU's ESMS, and which will be mandatory for the contractors and their sub-contractors. The System will be inclusive of, but not limited to, measures associated with developing of H&S procedures, risk assessments, incident reporting and investigation, emergency preparedness and response, PPE, training delivery and security arrangements. The ESMS will set out the approach to risk assessments, accident/incident investigation, developing a safe system of work and the selection of work equipment. The Contractor and their sub-contractors will employ qualified Health and Safety personnel.
- An **Occupational Health and Safety Plan**, which will support the Health and Safety Management System and will be complaint with the primary and secondary Macedonian laws discussed in Section 18.1. The Plan will contain details regarding (but not limited to), roles and responsibilities, risk assessment and control processes, PPE requirements, enforcement mechanisms, safety training for all personnel and reporting procedures for incidents and accidents. The workforce will be encouraged to stop works when imminent danger is present and to report any unsafe acts or condition in the workplace. The Contractor, and their sub contractors, will need to ensure that all workers are provided with continued and appropriate supervision to ensure safe use of work equipment and adequate implementation and enforcement of the safety and health procedures and rules. Labour audits will be undertaken to monitor the implementation of Occupational Health and Safety Plan, including reviews of employee's induction records, training records, near misses and complaints raised.

- A **Grievance Mechanism for Workers** and a **Code of Conduct for Construction Workers**. A Grievance Mechanism will set out the process for workers to communicate their grievances. A Code of Conduct will set out practice measures that the construction workers will have to adhere, to ensure a positive relationship is built and maintained with the local communities. A specific training session will be delivered as part of the Code of Conduct on sexual harassment, abuse, exploitation, including a requirement not to forage for plants and fungi. All construction workers (those directly employed and those subcontracted) will sign the Code of Conduct, which should be accessible and visible.
- A **Local Employment and Procurement Plan**, which will ensure that priority is given to employing the local workforce where the skills are appropriate. The Plan will cover all aspects, from the analysis of the existing skills available at a local, regional and national level, to the processes of employment.
- A **Construction Workers' Accommodation Management Plan**, which will set out best practice measures, including requirements for good quality accommodation to protect workers' health, with a focus on the prevention of gender-based violence and the promotion of a gender-sensitive working environment. Measures to prevent illness or the spread of infectious diseases will be key components of the plan.
- A **Supply Chain Management Plan** will be prepared by the Contractor ahead of the start of works. All mitigation outlined within this chapter and the ESMP will apply to all suppliers and sub-contractors.
- A **Labour and Working Conditions Management Plan** (**LWCMP**) will be prepared by the Contractor. The Contractor will conduct induction training for all workers prior to the start of civil works in a format easily understood by the workforce. The workforce induction and documentation should specifically include: worker rights and responsibilities, including the worker grievance procedure, cultural context induction, and interaction / engagement with community members. The induction needs to apply for all workers (anyone working on the project site). The above measures will be secured through contractual mechanisms and measures in the Contractor's CESMP, which will be approved by the Engineer and PESR. The LWCMP will align with the **Grievance Mechanism** (**GM**).
- A **Blasting Management Plan** will be prepared by the Contractor. It will include measures for the safe and secure storage of blasting equipment (including explosives) when not in use, the requirements for pre and post blast surveys. The Contactor must appoint an authorised blasting contractor. The PESR/ Supervising Engineer to review the contractor's licence.
- A **Construction Traffic Management Plan** (**CTMP**) will be prepared by the Contractor. The plan shall be designed to ensure that traffic congestion and traffic safety impacts due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimised. The plan shall be prepared in consultation with traffic officials. The plan will cover both on-site and off-site traffic movements.
- A **Stakeholder Engagement plan** will be implemented during the construction period which will include a Grievance Mechanism. If external parties note any dangerous activities on site, they will be able to raise it formally.
- All construction based management plans will cross-reference the equivalent community focused management plans such as the **Community Health, Safety and Security Plan**.
- All works will be undertaken in accordance with **Construction Plans** and **Method Statements** prepared prior to the start of construction works.

18.4.3. During the construction phase of the Project these plans will be reviewed, as a minimum quarterly, and with changes to international and national legislation, as appropriate. They will also be reviewed following any safety incidents and accidents.

Construction Workers Recruitment

18.4.4. Contractors will be required to implement policies into their recruitment procedures to account for hiring of local workers and the general public.

Construction Workers Training

18.4.5. Prior to the construction phase of the Project commencing the contractor will review the qualifications held by all construction workers (those directly employed and those subcontracted). The contractor will subsequently organise and provide a comprehensive one-day training course for all construction workers (those directly employed and those subcontracted).

18.4.6. During the construction phase of the Project the contractor will develop and implement a safety and security training programme for all construction workers. The programme will include toolbox talks, safety briefings, and topic specific training. The contractor will conduct safety briefings, as a minimum, on a monthly basis.

18.4.7. The Contractor will prepare **Construction Plans and Method Statements** for all activities to ensure that all works are undertaken in a safe manner. All workers will sign up to these plans and method statements to confirm they understand the requirements. For any particular/critical activity that needs additional H&S measures, supplementary training should be delivered the workforce to cover any update or change in the risk assessment and working procedure.

Construction Workers Contracts

18.4.8. All construction workers (those directly employed and those subcontracted) will have employment contracts. The contracts will detail employees' rights and working conditions, and responsibilities in relation to their own health and safety. Contracts will be explained to all workers when necessary to ensure that workers understand the detail presented. Contracts will be signed before the commencement of any construction activities.

OPERATIONAL PHASE

18.4.9. As part of the **Labour and Working Conditions Management Plan** (**LWCMP**), all employees will be provided with a reference/ confirmation of employment letter and a skills/ training log, to enhance their employment prospects. This will be a benefit for both a local and internationally sourced workforce.

18.4.10. During operational works, an **Operational Worker Health and Safety Management Plan** will be prepared and implemented which will set out best practice measures to be followed by operational workers undertaking maintenance and inspection activities.

18.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Construction Workers employment rights and working conditions

18.5.1. Prior to the implementation of mitigation, the effect on construction workers employment rights and working conditions will be **Moderate Adverse**. Mitigation in the form of Labour and Working

Conditions Management Plan (LWCMP) will reduce this effect. With the mitigation measures in place, it is anticipated that effects associated with workers' rights will be **Slight Adverse** (**not significant**).

HSE Management on-site and HSE training among workers

18.5.2. Prior to the implementation of mitigation, a **Large** or **Very Large Adverse** effect may occur. Mitigation will be required in the form of an Occupational Health and Safety Plan and Construction Plans and Method Statements. With the mitigation measures in place, it is anticipated that effects associated with construction workers without the appropriate training and / or qualifications will be **Slight Adverse** (**not significant**).

Construction Worker Incidents and Accidents

18.5.3. Prior to mitigation, the effect of accidents involving construction workers will be **Moderate** or **Large Adverse**. Mitigation will be required in the form of an Occupational Health and Safety Plan. With the mitigation measures in place, it is anticipated that effects associated with incidents and accidents involving construction worker will be **Slight Adverse** (**not significant**).

Construction Workers' Accommodation

18.5.4. Prior to mitigation the effect of worker's accommodation may be **Slight Adverse** to **Moderate Adverse**. A Construction Workers' Accommodation Management Plan will be prepared and implemented as mitigation. With the mitigation measures in place, it is anticipated that effects associated with the use of community infrastructure, in relation to the construction workers' accommodation will be **Slight Adverse** (**not significant**).

OPERATIONAL PHASE

Subsequent Employment of Construction Workers

18.5.5. A **Slight to Moderate Beneficial** effect will occur prior to the implementation of mitigation. It is anticipated that beneficial effects associated with the training, qualifications and experience gained by the construction workforce for the Republic of North Macedonia and its economy will remain **Moderate Beneficial** (**significant**).

18.6 SUMMARY OF EFFECTS

Table 18-6 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
Occupational Health, Safety and Security	Construction	Construction Workers employment rights and working conditions	Moderate Adverse (significant)	An **Occupational Health and Safety Management System**. An **Occupational Health and Safety Plan**. A **Code of Conduct for Construction Workers**. A **Local Employment and Procurement Plan**. A **Construction Workers' Accommodation Management Plan**. **Labour and Working Conditions Management Plan (LWCMP)** Provision of construction workers training and construction workers contracts.	Slight Adverse (not significant)
		Employment of Construction Workers (HSE management on site and HSE training among workers)	Large or Very Large Adverse (significant)		Slight Adverse (not significant)
		Construction Worker Incidents and Accidents (Labour and Working Conditions)	Moderate or Large Adverse (significant)		Slight Adverse (not significant)
		Construction Workers' Accommodation (HSE management on site and HSE training among workers)	Slight Adverse (not significant) or Moderate Adverse (significant)		Slight Adverse (not significant)
	Operation	Subsequent Employment of Construction Workers	Minor to Moderate Beneficial (non-	All employees will be provided with a reference/ confirmation of employment	Moderate Beneficial (significant)

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
			significant and significant))	letter and a skills/ training log, to enhance their subsequent employment prospects.	

19 PROPERTY AND LIVELIHOOD

19.1 BASELINE CONDITIONS

19.1.1. The baseline data has been obtained through a combination of observations during a site visit, and the desk-based review of third-party information and official census data.

19.1.2. At the time of preparing this chapter, the Expropriation Elaborate had not been finalised, so a full census of all the properties that would need to be acquired for the purpose of this Project has not been completed. The baseline study will be established further and confirmed during a census of the Project area ahead of the start of works and to inform the Land Acquisition Plan (LAP).

PROPERTY

19.1.3. The City of Kichevo, located at the southern end of the Project alignment, is the largest urban settlement in the surrounding area. Residents of the City of Kichevo typically live in flats or apartments.

19.1.4. The rural settlements in the wider Municipality of Kichevo are compact and mostly located in valleys, near rivers and along the main road infrastructure. The rural settlements surrounding the Project alignment include Bukojchani, Gorno Strogomishte, Dolno Strogomishte, Oslomej, Osoj, Trapchin Dol, Rashtani, Crvivci, Kolibari, and Zajas. Residents of the rural settlements typically live in houses.

19.1.5. The typical household types in the Municipality of Kichevo are as follows:

- Individual households composed of a single family (83%);
- Households which include extended family (three of four generations) households (9%); and
- Households with two or more families (8%).

19.1.6. Individuals of Albanian ethnic origin are more likely to live in households with two or more families.

19.1.7. Among the households with one family, most are married couples with children (69%), followed by households consisting of married couples without children (20%). The average number of family members within Kichevo municipality is 3.36 members per family.

19.1.8. It is not uncommon for individuals to emigrate abroad, returning only in summer, leaving their homes empty during this time.

19.1.9. In Osoj area, which was visited in July 2019, it was noted that local Roma families live close to the Project alignment. Up to eight (8) local Roma households could be affected by the Project through physical displacement or reduced access to property, but this will be established through the census to inform the LAP.

ECONOMY, NATURAL RESOURCES USE AND LIVELIHOOD

19.1.10. Macedonian residents generally gain their income from:

- Employment (salary and other income);
- Income from property and property rights (renting real-estate and other means);
- Farming and providing independent services;
- Transferable incomes (retirement, social transfers, transfers to unemployed and current private transfers from abroad);
- Capital gains (income from securities sale, capital participation and real-estate); and

- Dividend and interest inflow (inflow of investments or capital inflows).

19.1.11. Based on available census data, the main income source in the area surrounding the Project alignment is salaried employment. The transfer of money from family members abroad may represent a significant proportion of income within some communities within the Project area. Again, this will be confirmed through the census to inform the LAP.

19.1.12. Some residents from the rural settlements surrounding the Project alignment supplement their incomes with agricultural activities, such as farming. Some residents rent real-estate or property, such as farmland, to others. Other sources of income include: informal employment such as in unregistered garages and workshops, logging, foraging and the sale of food. In addition, some residents work abroad on a seasonal basis to supplement their household income and send remittances to their families.

19.1.13. It is understood that some residents gather plants for culinary needs (such as rare herbs, plants, and fungi etc).

19.1.14. It is not uncommon in the region for individuals to emigrate abroad during the non-summer months for employment. These individuals will return during the summer and will spend some of their earnings in the local economy (construction, food etc). Therefore, a proportion of the local population are not tied to the Project Area for employment reasons. This will be established and confirmed through the census to inform the LAP.

EMPLOYMENT

19.1.15. Based on census data, the population is divided into economically active and economically inactive individuals. The economically active population comprises individuals over 15 years of age who are employed, self-employed, or are seeking employment. The economically inactive population are people who are capable of working but are not in employment or actively seeking employment (such as students) and those who are unable to work (such as pensioners). The economically inactive population includes: homemakers, military personnel, prisoners, students, pensioners and people physically unable to work, such as disabled individuals.

19.1.16. According to census data, the Republic of North Macedonia has a relatively high unemployment rate. However, the unemployment rate in the Municipality of Kichevo is slightly lower than the national average.

19.1.17. The following table shows the number of unemployed people both nationally and in the Municipality of Kichevo.

Table 19-1 - Unemployment in the Republic of North Macedonia and the Municipality of Kichevo (2013 to 2018)[109]

Year	North Macedonia			Municipality of Kichevo		
	Total Population	Population Unemployed	Percentage	Total Population	Population Unemployed	Percentage
2013	96,200	26,089	27.12%	3,322	889	26.76%
2014	123,661	37,436	30.27%	4,442	1,277	28.75%
2015	114,979	35,928	31.25%	3,842	1,150	29.93%
2016	104,523	34,335	32.85%	3,449	1,101	31.92%
2017	102,94	33,899	33.11%	3,214	1,037	32.27%
2018	94,721	32,150	33.94%	2,513	770	30.64%

19.1.18. Figure 19-1 shows the ethnic composition of the unemployed population in the Municipality of Kichevo, as on the 31st December 2018.

[109] The Employment Agency of the Republic of North Macedonia (website).

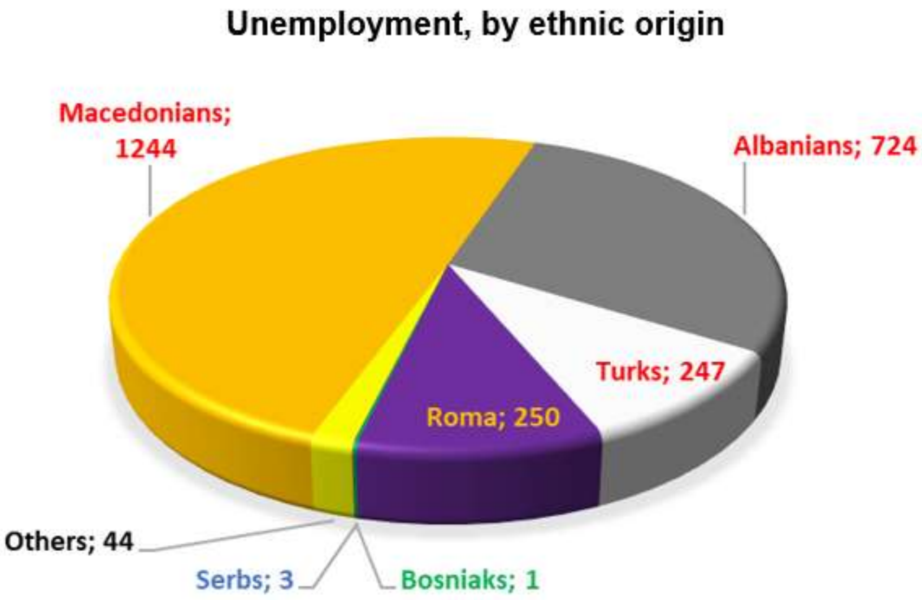

Figure 19-1 - Ethnic Composition of Unemployment in Municipality of Kichevo[110]

19.1.19. According to census data, approximately half of the unemployed in the Municipality of Kichevo are of Macedonian ethnic origin and over a quarter are of Albanian ethnic origin. Turkish and Roma largely comprise the remaining ethnic origin.

19.1.20. In total 41.7% of those unemployed in the Municipality of Kichevo are female.

EMPLOYMENT SECTORS

19.1.21. The service sector (for example hospitality, health, utilities and education) is the main sector for employment in the Municipality of Kichevo, followed by agriculture and the food processing industry, the wood industry, and textile industry. The following table provides a summary of the number of businesses per sectors in the Republic of North Macedonia and the Municipality of Kichevo.

[110] The Employment Agency of the Republic of North Macedonia (website).

Table 19-2 - Sectors in the Republic of North Macedonia and the Municipality of Kichevo (2018)[111]

Sector	Number of Businesses	
	Republic of North Macedonia	Municipality of Kichevo
Agriculture, Forestry and Fishing	2,546	28
Mining and Quarrying	205	4
Manufacturing	8,033	131
Electricity, Gas, Steam and Air Conditioning Supply	186	0
Water Supply, Sewerage, Waste Management and Remediation	250	3
Construction	4,938	128
Wholesale and Retail	22,950	529
Transportation and Storage	5,667	100
Accommodation and Food	4,597	120
Information and Communication	1,856	18
Financial and Insurance	448	11
Real Estate	575	4
Professional, Scientific and Technical	7,261	115
Administrative and Support	1,752	24

[111] Website of State Statistical Office, MAKStat Database.

Sector	Number of Businesses	
	Republic of North Macedonia	Municipality of Kichevo
Public Administration and Defence	264	3
Education	1,222	22
Human Health and Social	3,357	73
Arts, Entertainment and Recreation	1,404	23
Other	4,804	111
Total	**72,315**	**1447**

19.1.22. The Municipality of Kichevo has approximately 2% of the total number of businesses in the Republic of North Macedonia. Table 19-3 depicts the size of businesses within the Municipality of Kichevo. Businesses are categorised as micro, small, and medium-size enterprises, based on the number of employees. There is no standard definition of firm size; however, many institutions that collect information use the following size categories: very small enterprises have 0 to 9 employees, small enterprises have 10 to 49 employees, and medium-size enterprises have 50 to 249 employees.

Table 19-3 - Business Size in the Municipality of Kichevo (2014 to 2018)[112]

Year	Very Small	Small	Medium	Large	Total
2018	1,204	231	8	4	1,447
2017	1,221	225	8	2	1,456
2016	1,249	221	10	2	1,482
2015	1.197	211	10	1	1,419

[112] Website of State Statistical Office, MAKStat Database .

Year	Very Small	Small	Medium	Large	Total
2014	1,175	233	7	2	1,417

19.1.23. Within the Municipality of Kichevo the majority of businesses are very small enterprises, comprising 83.2% of the total number of businesses. A further 16% of businesses within the Municipality of Kichevo are small enterprises.

19.1.24. A Thermal Power Plant is located next to the rural settlement of Oslomej, approximately 3 km east of the Project alignment beyond the rural settlement of Dolno Strogomishte. The Thermal Power Plant employs a large number of individuals who reside in close proximity to the Project. Furthermore, the Tajmishte iron mine is located approximately 9 km west of the Project alignment. The iron mine is also a source of employment for individuals who reside in close proximity to the Project.

AGRICULTURE

19.1.25. Agriculture in is the highest income generating activity in the rural settlements surrounding the Project alignment, and the second highest income generating activity in the city of Kichevo.

19.1.26. In 2007, the State Statistical Office for the Republic of North Macedonia conducted a detailed agricultural survey. The survey provided information on the state and the character of the agricultural land and the agricultural sector across the Republic of North Macedonia. The survey data for the Municipality of Kichevo recorded 5,649 agricultural holdings, across 15,881 separate parcels of land, which in total covered 4,880 hectares (ha). The 4,880 hectares represents 81.7% of the total available agricultural land in the Municipality of Kichevo. The average plot size in the municipality is 0.38ha, which is lower than the national average of 0.5ha.

19.1.27. The following table presents the uses for the agricultural land in the Municipality of Kichevo.

Table 19-4 - Agricultural Land Use in the Municipality of Kichevo (2007)[113]

Type of Agricultural Land	Hectares
Meadows	2,128
Pastures	460
Orchards	178

[113] Website of State Statistical Office, MAKStat Database.

Type of Agricultural Land	Hectares
Vineyards	5
Nurseries	2
Cereals	1,524
Industrial Crops	7
Fodder Crops	260
Vegetables	259
Aromatic and Medical Plants	0
Flowers and Decorative Plants	5
Seeds and Seedlings	1
Fallow Land and Other Uncultivated Land	51
Total	**4,880**

19.1.28. In the Municipality of Kichevo the agricultural land that is in use is predominantly divided between meadows and cereal crops. Further data sources indicated that there are also two fish-farms, covering 0.2 ha in the Municipality of Kichevo.

19.1.29. The following figure shows the agricultural practices of the individual agricultural holdings in the Municipality of Kichevo. The most common are cereals, planted at 4,259 of the 5,649 individual agricultural holdings. Vegetables, flowers and ornamental plants follow as the most common. In terms of animal husbandry, the most common practice is breeding cattle.

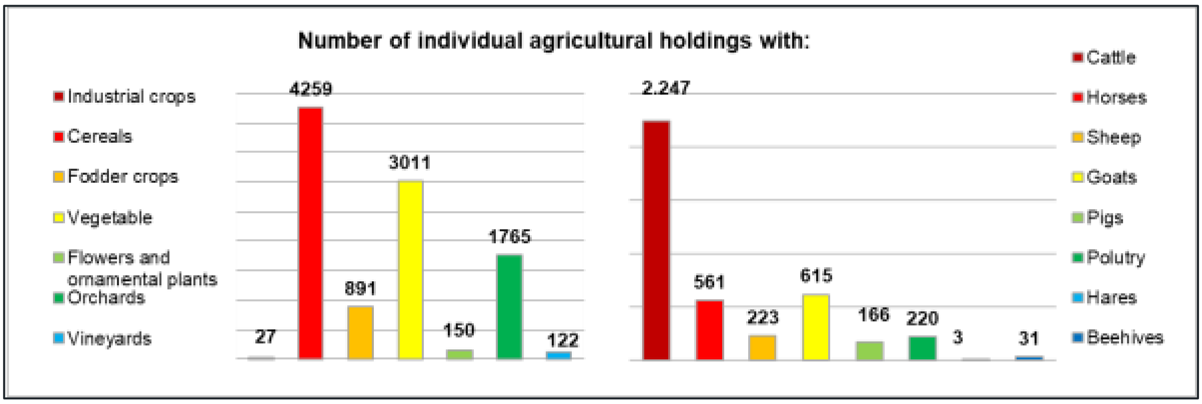

Figure 19-2 - Agricultural Practices in Municipality of Kichevo (2007)[114]

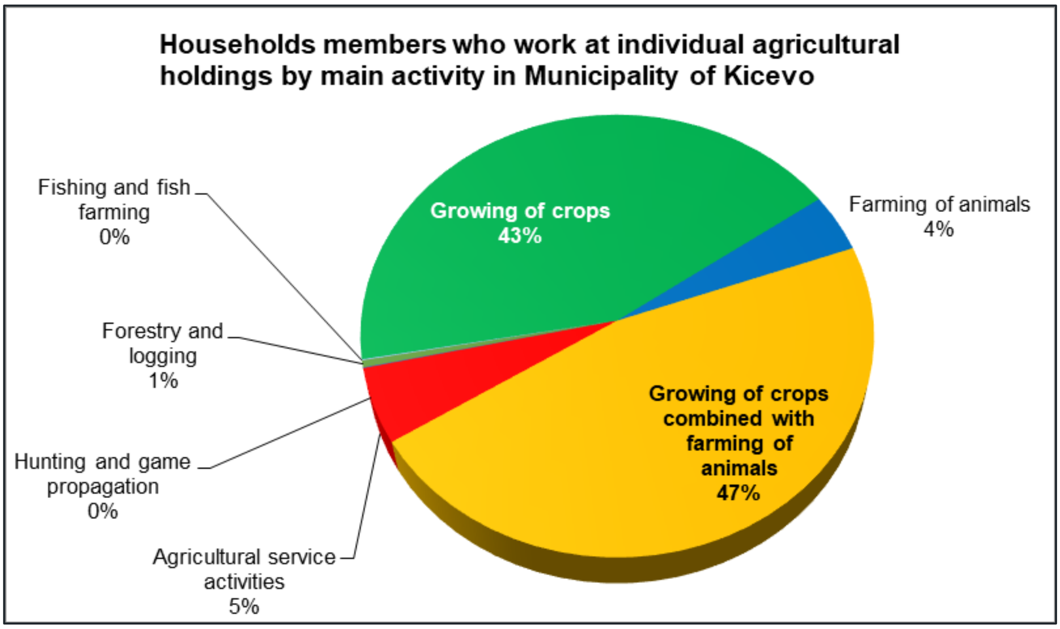

Figure 19-3 - Activities at Individual Agricultural in the Municipality of Kichevo (2007)[115]

19.1.30. Irrigation is essential to maintain agricultural production in the Municipality of Kichevo. A total area of 1,313 ha of agricultural land benefits from irrigation (see Table 19-5). A total of 4,220 of 5,496 individual agricultural holdings (76.8%) are irrigated. The cereal is the most irrigated crop, accounting for 39.8% of the total agricultural land is irrigated.

[114] Website of State Statistical Office, MAKStat Database.
[115] Website of State Statistical Office, MAKStat Database.

Table 19-5 - Irrigation of Agricultural Land in the Municipality of Kichevo (2007)[116]

Type of Agricultural Land	Hectares
Cereals	522
Industrial Crops	77
Vegetable	208
Fodder Crops	78
Orchards	60
Vineyards	5
Meadows	335
Other Plants	28
Total	**1,313**

19.2 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Access to Rural Settlements, Land and Property

Description

19.2.1. Rural settlements along the Project alignment may experience access restrictions during the construction phase, such as to the residential dwellings within the rural settlements, shops, health and community facilities, land and property. The rural settlements within the surrounding area include Bukojchani, Gorno Strogomishte, Dolno Strogomishte, Oslomej, Osoj, Trapchin Dol, Rashtani, Crvivci, Kolibari, and Zajas. Several of these settlements have single track roads, that will be particularly sensitive to construction traffic accessing the construction area.

Magnitude and Severity of Impacts

19.2.2. The description of the magnitude thresholds is provided in Table 19-6 below.

[116] Website of State Statistical Office, MAKStat Database

Table 19-6 - Magnitude of Impacts (Access to Rural Settlements, Land and Property)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Direct impacts to residents, land and property owners.
Reversibility	Reversible	Impact is reversible.
Geographic Extent	Local	Limited to the rural settlements, shops, community facilities, land and property in the vicinity of the Project alignment.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Certain	Impact has a high likelihood of occurring.
Magnitude	Moderate	Restricted access to rural settlements, shops, health and community facilities, land and property.

19.2.3. The sensitivity of the residents, land and property owners, in close proximity to the Project alignment is considered to be **High**.

19.2.4. The construction phase of the Project is anticipated to start in 2021 and be completed in 2025. However, due to the potential for access restrictions to residential dwellings, shops, health and community facilities, land and property the magnitude of the impact is considered to be **Moderate**. This assessment considers the worst case scenario, as the magnitude of this impact will vary along the Project alignment, and many locations will only be affected for part of the construction period.

Significance of Effects

19.2.5. The potential for significant effects associated with access restrictions to residents within the rural settlements, land and property owners, as a result of the construction activities is Moderate or Large Adverse (significant), without mitigation. Mitigation in the form of a Land Acquisition (LAP) will be implemented to manage the effects to acceptable levels.

Utilities Provision

Description

19.2.6. The Project alignment is likely to intersect with electricity lines, gas pipelines, potable water pipelines and the sewerage network. A study to identify the intersections with existing utilities will be undertaken as part of the detailed design of the Project and the information will be made available at that time. The construction activities associated with the Project may cause distribution to the utilities provision for residential dwellings, land and property. In addition, any unexpected damage to the utilities provisions could lead to an incident or accident involving the local community, or construction workers, as described in Section 18.2.1 of Chapter 18: Occupational Health, Safety and Security.

Magnitude and Severity of Impacts

19.2.7. The description of the magnitude thresholds is provided in Table 19-7.

Table 19-7 - Magnitude of Impacts (Utilities Provision)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	Impact is not desirable
Type of Impact	Direct	Direct impacts on access to residential dwellings, shops, health and community facilities, land and property.
Reversibility	Reversible	Impact is reversible.
Geographic Extent	Local	Limited to the rural settlements, land and property in the vicinity of the Project alignment.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Certain	Impact has a high likelihood of occurring.
Magnitude	Minor	Temporary disruption to residential dwellings, land and property.

19.2.8. The sensitivity of users of residential dwellings, shops, community facilities, land and property in close proximity to the Project alignment is considered to be **High**. This will be established and confirmed through the census as part of the LAP.

19.2.9. The construction phase of the Project will be limited in time and physical extent. However, there is potential for impacts to users of residential dwellings, shops, community facilities, land and property owners should utilities provision be disrupted. Should the utilities provision be disrupted during the construction activities this will be pre-planned and advance notice provided. Utilities surveys will be carried out as part of the detailed design for the Project. Such information will also be provided to the Contractor(s). Therefore, the magnitude of impact is considered to be **Minor**.

Significance of Effects

19.2.10. The potential for significant effects associated with the potential disruption of utilities provision to residential dwellings, shops, community facilities, land and property as a result of the construction activities is Slight Adverse (not significant) or Moderate Adverse (significant), without mitigation. Mitigation in the form of Community Access and Infrastructure Plan (see Chapter 23 – ESMP) will be implemented to manage the effects to acceptable levels.

Deterioration of Local Roads

Description

19.2.11. There will be increased traffic movements (both on-site and off-site), particularly by heavy vehicles, during the construction phase of Project. The increased traffic movements may degrade the quality of the local roads if used by construction vehicles or for the transportation of construction plant and materials117. The degraded quality of the roads may cause disruption to those accessing residential dwellings, land and property surrounding the Project alignment, and damage vehicles. The local roads which will be used for access during the construction phase of the Project is currently unknown and will be determined as part of the detailed design process, however measures to maintain local roads and minimise disruption to access during construction, have been included in the ESMP (Chapter 23).

Magnitude and Severity of Impacts

19.2.12. The description of the magnitude thresholds is provided in Table 19-8 below.

Table 19-8 - Magnitude of Impacts (Deterioration of Local Roads)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Negative	Impact is not desirable
Type of Impact	Direct	Direct impacts to residential dwellings, land and property.

[117] The local roads to be used for construction access will be specified in the Construction Traffic Plan.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Reversibility	Reversible	Impact is reversible.
Geographic Extent	Local	Limited to the rural settlements, land and property in the vicinity of the Project alignment.
Time when the Impact Occurs	Delayed	There may be a short-term lag in the impact following the commencement of operation.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a medium likelihood of occurring.
Magnitude	Moderate	Increase in construction generated traffic on the local roads may deteriorate to the local road infrastructure.

19.2.13. The sensitivity of the local roads is considered to be Medium.

19.2.14. The construction phase of the Project will be limited in time and physical extent. However, there is potential for impacts to the quality of the local roads as a result of the construction traffic. The magnitude of impact is considered to be Moderate.

Significance of Effect

19.2.15. Overall, it is considered that the potential for significant effects associated with the potential deterioration of the local roads, and vehicles, as a result of the construction traffic is Moderate Adverse (significant), without mitigation. Mitigation in the form of Community Access and Infrastructure Plan (see Chapter 23 – ESMP) will be implemented to manage the effects to acceptable levels.

Physical Displacement / Resettlement

Description

19.2.16. The assessment has been undertaken without a detailed census of the Project Alignment. The detailed census cannot be undertaken until the detailed design has been finalised, and the exact land requirements for the Project are known, to prevent property blight. The assessment therefore present a worst case scenario as the use of all the affected buildings is not known. The sensitivity of the community along the Project alignment will be established and confirmed through the census for the LAP.

19.2.17. At two locations along the Project alignment, eight residential dwellings and two auxiliary buildings are expected to be expropriated, and the residents resettled. The residential dwellings and auxiliary buildings are located towards the southern end of the Project alignment, within the rural settlements of Rashtani and Osoj. The following figure shows the two locations, (1) depicts Rashtani and (2) Osoj.

Figure 19-4 - Locations of Physical Displacement / Resettlement

19.2.18. The specific residential dwellings and auxiliary buildings are shown in Figure 19-5 (Rashtani) and Figure 19-6 (Osoj).

19.2.19. Within Figure 19-5 the red dotted line denote the expropriation line for the Project in Rashtani, within the red dotted line four residential dwellings are located. These four residential dwellings are believed to be occupied by Roma families. During the site visit undertaken in 2019, the team were able to make observations of these properties but were unable to undertake interviews, to determine land ownership, due to lack of land acquisition (expropriation) elaborate at the time this assessment. Figure 19-6 shows the four residential dwellings for expropriation and the auxiliary buildings (numbers 2 and 3). The identification of the number of individuals and vulnerable groups (i.e. Roma and the elderly) within these residential dwellings will be established as part of the Land Acquisition Plan (LAP).

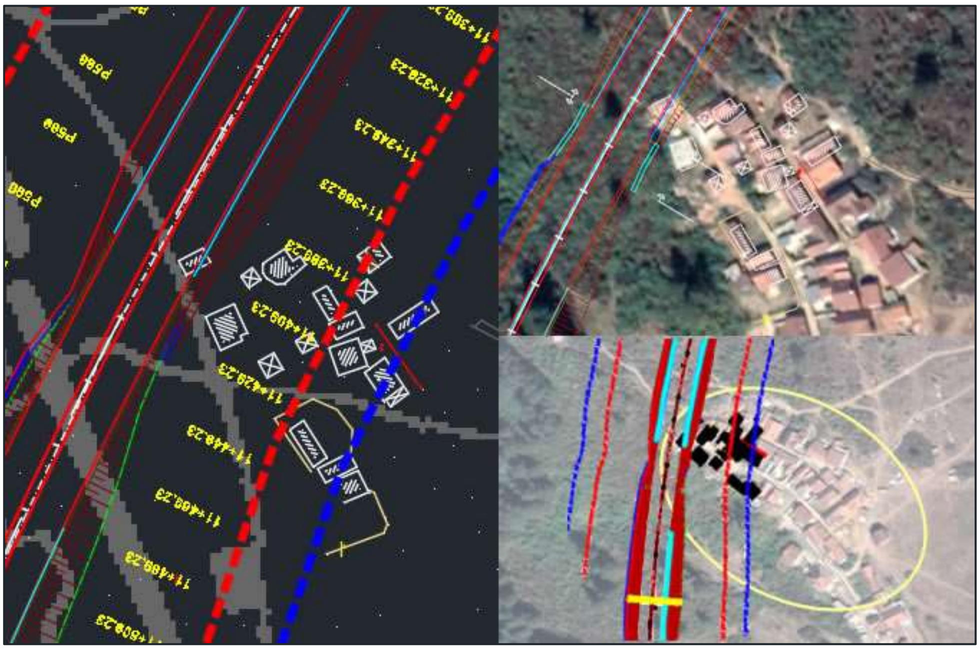

Figure 19-5 - Rashtani Location of Physical Displacement / Resettlement

Figure 19-6 - Osoj Location of potential Physical Displacement / Resettlement

- Structure number 1 and 4 are occupied, while 2 is the former house of residents living in house number 2. Structure number 3 is an auxiliary building.

- An embankment of the motorway will start next to structures 4, 5 and 6, which are occupied by families (with children).
- By the time of this report, the Expropriation Elaborate had not been finalised, so a full census of all the properties that would need to be acquired for the purpose of this project has not been completed.

Magnitude and Severity of Impacts

19.2.20. The description of the magnitude thresholds is provided in Table 19-9 below.

Table 19-9 - Magnitude of Impacts (Physical Displacement / Resettlement)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Impact is not desirable.
Type of Impact	Direct	Direct impacts to eight residential dwellings and two auxiliary buildings.
Reversibility	Irreversible	Residential dwellings and auxiliary buildings cannot be returned into previous condition.
Geographic Extent	Local	Limited to the eight residential dwellings and two auxiliary buildings.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities in this area.
Duration	Short-term	Although the duration is short-term, the change is permanent.
Likelihood of Appearance	Certain	Impact has a high likelihood of occurring.
Magnitude	Moderate	Eight residential dwellings and two auxiliary buildings are expected to be expropriated, and the residents resettled.

19.2.21. The sensitivity of the residential dwellings and the two auxiliary buildings, along with their residents, are considered to be Medium. The sensitivity of these dwellings will be established and confirmed during the census for the LAP. It should be noted that there is robust legislation within North Macedonia for the protection of Roma people (see Chapter 2 – ESIA Legislation and Requirements).

19.2.22. Whilst permanent expropriation will occur this will be limited to eight residential dwellings and two auxiliary buildings and therefore the magnitude of impact is considered to be Moderate.

Significance of Effects

19.2.23. The potential for significant effects associated with the permanent expropriation of eight residential dwellings and two auxiliary buildings is Moderate Adverse (significant), without mitigation. Mitigation in the form of Land Acquisition Plan (see Chapter 23 – ESMP) will be implemented to manage the effects to acceptable levels.

Loss of Agricultural Land and livelihood

Description

19.2.24. According to the census date, in the Municipality of Kichevo, agriculture is the highest income generating activity in the rural settlements surrounding the Project alignment and the second highest in the city of Kichevo. Construction activities have the potential to have an adverse effect on the livelihoods of local residents either as a result of disruption to the agricultural practices and / or permanent loss of agricultural land, as well as temporary disruption of routine economic activities and economic practices in local businesses or agricultural holdings. It is anticipated that agricultural land may be required for the construction phase of the Project. Local residents also known to forage for plants and fungi for culinary and medicinal purposes. Although unlikely, if construction workers also forage for these resources or limit access to them, this could cause tension with the local population and this risk will need to be managed.

19.2.25. The number of agricultural land holdings, the agricultural use and ownership will be established as part of the Land Acquisition Plan.

Magnitude and Severity of Impacts

19.2.26. The description of the magnitude thresholds is provided in Table 19-10 below.

19.2.27. Some people will lose fertile land that supports their livelihood and income in the household. A household survey which will be carried out as part of the Land Acquisition Plan preparation, to establish the number of people who will lose all their land or only parts of it, and also the extent to which losing their access to fertile land is likely to affect their livelihoods.

19.2.28. Based on the length of the Project, and potential construction area, up to 42 ha may be acquired for the construction of the Project.

19.2.29. The magnitude of the impact is as set out in Table 19-10.

Table 19-10 - Magnitude of the Impact – Loss of agricultural land and livelihood

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Impact is not desirable.
Type of Impact	In-direct	Direct impacts to agricultural land which will indirectly impact the livelihoods of individuals with agricultural land holdings.

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Reversibility	Irreversible	Agricultural land which is permanently lost cannot be returned into previous condition.
Geographic Extent	Local	Limited to the agricultural land.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities in this area.
Duration	Short-term	Although the duration is short-term, the change is permanent.
Likelihood of Appearance	Certain	Impact has a high likelihood of occurring.
Magnitude	Moderate	Agricultural land may be required for the Project.

19.2.30. Agriculture forms a notable component of the local economy and is considered to be of Medium sensitivity, however this will be confirmed through the census for the LAP.

19.2.31. Disruption to the agricultural practices and / or permanent loss of agricultural land will occur across a large area and is expected to impact a large number of land holdings (anticipated to be more than 100 landowners). This may impact livelihood provisions for each agricultural land holdings. The magnitude of the impact is considered to be Moderate.

19.2.32. Plants and fungi in the Project study area, provide a finite resource that is valued by the local community, and is therefore considered to be of Medium sensitivity.

19.2.33. If construction workers forage for plants and fungi or if the works restrict access to them, this could result in tension with the local communities, so mitigation measures will need to be implemented to discourage this. The magnitude of the impact is considered to be Minor.

Significance of Effects

19.2.34. Overall, it is considered that the disruption to the agricultural practices and / or permanent loss of agricultural land has the potential for significant effects to livelihoods associated with each agricultural land holding is up to Moderate Adverse (significant), without mitigation. Mitigation in the form of Land Acquisition Plan (see Chapter 23 – ESMP) will be implemented to manage the effects to acceptable levels.

19.2.35. The potential foraging of plants and fungi by construction workers or restricted access to these resources, may limit their availability to the local community and so the effect will be Slight (significant), without mitigation.

Construction Employment and Economic Growth

Description

19.2.36. Construction workers, of various skill levels, will be required throughout the construction phase of the Project. The construction workers will either be directly employed or subcontracted.

19.2.37. It is understood that there are suitably trained, and qualified construction workers available within the Municipality of Kichevo, due to the presence of the adjacent motorway project (comprising a mainly internationally sourced workforce[118]). Furthermore, construction workers' accommodation will be provided as part of the , for those construction workers who do not live in close proximity to the Project, including Macedonian workers from other municipalities As per Chapter 18 – Occupational Health, Safety and Security, construction worker's accommodation will be provided in line with international good practice.

19.2.38. The use of construction workers from within the Municipality of Kichevo and the associated use of the existing commercial infrastructure (such as convenience and grocery stores and petrol stations) will stimulate economic growth on a local and municipal scale. Furthermore, there is likely to be associated use of locally based machinery and material suppliers.

Magnitude and Severity of Impacts

19.2.39. The description of the magnitude thresholds is provided in Table 19-11 below.

Table 19-11 - Magnitude of Impacts (Construction Employment and Economic Growth)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Positive	Impact improves the current situation.
Type of Impact	Direct	Direct Project employment and assoisated use of the existing commercial infrastructure.
Reversibility	Reversible	Impact is reversible upon completion of the construction activities.
Geographic Extent	Regional	Impact will extend across the Municipality of Kichevo.
Time when the Impact Occurs	Immediate	At any point following the commencement of construction activities.
Duration	Medium-term	It will last the time for the full duration of the construction phase.
Likelihood of Appearance	Certain	The impact can be considered to have a high likelihood of occurring.

[118] Where an international contractor brings their own employees from their home-country.

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Magnitude	Moderate	Improvement to existing employment and economic growth across the Municipality of Kichevo.

19.2.40. The sensitivity of employment and economic growth within the Municipality of Kichevo is considered to be Medium.

19.2.41. It is expected that the creation of employment, particularly among construction workers available within the Municipality of Kichevo and associated use of the existing commercial infrastructure will result in employment and economic growth across the Municipality of Kichevo. Therefore, the magnitude of the positive impact is considered to be Moderate.

Significance of Effects

19.2.42. Overall, it is considered that the potential for significant effects to employment and economic growth across the Municipality of Kichevo as a result of the employment of the construction workforce and associated use of the existing commercial infrastructure is Moderate Beneficial (significant), without mitigation.

OPERATIONAL PHASE

Employment and Economic Growth

Description

19.2.43. Following the completion of the construction phase of the Project construction workers will need to find alternative employment opportunities. The training, qualifications and experience of the construction workforce will be valuable to the Republic of North Macedonia and its economy. Furthermore, the completion of the Project will increase the usage of the Project alignment which has the potential to bring customers into the Municipality of Kichevo, who may use the existing commercial infrastructure (such as convenience and grocery stores and petrol stations).

Magnitude and Severity of Impacts

19.2.44. The description of the magnitude thresholds is provided in Table 19-12 below.

Table 19-12 - Magnitude of the Impact – Loss of agricultural land and livelihood

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Positive	Impact will improve current situation.
Type of Impact	Indirect	Indirect onward employment of the construction workforce and subsequently the local community and the local economy.
Reversibility	Irreversible	The experience of the construction workforce will have been gained and the increased usage of

Criteria	Assessment Thresholds	
	Threshold	Descriptions
		the Project alignment will have occurred, and as such it is irreversible.
Geographic Extent	National	Impacts have the potential to extend across the Republic of North Macedonia.
Time when the Impact Occurs	Immediate	Effect will occur immediately following completion of the construction activities.
Duration	Long-term	The experience of the construction workforce will have been gained will cascade to future workforces. Futhermore, the the usage of the Project alignment will continue to increase.
Likelihood of Appearance	Certain	The impact can be considered to have a high likelihood of occurring.
Magnitude	Moderate	Improvement to existing employment and economic growth within the wider Republic of North Macedonia.

19.2.45. The sensitivity of employment and economic growth within the Municipality of Kichevo is considered to be of Medium.

19.2.46. There is the potential for large positive impacts once the experience of the construction workforce cascades throughout the Republic of North Macedonia and to future construction workforces. Furthermore, there will be increased usage of the Project and as such onward increased use of the existing commercial infrastructure. Therefore, the magnitude of the positive impact is considered to be Moderate.

19.2.47. If a predominantly migrant workforce is used, the direct benefits to the workforce of the Republic of North Macedonia will be reduced to Minor levels as the workforce will likely return to their home country or work on another international project rather than remain in country.

Significance of Effects

19.2.48. The potential for significant effects to employment and economic growth across the Republic of North Macedonia as a result of the employment of the construction workforce and the usage of the Project is Moderate Beneficial (significant), without mitigation.

19.3 SUMMARY OF EFFECTS

19.3.1. The following effects are anticipated during the construction phase, before the implementation of mitigation:

- The potential for significant effects associated with access restrictions to residential dwellings within the rural settlements, land and property as a result of the construction activities is **Moderate or Large Adverse (significant).**

- The potential for significant effects associated with the potential disruption of utilities provision to residential dwellings, land and property as a result of the construction activities is **Slight Adverse (not significant) or Moderate Adverse (significant).**
- The potential for significant effects associated with the potential deterioration of the local roads as a result of the construction traffic is **Moderate Adverse (significant).**
- The potential for significant effects associated with the permanent expropriation of eight residential dwellings and two auxiliary buildings is **Moderate Adverse (significant).**
- The agricultural practices and / or permanent loss of agricultural land has the potential for significant effects to livelihoods associated with each agricultural land holding is **Moderate Large Adverse (significant).**
- The potential for significant effects associated with the foraging of plants and fungi by construction workers and resulting depletion of a resource that is valued by the local community and community tension is **Minor (not significant).**
- The potential for significant effects to employment and economic growth across the Municipality of Kichevo as a result of the employment of the construction workforce and associated use of the existing commercial infrastructure is **Moderate Beneficial (significant).**

19.3.2. The following effects are anticipated during the operational phase, before the implementation of mitigation:

- The potential for significant effects to employment and economic growth across the Republic of North Macedonia as a result of the employment of the construction workforce and the usage of the Project is **Moderate Beneficial (significant).**

19.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

19.4.1. The implementation of the Land Acquisition Framework (LAF), and subsequently the preparation of a Land Acquisition (LAP) will ensure appropriate measures are included for the process of land acquisition, and physical and economic displacement. The LAF and the subsequent LAP will be in accordance with best practice. The LAP will include and implement a process to collect robust and reliable socio-economic baseline of the project affected people (PAPs) through a household surveys / census, and also early communication and consultation with the PAPs, as per the national legislation requirements and the guidelines specified in the EBRD PR5. As part of the LAP preparation and implementation, the PESR will work in close collaboration with the local Intermunicipal Centre for Social Work Kichevo (IMCSWK), the local branch of the National Employment Agency and the Municipality of Kichevo to identify, agree and mitigate the specific needs of the vulnerable people (i.e. Roma and the elderly) affected by the Project. The PESR, together with these three institutions will create programme to support vulnerable people. This programme will include:

- Prequalification process for expropriation;
- Physical displacement assistance; and
- Ongoing monitoring following permanent expropriation.

19.4.2. In addition, as outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the following Plans will be prepared, which will form part of the Construction Environmental and Social Management Plan (CESMP):

- A Local Employment and Procurement Plan , which will ensure that priority is given to employing the local workforce where the skills are appropriate. The Plan will cover all aspects, from the analysis of the existing skills available at a local, regional and national level, to the processes of employment. The Supervising Engineer / PESR will undertake a labour audit during the first month of the construction phase to confirm compliance with National Labour regulations,
- A Code of Conduct for Construction Workers, which will set out practice measures that the construction workers will have to adhere to ensure a positive relationship is built and maintained with the local communities. Including measures to prevent foraging of plants and fungi.
- A Community Health, Safety and Security Plan, which will outline health and safety procedures for the protection of the local community.
- A Community Access and Infrastructure Plan, which will ensure safe access is maintained throughout the construction period. Utilities will be maintained throughout the construction period. If the Contractor cuts off a utility connection, it will be replaced as soon as safe to do so and temporary alternatives will be provided (i.e. drinking water tanks etc). Existing roads will be regularly monitored and maintained. Damage will be repaired as soon as safe to do so. All local roads will be returned to their original state (pre-construction).
- A Supply Chain Management Plan will ensure that all sub-contractors will need to comply with the same requirements as the main Contractor including compliance with national legislation and EBRD PRs.

19.4.3. During the construction phase of the Project these plans will be reviewed, as a minimum quarterly, and with changes to international and national legislation, as appropriate.

19.4.4. Furthermore, during the construction process, the Contractor will be repair utilities provisions and minimise disruption, where practicable. The Contractor will compensate for any damages to private residential dwellings, land and property caused by their activities, machinery or workers. Upon completion of the construction activities in a particular area, the Contractor will repair damage to local roads to ensure that they are returned to their original state (pre-construction). The duration of activities which restrict access to properties will be minimised, and the Contractor will be required to repair any damage or restriction to access, in a timely manner.

OPERATIONAL PHASE

19.4.5. As part of the Labour and Working Conditions Management Plan (LWCMP), all construction workers will be provided with a reference / confirmation of employment letter and a skills/ training log, to enhance their employment prospects. This will be a benefit for both a local and migrant workforce. The Local Employment and Procurement Plan will ensure that a proportion of the construction workforce are recruited locally which will benefit the local economy once the Project has been finished as skilled workers will be available to the workforce.

19.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Access to Rural Settlements, Land and Property

19.5.1. Prior to mitigation there is the potential for up to a Large adverse effect to occur. With the mitigation measures in the Community Access and Infrastructure Plan in place, it is anticipated that effects associated with access restrictions to residential dwellings within the rural settlements, land and property as a result of the construction activities will be Slight Adverse (not significant).

Utilities Provision

19.5.2. Prior to mitigation there is the potential for up to a Moderate adverse effect to occur With the mitigation measures in the Community Access and Infrastructure Plan in place, it is anticipated that effects associated with the potential disruption of utilities provision to residential dwellings, land and property as a result of the construction activities will be Slight Adverse (not significant).

Deterioration of Local Roads

19.5.3. Prior to mitigation there is the potential for up to a Moderate adverse effect to occur It is anticipated that effects associated with the potential deterioration of the local roads as a result of the construction traffic will be Slight Adverse (not significant), with the mitigation measures in the Community Access and Infrastructure Plan in place.

Physical Displacement / Resettlement

19.5.4. Prior to mitigation there is the potential for a Moderate adverse effect to occur It is anticipated that effects associated with the permanent expropriation of eight residential dwellings and two auxiliary buildings will be Slight Adverse (not significant), with the mitigation measures outlined in the Land Acquisition Framework in place ,.

Loss of Agricultural Land

19.5.5. Prior to mitigation there is the potential for up to a Large adverse effect to occur It is anticipated that effects associated with agricultural practices and / or permanent loss of agricultural land, and thus livelihoods associated with each agricultural land holding, will be Slight Adverse (not significant), with the outlined in the Land Acquisition Framework in place.

19.5.6. It is anticipated that effects associated with construction workers foraging plants and fungi will be Slight Adverse (not significant), with the mitigation outlined in the Code of Conduct for Construction Workers in place.

Construction Employment and Economic Growth

19.5.7. It is anticipated that effects associated employment and economic growth across the Municipality of Kichevo as a result of the employment of the construction workforce and associated use of the existing commercial infrastructure will be Moderate Beneficial (significant), with the mitigation measures outlined in the Local Employment and Procurement Plan in place.

OPERATIONAL PHASE

Employment and Economic Growth

19.5.8. It is anticipated that effects associated employment and economic growth across the Republic of North Macedonia as a result of the employment of the construction workforce and the usage of the Project will be **Moderate Beneficial** (**significant**). The mitigation measures outlined in the **Local Employment and Procurement Plan** will have ensured that a proportion of the construction workforce were recruited locally and gained skills for future employment opportunities. The Contractor will supply all workers with training records and letters confirming their skills and employment on the Project which will help with their employability after construction has finished and will benefit both local and migrant workers.

19.6 SUMMARY

Table 19-13 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation)	Mitigation Measures	Residual Effect
Property and Livelihood	Construction	Access to Rural Settlements, Land and Property	Moderate or Large Adverse (significant)	A **Land Acquisition Plan (LAP)**. A Local **Employment and Procurement Plan** . A **Code of Conduct for Construction Workers**. A **Community Health, Safety and Security Plan**. A **Community Access and Infrastructure Plan**.	Slight Adverse (not significant)
		Utilities Provision	Slight Adverse (not significant) or Moderate Adverse (significant)		Slight Adverse (not significant)
		Deterioration of Local Roads	Moderate Adverse (significant)		Slight Adverse (not significant)
		Physical Displacement / Resettlement	Moderate Adverse (significant)		Slight Adverse (not significant)
		Loss of Agricultural Land	Moderate Adverse (significant)		Slight Adverse (not significant)
		Foraging of plants and Fungi	Slight Adverse (not significant)		Slight Adverse (not significant)
		Construction Employment and Economic Growth	Moderate Beneficial (significant)		Large Beneficial (significant)
	Operational	Employment and Economic Growth	Moderate Beneficial (significant)	**Local Employment and Procurement Plan (LEPP).** Workers training records and letters confirming their skills and employment on the Project	Moderate Beneficial (significant)

20 CULTURAL HERITAGE

20.1 BASELINE CONDITIONS

20.1.1. The baseline data has been obtained through a combination of observations during a site visit, and the desk-based review of third-party information.

HERITAGE ASSETS

20.1.2. Heritage assets are buildings, sites or areas of cultural or historical value. Within the Republic of North Macedonia information regarding heritage assets is largely available from the Museum of Macedonia, a national institution located in Skopje. At a regional level, in the Municipality of Kichevo, information regarding heritage assets is largely available from the Museum of Kichevo.

20.1.3. Heritage assets along the Project alignment include: cemeteries, a memorial and sites of archaeological interest.

20.1.4. There are three cemeteries adjacent to the Project alignment in the rural settlements of Dolno Strogomishte and Crvivci and the City of Kichevo. The cemeteries in Dolno Strogomishte and the City of Kichevo are shown in Figure 20-1 and Figure 20-2, respectively. The view towards the Project alignment from the location of the Crvivci cemetery is shown in Figure 20-3.

Figure 20-1 - Cemetery in Dolno Strogomishte

Figure 20-2 - Cemetery in the City of Kichevo

Figure 20-3 – View towards Project Alignment from the small cemetery and mosque in Crvica.

20.1.5. There is a memorial located adjacent to the existing A2 near the rural settlement of Zajas, that is also adjacent to the Project alignment. The memorial, named the Albanian Mother, is in commemoration of the Albanians who lost their lives during the Second Balkan War (1913). The memorial is shown in Figure 20-4.

Figure 20-4 - Albanian Mother Memorial in Zajas

20.1.6. There are several mosques in vicinity of the Project alignment, the closest of which is located at Crvica. The visual impact of the Project on visitors to this mosque is addressed in Chapter 16 – Landscape and Visual Impact.

20.1.7. There are also several sites of archaeological and heritage interest within close proximity to the Project alignment, which are listed in Table 20-1. The location of these sites of archaeological and heritage interest are shown in Figure 20-5.

Table 20-1 - Sites of Archaeological and Heritage Interest[119]

Name and Location		Description of Archaeological and Heritage Site
City of Kichevo		
1	Kitino Kale	Fortified settlement from bronze and iron, and medieval age
2	Kitka	Depot of medieval coins
3	Chuka	Bronze age settlement
4	Palatishta	Roman age settlement
5	Juma Mosque	Sultan Bayazit Mosque – Medieval object
Rural Settlement of Zajas		
6	Zheleznichka Stanica	Late antique necropolis
Rural Settlement of Kolibari		
7	Kokale	Medieval necropolis
8	Roman Cemetery	Late antique settlement
Rural Settlement of Oslomej		
9	Aleksova Niva	Late antique settlement
Rural Settlement of Rashtani		
10	Drenoska Niva	Medieval church and necropolis
11	Sina Voda	Medieval settlement and necropolis
Rural Settlement of Osoj		
12	Latin Church	Medieval settlement and necropolis
13	Mikjo Kostenche	Medieval necropolis
14	Razdol	Late antique necropolis
15	Crkvishte	Late antique settlement
16	Jamchishte	Late medieval necropolis
Rural Settlement of Crvivci		

[119] Archaeological Map of the Republic of Macedonia, 1996.

Name and Location		Description of Archaeological and Heritage Site
17	Latinska Crkva	Medieval church
18	Kodra Kalangochit	Neolithic settlement
19	Gramada	Villa Rustic from late antique time
20	Ogragje	Late antique necropolis
21	Sveti Ilija	Ancient Christian basilica and necropolis

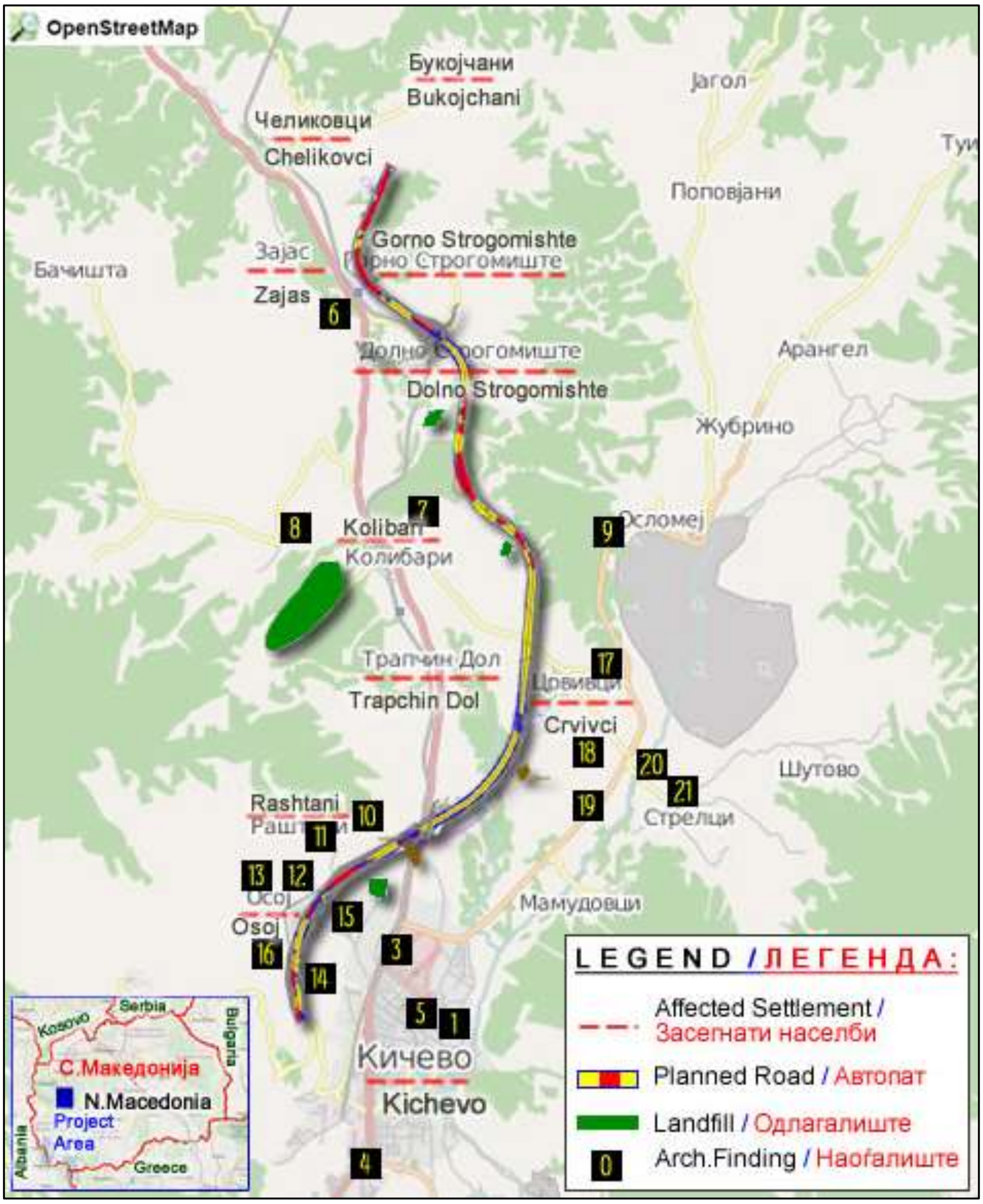

Figure 20-5 - Location of Sites of Archaeological Interest

20.1.8. There is one internationally designated cultural heritage site within the Republic of North Macedonia, which is a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site. The site is named the 'Natural and Cultural Heritage of the Ohrid Region' and is located approximately 4 km south of the Project alignment. In addition to the UNESCO World Heritage Site the Republic of North Macedonia has listed four sites which may be nominated for UNESCO World Heritage status in the future. These sites are as follows:

- Cave Slatinski Izvor, located approximately 19 km east of the Project alignment in the Municipality of Makedonski Brod;
- Markovi Kuli, located approximately 53 km south of the Project alignment in the Municipality of Prilep;
- Archaeo-astronomical Site Kokino, located approximately 110 km north east of the Project alignment in the Municipality of Staro Nagoričane; and
- Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe (proposed extension to include the forest of Dlaboka Reka), located at its closest point approximately 12 km north west of the Project in the Municipality of Mavrovo and Rostuša.

20.1.9. The sites are all located a considerable distance from the Project and have no inter-visibility with the Project. On this basis there will be no impacts on these sites, and they have not been considered further in this assessment.

20.2 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Disruption at Cemeteries and Memorials

Description

20.2.1. Construction activities can be disturbing, especially when they occur in close proximity to sensitive receptors, such as cemeteries. If disturbance occurs when ceremonies are taking place at cemeteries, this can be perceived as being disrespectful to the local community..

20.2.2. There are three cemeteries in close proximity to the Project alignment, that may be disturbed by construction activities: the first is located is in the City of Kichevo; the second to the southwest of Crivca (where the is also a mosque); and the third is in the rural settlement of Dolno Strogomishte. The Albanian Mother Memorial, near Zajas, is located immediately adjacent to the Project alignment.

Cemetery in the City of Kichevo

20.2.3. Figure 20-5 depicts the proximity of the cemetery in the City of Kichevo to the Project alignment. The Project alignment is shown in orange and red in Figure 20-6.

Cemetery in the Dolno Strogmishte

20.2.4. As explained in **Chapter 2 - Description of the Project** and detailed in **Chapter 4 – Consideration of Alternatives**, three designs options / variants are currently being considered for the Strogomishte Interchange and the maximum potential impact of all three variants have been assessed using a parameter based approach. Variant 0 requires the construction of two viaduct piers in the cemetery at Dolno Strogmishte, Variants 1 and 2 have been developed to investigate design options that do not require the location of piers in the cemetery. Variant 0 has the potential to have the greatest physical impact on the cemetery. The Project alignment for Variant 0 of the Strogomishte Interchange is shown in Figure 20-7. The viaduct piers are shown in yellow. The assessment of the physical impact on the cemetery is considered in Paragraph 20.2.8.

Cemetery at Crvica

20.2.5. The cemetery at Crvica is located approximately 400 m from the Project alignment and will be separated from the Project alignment by an area of woodland to the north west, which will provide visual screening.

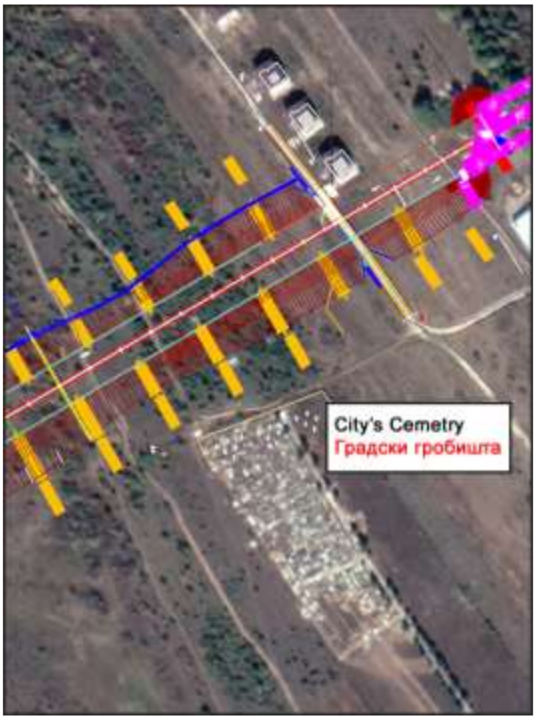

Figure 20-6 - Project Alignment and the Cemetery in the City of Kichevo

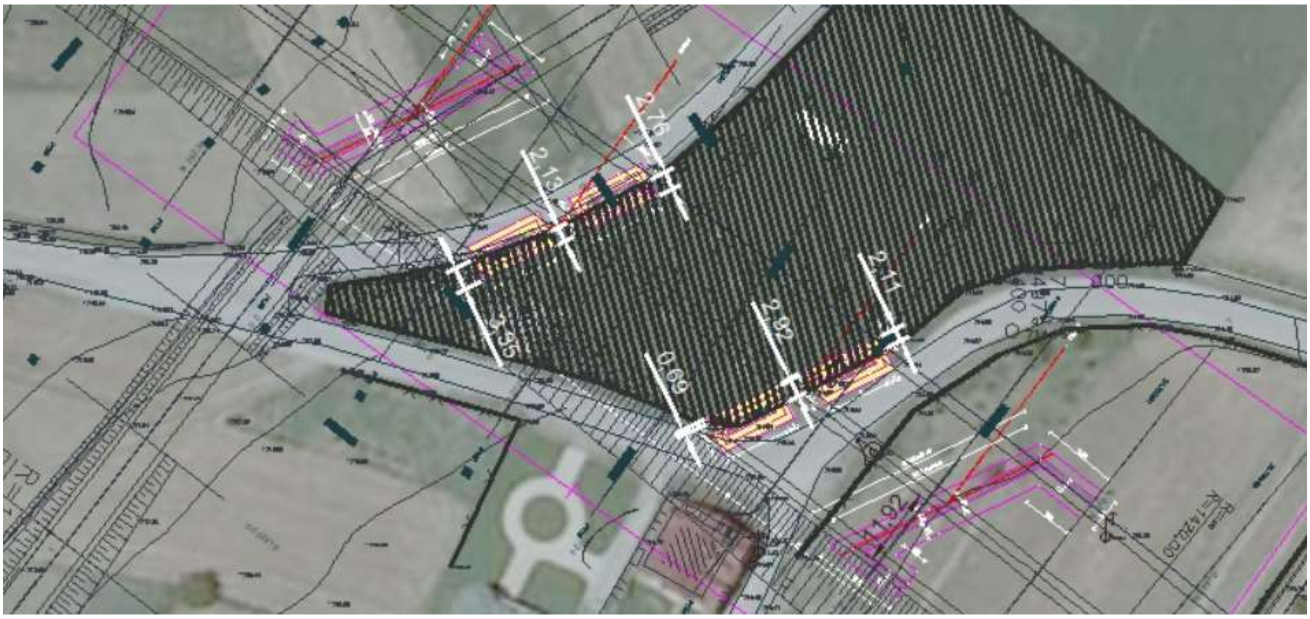

Figure 20-7 - Project Alignment and the Strogomishte Cemetery (Variant 0)

Magnitude and Severity of Impacts

20.2.6. The description of the magnitude thresholds is provided in Table 20-2 below.

Table 20-2 - Magnitude of Impacts (Disturbance at Cemeteries)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Construction activities will directly influence these receptors.
Reversibility	Reversible	Situation will be reversed upon completion of the applicable construction activities. The relocation of graves is assessed in Section 20.2.9.
Geographic Extent	Local	Impact is limited to the local communities holding ceremonies at the three cemeteries.
Time when the Impact Occurs	Immediate	Impact occurs at the time of the applicable construction activities commencing.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a high likelihood of occurring.
Magnitude	Moderate for Kichevo and	Disrespectful to the local community and relatives of the deceased .

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
	Cvica. Major for cemetery at Dolno Strogomishte	

20.2.7. The sensitivity of the cemeteries and the local communities that use the cemeteries is considered to be High.

20.2.8. The construction phase of the Project will be limited in time and physical extent, but there will be adverse effects on setting and disruption due to construction, including noise and air quality impacts. The construction activities which will take place in close proximity to the three cemeteries have the potential to be considered disrespectful to the local community and relatives of the deceased.

20.2.9. Therefore, the magnitude of the impact is considered to be Moderate - Major, without mitigation.

Significance of Effects

20.2.10. Overall, it is considered that the potential for significant effects on the three cemeteries, particularly during ceremonies, and the memorial, as a result of the construction activities is Large Adverse (significant), without mitigation.

Direct Physical Impacts due to works in Dolno Strogomishte Cemetery

Description

20.2.11. The Project may have a direct physical impact on the Dolno Strogomishte Cemetery, depending on the viaduct design option / variant selected for the detailed design. Where the Project alignment goes through the village of Dolno Strogomishte a viaduct structure will pass over the Dolno Strogomishte Cemetery, and one local road. The viaduct will consist of two parallel structures, one for the left and the other for the right carriageway (Variant 0 is shown in Figure 20-8). The viaduct will be connected to the ground using upright supports (commonly referred to as piers). Variant 0 requires the construction of two viaduct piers in the cemetery at Dolno Strogmishte, Variants 1 and 2 have been developed to investigate design options that do not require the location of piers in the cemetery. Variant 0 has the potential to have the greatest physical impact on the cemetery.

20.2.12. For Variant 0, the piers will be located on the edge of the Dolno Strogomishte Cemetery, and a wider area will be required to construct the piers. The graves on the edge of the cemetery are likely to need to be relocated to enable the construction of this option / variant. The PESR predict that a maximum of between 10 and 15 graves may be affected by this option / variant at the cemetery at Dolno Strogomishte.

20.2.13. Variant 1 and 2 would avoid the need to construct piers within the cemetery and therefore grave relocation would not be required.

20.2.14. It was not possible to realign the route to avoid passing over this cemetery, due to the surrounding constraints in terms of the houses and need to pass over the Kichevo-Gostivar railway line.

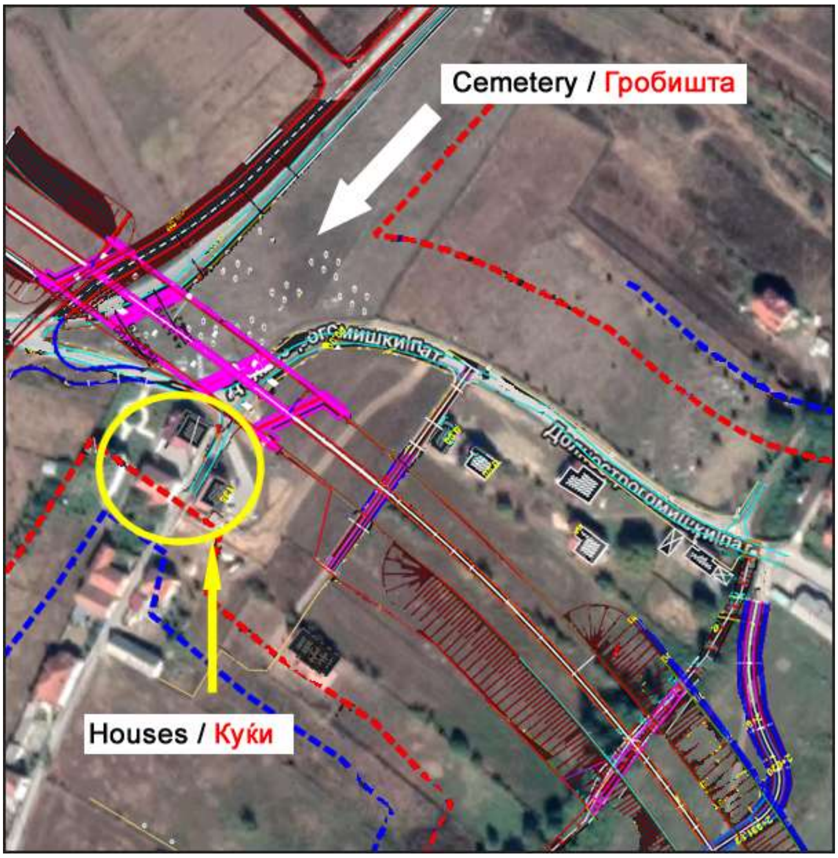

Figure 20-8 - Location of the Viaduct Structure (Variant 0) and Dolno Strogomishte Cemetery

Magnitude and Severity of Impacts

20.2.15. The description of the magnitude thresholds is provided in Table 20-3 below.

Table 20-3 - Magnitude of Impacts due to works in Dolno Strogomishte Cemetery)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Construction activities will directly influence this receptor.
Reversibility	Reversible	It may be possible to reverse the situation if the graves can be returned to their original location. This would need to be discussed will affected parties.
Geographic Extent	Local	Impact is limited to the local communities where the families associated with the graves which may be relocated are likely to reside.

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Time when the Impact Occurs	Immediate	Impact occurs at the time of the applicable construction activities commencing.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Probable	The impact has a high likelihood of occurring.
Magnitude	Moderate for Variant 0 Minor for Variants 1 and 2	This needs to be managed very sensitively to avoid being perceived as showing insufficient courtesy to the local community and relatives of the deceased .

20.2.1 The sensitivity of the local community, where the families associated with the graves which may be relocated are likely to reside, is considered to be **High**.

20.2.2 The construction phase of the Project will be limited in time and physical extent. However, the construction activities associated with the piers may require graves on the edge of the cemetery to be relocated on a temporary or permanent basis. For Variant 0, the relocation of the graves needs to be managed very sensitively to avoid being perceived as showing insufficient courtesy to the local community and relatives of the deceased.

20.2.3 Therefore, the magnitude of the impact is considered to be **Moderate**, without mitigation for Variant 0.

20.2.4 For Variants 1 and 2, the magnitude of the impact is considered to be Minor, without mitigation.

Significance of Effects

20.2.5 For Variant 0, it is considered that the potential for significant effects associated with the temporary or permanent relocation of graves at Dolno Strogomishte Cemetery, as a result of the construction activities is **Moderate** or **Large Adverse (significant)**, without mitigation.

20.2.6 For Variants 1 and 2, the effects are considered to be **Slight adverse** (not significant), without mitigation.

Undiscovered Below-Ground Heritage Assets

Description

20.2.7 During the construction phase there is potential for direct physical impacts to below-ground heritage assets within the vicinity of the Project alignment. Machinery, vibration due to soil removal and a change in water levels can all have an adverse impact on below-ground heritage assets. It is unknown whether there are below-ground heritage assets along the Project alignment, and if there are, the importance of them is unknown.

20.2.8 However, the presence of heritage assets in the study area surrounding the alignment, indicates that there is the potential for assets to be present in areas, and there are likely to be in a good state of preservation, in areas that have not previously been disturbed. Therefore, measures will be required to identify and prevent the damage to of the destruction of any below-ground heritage assets during construction.

Magnitude and Severity of Impacts

20.2.9 The description of the magnitude thresholds is provided in Table 20-4 below.

Table 20-4 - Magnitude of Impacts (Potential Loss or Partial Damage to Undiscovered Below-Ground Heritage Assets)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Negative	Not desirable.
Type of Impact	Direct	Construction activities will directly influence this receptor.
Reversibility	Irreversible	Situation cannot be reversed.
Geographic Extent	Local	Limited to the Project alignment.
Time when the Impact Occurs	Immediate	Impact occurs at the time of the applicable construction activities commencing.
Duration	Short-term	It will last the time for which the construction activities occur.
Likelihood of Appearance	Unlikely	The impact has a low likelihood of occurring as there are no known below-ground heritage assets along the Project alignment.
Magnitude	Moderate	Loss or partial damage of undiscovered below-ground heritage assets.

20.2.10 The sensitivity of any below-ground heritage assets is considered to be **High**.

20.2.11 The construction phase of the Project will be limited in time and physical extent. However, the construction activities may lead to the loss or partial damage of undiscovered below-ground heritage assets which are a finite resource.

20.2.12 Therefore, the magnitude of the impact is considered to be **Moderate**, without mitigation.

Significance of Effects

20.2.13 Overall, it is considered that the potential for significant effects associated with the potential loss or partial damage to undiscovered below-ground heritage assets, as a result of the construction activities is **Moderate** or **Large Adverse (significant)**, without mitigation.

OPERATIONAL PHASE

Setting of the Albanian Mother Memorial

Description

20.2.14 The Albanian Mother memorial is located immediately adjacent to the A2, near Zajas. All (local and long distance) traffic passes immediately adjacent to the memorial which affects the setting of monument due to noise and visual intrusion due to vehicles passing by. This traffic will continue to pass through this junction once the Project is constructed, as this will be the route to join the new motorway.

20.2.15 This will be the situation until the time when the future phase of the motorway to the north has been constructed and is opened. The benefits associated with this future improvement, which will take long distance traffic from this junction, have not been considered in this assessment, as they are outside the scope of this Project.

Magnitude and Severity of Impacts

20.2.16 The description of the magnitude thresholds is provided in Table 20-4 below.

Table 20-5 - Magnitude of Impacts (Setting of the Albanian Mother Memorial)

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterisation of Impact	Beneficial	Desirable.
Type of Impact	Direct	Reduction in traffic.
Reversibility	Irreversible	But considered beneficial.
Geographic Extent	Local	Limited to the Project alignment.
Time when the Impact Occurs	Immediate	Impact occurs as soon as traffic begins to use the Project
Duration	Long-term	Will last as long as the Project is used.
Likelihood of Appearance	Likely	An impact on setting is likely to occur, but it is not expected to be large.
Magnitude	Minor	The volume of traffic is unlikely to change due to the Project, but the junction design will be enhanced.

20.2.17 The sensitivity of the memorial assets is considered to be **High**.

20.2.18 The change in setting is considered to be minor as a result of the Project. The volume and type of traffic passing the location is expected to be similar to the volume without the project, but there will be improvements to the design and layout of the junction.

Significance of Effects

20.2.19 Overall, it is considered that the potential for significant effects associated with the change in setting to the Albanian Mother memorial, as a result of the operation of the Project is **Slight Beneficial**, without mitigation.

Setting of the Cemetery at Dolno Strogomishte

20.2.20 As outlined under the construction phase effects, the Project Alignment will run above the cemetery at Dolno Strogmishte as a viaduct. Although the piers of the viaduct may be located outside of the cemetery (for Variants 1 and 2), there will be a significant effect associated with the operation of the Project. The proximity of the Project as well as noise and overshadowing will be notable to visitors of the cemetery or during ceremonies.

Magnitude and Severity of Impacts

20.2.21 The description of the magnitude thresholds is provided in Table 20-5 below.

Table 20-6 - Magnitude of Impacts (Setting of the Albanian Mother Memorial)

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterisation of Impact	Adverse	Not desirable.
Type of Impact	Direct	Direct impact associated with the proxmity of the Project to the cemetery
Reversibility	Irreversible	Will occur for as long as the Project is operational.
Geographic Extent	Local	Limited to the Project alignment.
Time when the Impact Occurs	Immediate	Impact occurs as soon as traffic begins to use the Project
Duration	Long-term	Will last as long as the Project is used.
Likelihood of Appearance	Likely	An impact on setting is likely to occur.
Magnitude	Major	The volume of traffic is unlikely to change due to the Project, but the junction design will be enhanced.

20.2.22 The sensitivity of the cemetery is considered to be **High**.

20.2.23 The change in setting is considered to be Major as a result of the Project due to the proximity of the Project to the cemetery.

Significance of Effects

20.2.24 Overall, it is considered that the potential for significant effects associated with the change in setting to the cemetery at Dolno Strogmishte, as a result of the operation of the Project is **Large Adverse**, without mitigation.

20.2.16. Further operational effects on local cultural heritage assets including local cemeteries can be found in Chapter 16: Landscape and Visual.

20.3 SUMMARY OF EFFECTS

20.3.1. The following effects are anticipated during the construction phase, before the implementation of mitigation:

- The potential for significant effects on the three cemeteries, and particularly during ceremonies, and the Albanian Mother Memorial, as a result of the construction activities is Large Adverse (significant).
- The potential for significant effects associated with the potential loss or partial damage to undiscovered below-ground heritage assets, as a result of the construction activities is Moderate or Large Adverse (significant).

20.3.1 The following effects are anticipated during the operational phase, before the implementation of mitigation:

- The potential improvement to the setting of the Albanian Mother Memorial, resulting in a Slight Beneficial effect.
- The potential effects on the setting of the cemetery at Dolno Strogomishte, as a result of the operation of the Project will be Large adverse (significant).

20.4 MITIGATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASE

20.4.1. The detailed design of the Project should aim to design out the piers from the cemetery at Dolno Strogomishte. If the piers and requirements to move graves were removed, there would be no need for the Grave Relocation Plan (see below).

20.4.2. As outlined in the Environmental Social Management Plan (Chapter 23) prior to the start of construction the following Plans will be prepared, which will form part of the Construction Environmental and Social Management Plan (CESMP):

- A Cultural Heritage Management Plan, which will inform all the requirements, procedures, resources and skills and timeline needed to minimise impacts on cultural heritage assets. The overall objective of the Plan will be to preserve and protect cultural heritage assets from adverse effects.
- If the Project cannot be designed to avoid the cemetery at Dolno Strogomishte, a Grave Relocation Plan, which will outline measures to protect graves during the temporary or permanent relocation should be prepared. As outlined in Chapter 23: Environmental and Social Management plan, the Grave Relocation Plan will be prepared by the PESR/ on behalf of the PESR, prior to the appointment of the Contractor. It will be prepared through consultation with local religious leaders, relevant authorities and affected families. The following process will be undertaken:
  - Confirm the relevant Regulating and Permitting Bodies
  - Engagement with the Relevant Authorities and Organisations
  - Relationship Mapping
  - Public Consultation
  - Baseline Data Collection
  - The Preparation of a Grave Relocation Plan (GRP).

- A Chance Find Procedure, which form part of the Cultural Heritage Management Plan and mitigate for potential chance finds during the construction phase. The Procedure will be prepared in accordance with the Macedonian Law on Protection of the Cultural Heritage.

20.4.3. During the construction phase of the Project these plans will be reviewed, as a minimum quarterly, and with changes to international and national legislation, as appropriate.

Chance Finds

20.4.4. If a chance find is discovered the contractor(s) will be required to stop work, notify the Cultural heritage authorities and put a cordon around the chance find. The contractor(s) will not disturb any find until a designated and qualified heritage specialist has been contacted who can identify the find, record it and identify the importance. The procedure will be further detailed in the Chance Find Procedure, as set out in the ESMP (Chapter 23).

OPERATIONAL PHASE

20.4.5. No mitigation measures are recommended for the operational phase as there are no anticipated adverse operational phase effects associated with buried heritage. The **Cultural Heritage Management Plan** would not be required during the operational phase.

20.4.6. There is limited mitigation that can be applied for the effect on the setting of the cemetery at Dolno Strogomishte. Mitigation measures in Chapter 14 – Noise and Vibration (to reduce noise) and Chapter 16 – Landscape and Visual (to cover the sections of retaining wall with vegetation) will reduce effects as far as possible but a significant effect will likely remain due to the nature of the Project and proximity to the cemetery.

20.5 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Disturbance at Cemeteries and Memorials

20.5.1. It is anticipated that effects on the three cemeteries, particularly during ceremonies, and the Albania Mother Memorial, will be **Slight Adverse (not significant),** following the implementation of the mitigation measures proposed in the ESMP.

Works in Dolno Strogomishte Cemetery

20.5.2. It is anticipated that effects associated with the temporary or permanent relocation of graves at Dolno Strogomishte Cemetery will be **Moderate Adverse (Significant) for Variant 0**, following the implementation of the mitigation measures proposed in the ESMP, and the Grave Relocation Plan. The Grave Relocation Plan will be prepared prior to procuring the Contractor. It will be included as part of the tender documentation for the Contractor, with a requirement to implement the plan.

20.5.3. Following the implementation of the Cultural Heritage Management Plan, the effects on Dolno Strogomishte cemetery as a result of Variants 1 and 2 for the Strogomishte Interchange will be **Slight Adverse (not significant**).

Undiscovered Below-Ground Heritage Assets

20.5.4. It is anticipated that effects associated with the potential loss of partial damage to undiscovered below-ground heritage assets will be **Slight Adverse (not significant)**, following the implementation of the mitigation measures proposed in the ESMP, including the Chance Find Procedure.

OPERATIONAL PHASE

Improved Setting to the Albanian Mother Memorial

20.5.5. The Project is anticipated to have a **Slight Beneficial** effect on the setting of the Albanian Mother Memorial. No mitigation is required.

Setting of the Cemetery at Dolno Strogomishte

20.5.6. The Project is anticipated to have a **Large Adverse** effect on the setting of the cemetery at Dolno Strogmishte following the application of mitigation measures.

20.6 SUMMARY

Table 20-7 – Summary of Residual Effect

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Cultural Heritage	**Construction**	**Disturbance at Cemeteries and Memorials**	**Moderate or Large Adverse (significant)**	A Cultural Heritage Management Plan.	**Slight Adverse (not significant)**
		Works in Dolno Strogomishte Cemetery	Variant 0 **Moderate or Large Adverse (significant)**	A Grave Relocation Plan (for Variant 0)	Moderate Adverse (significant)
			Variants 1 and 2 Slight (significant)	A Cultural Heritage Management Plan.	Slight Adverse (not significant)
		Potential Loss of Partial Damage to Undiscovered Below-Ground Heritage Assets	Moderate or Large Adverse (significant)	**A Chance Finds Procedure.**	Slight Adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
	Operation	**Improved Setting to the Albanian Mother Memorial**	Slight Beneficial (significant)	**None required**	Slight Beneficial (not significant)

21 CUMULATIVE EFFECTS

21.1 INTRODUCTION

21.1.1. The following chapter presents the assessment of the effects on each environmental and social resource or receptor, where cumulative effects may occur as a result of the construction and operation of the Project in combination with other planned projects.

21.1.2. The Project forms part of Corridor VIII, which will provide a transport link from Burgas in Bulgaria, through Skopje and Ohrid in North Macedonia, and ending at Durres in Albania. Corridor VIII will provide access to Brindisi in Italy via the Adriatic Sea. There is the potential for cumulative effects to occur as a result of other sections of the Corridor VIII within North Macedonia, and other schemes within North Macedonia.

21.1.3. The assessment of transboundary effects refers to those effect of the Project that may cause affect receptors located outside the territory of the Republic of North Macedonia. Transboundary effects are not anticipated, based on the location of the Project, and the area in which any effects due to the Project are likely to take place, and therefore have not been considered in the assessment.

21.2 REVIEW OF CUMULATIVE SCHEMES

21.2.1. The identified past, present and reasonably likely to occur projects in the area of the Project the potential to give rise to cumulative effects as follows:

- A2 Kichevo - Ohrid Motorway, 56.7 km – currently under construction (planned to be completed by the end of 2021);
- Kichevo - Lin Railway (which is planned for construction);
- Upgrade of Existing Railway station – Kichevo;
- Kichevo – Gostivar Railway (which is planned for modernisation);
- A2 Motorway, subsection Gostivar-Gorna Gjonovica (Phase 2), the section of A2 Motorway to the north of the Project (which is planned for design and construction);
- A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3), the section of A2 Motorway immediately to the north of the Project.
- National Gasification System in Macedonia, section 5: Skopje-Gostivar-Kichevo

21.2.2. For each scheme a brief description is given in the text below:

A2 Kichevo – Ohrid Motorway

21.2.3. The A2 Ohrid – Kichevo Motorway is a 56 km scheme, located immediately adjacent to the south of the Project, and is currently under construction (shown in Figure 21.1). The Project will connect with the A2 Ohrid – Kichevo at the southern end of the Project alignment, at a location to the southwest of the City of Kichevo. Construction is expected to be completed by the end of

2021[120]. This construction programme will extend beyond the start of the construction programme for the Project, so cumulative construction effects have therefore been assessed.

Figure 21.1 – A2 Ohrid – Kichevo Motorway

https://reconnectingasia.csis.org/database/projects/kicevo-ohrid-highway/62f0bb78-b61e-4f4d-984c-aea7eda26aa8/

[120] https://www.zaman.mk/en/macedonia/14733-kicevo-ohrid-highway-construction-deadline-extended-to-3-5-years.html

Kichevo – Lin Railway

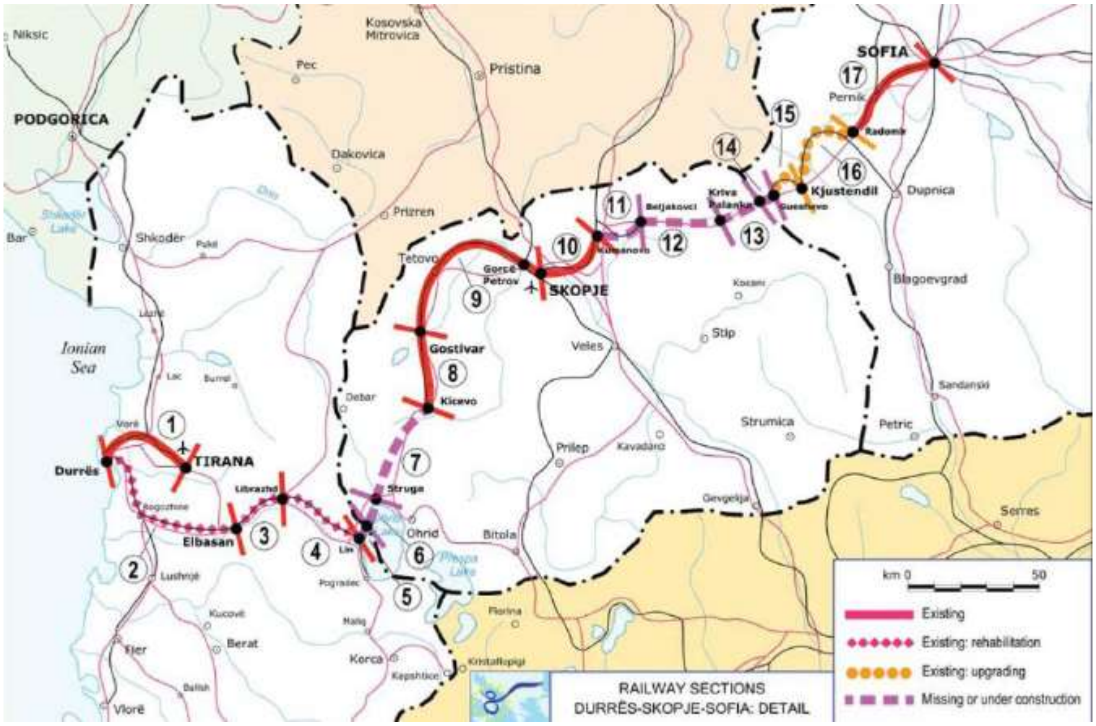

Figure 21.2 - Kichevo - Lin Railway

21.2.4. The Kichevo - Lin railway (shown in Figure 21.1), is the construction of a railway from Kichevo, at the southern end of the Project, to the Albanian city of Lin. It will be a part of the Corridor VIII Skopje-Tetovo-Gostivar-Kichevo railway (Figure 21.2) and will be mixed use (with passengers and freight). The railway will be 63 km long and fully electrified and composed of two sections:

- Section 1: Kichevo - Struga, and
- Section 2: Struga - Republic of Albania border

21.2.5. The Struga – Kichevo link is estimated to take 5 years to construct[121]. The project documentation for the scheme was completed in 2017, and an EIA in 2010[122]. However, in November 2019 the preliminary design for the railway was being revised in response to concerns raised by UNESCO, in relation to the section near Ohrid Lake. The revised design was due to be finalised in January 2020. The Struga – Kichevo ends at Kichevo station, which is

[121] http://www.mit.gov.it/mit/sites/varifiles/corridoioVIII/Corridoio_8_Stampato_Maggio%202008_ferrovie_completo.pdf
[122] https://www.yumpu.com/en/document/view/29639870/railway-corridor-8-a-republic-of-albania

approximately 1.25 km south east of the southern end of the Project. Cumulative effects during construction and operation have been considered.

Kichevo Railway Station

21.2.6. Kichevo Station will be modernised as part of the Skopje-Tetovo-Gostivar-Kichevo route modernisation. The Skopje - Kichevo railway is part of the Corridor VIII railway corridor and an element of the Skopje-Tetovo-Gostivar-Kichevo. The current railway conditions result in limited speeds, and this railway alignment is planned for modernisation. Kichevo station is located approximately 1.25 km south east of the southern end of the Project.

21.2.7. The delays to the Kichevo-Struga part of the route, are expected to delay the modernisation of this station, which will be at the northern most end of this railway route. Therefore, the modernisation of this station is not anticipated to take place at the same time as the construction of the Project, and cumulative construction effects are not anticipated.

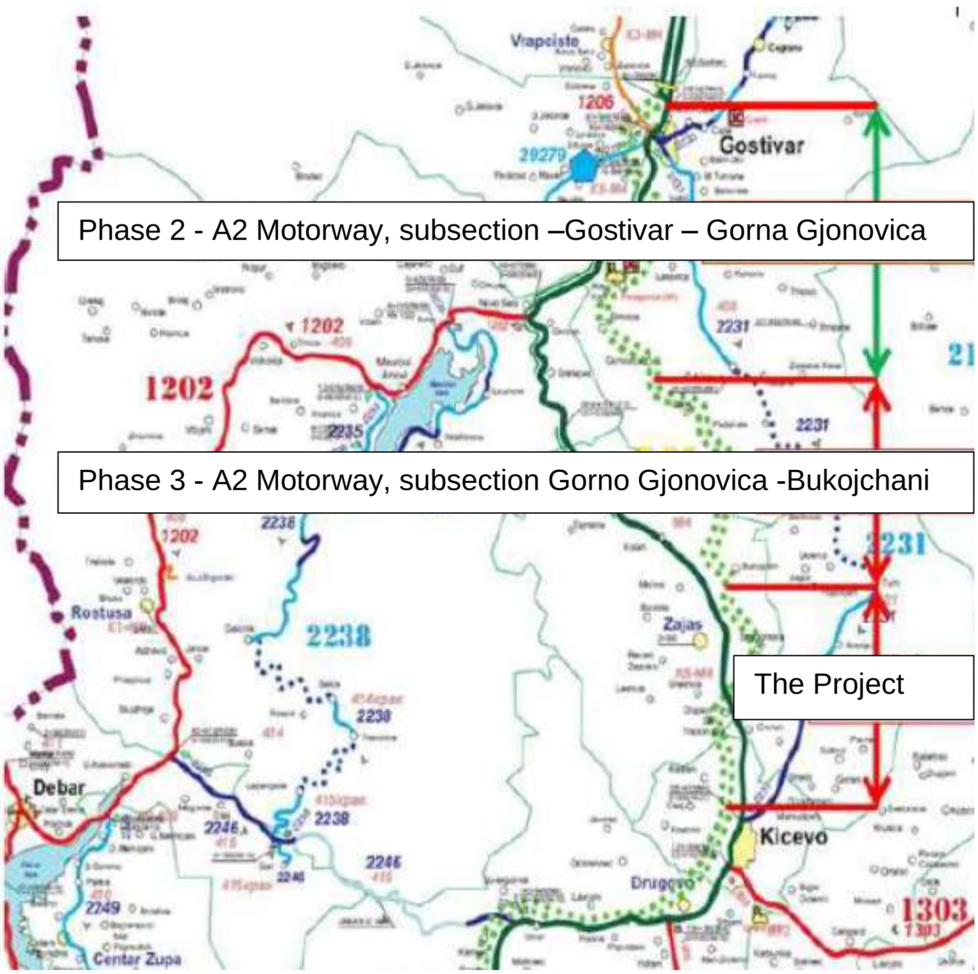

Figure 21.3 - Corridor VIII

Kichevo – Gostivar Railway

21.2.8. This 40 km railway upgrade, improving the maximum speed, electrification and signalling, is expected to take 1 year to construct. As the previous phase from Kichevo-Struga, that is expected to take 5 years to construct, has been delayed, and has not yet started construction, this scheme is not expected to commence within the next 5 years. Therefore, this scheme is not anticipated to be modernised at the same time as the Project, which will be constructed within the next 2 years.

A2 Motorway, Subsection Gorna Gjonovica - Bukojchani (Phase 3)

21.2.9. Sub-section Gorna Gjonovica – Bukojchani is a 17 km section of the Gostivar-Kichevo motorway, which is currently planned for design and construction. This sub-section of the A2 Motorway will connect to the northern end of the Project.

21.2.10. As the Project is likely to be constructed south to north, and will take 4 years to construct, it is unlikely that the construction of Phase 3 will commence, at the same time as the Project or have overlapping construction phases. Due to this, cumulative construction effects are unlikely to occur.

A2 Motorway, Subsection Gostivar – Gorna Gjonovica (Phase 2)

21.2.11. Sub-section Gostivar – Gorna Gjonovica (13 km), is currently planned for design and construction. This sub-section of the A2 Motorway will connect to the northern end Sub-section Gorna Gjonovica – Bukojchani. This subsection is unlikely to have cumulative effects with the Project, as it is located over 17 km from the Project. Although Sub-section Gostivar – Gorna Gjonovica may be constructed at the same time as the Project, the distance is the key factor as to whether cumulative effects are likely.

National Gasification System in Macedonia, Gostivar-Kichevo Pipeline

21.2.12. As part of the Macedonian Energy Strategy (2020-2040) a new gas pipeline is proposed connecting lot 5 from Skopje – Tetovo – Gostivar – Kichevo (110km). The main design for the scheme has been prepared by Chakar and Partners, and the construction of the section from Skopje to Gostivar is due to be completed in 2020[123]. There is limited information on the construction period for the Gostivar to Kichevo section, but for the purposes of this cumulative effects' assessment, it is assumed that it may overlap with the Project. A map of the general pipeline alignment is shown in Figure 21.4. The pipeline will be buried and so cumulative operational effects are not expected to occur.

[123] https://www.ebrd.com/documents/procurement/83635-2020-feasibility-study-update.pdf?blobnocache=true

Figure 21.4 - National Gasification System in Macedonia; Section 5: Skopje-Gostivar-Kichevo pipeline

Figure 21.5 – Typical Pipeline Construction

ASSESSMENT OF CUMULATIVE EFFECTS

21.2.13. For the assessment of cumulative effects, the likely cumulative effect arising from each of the identified projects are as follows:

Table 21-1 - Cumulative Schemes and Potential Cumulative Effects

Environmental Receptor / Resource	**Upgrade of the existing railway station – Kichevo**		**Construction Railway: Kichevo - Lin**		**Modernisation of Railway: Kichevo – Gostivar**		**A2 Kichevo - Ohrid Motorway**		**A2 Motorway, Sub-Section Gorna Gjonovica - Bukojchani**		**National Gasification System - Skopje Gostivar-Kichevo pipeline**	
Topic/ Phase	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Air Quality					X		X	X		X	X	
Climate					X	X	X	X		X	X	
Surface water					X		X	X		X		
Groundwater							X	X		X	X	
Geology and Soils							X				X	
Noise and vibrations							X	X		X	X	
Waste Generation and Resource Efficiency					X		X					
Biodiversity							X				X	
Landscape and Visual Impact					X		X				X	
Livelihood					X					X		
Social					X		X	X		X		
Heritage					X			X		X		

21.3 METHODOLOGY FOR CUMULATIVE ASSESSMENT

21.3.1. The following significance criteria has been used for the assessment of cumulative effects:

Table 21-2 - Significance Criteria for Cumulative Effects

Significance		**Effect**
Significant	Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
	Major	Effects that may become key decision-making issue
Not Significant	Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
	Minor	Effects that are locally significant.
	Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

21.4 IN-COMBINATION EFFECTS

21.4.1. There is the potential for groups of receptors to be affected by multiple affects from the Project. This may result in several non-significant effects cumulating into a significant effect. The likely in-combination effects of the Project have been assessed in Table 21-3 and Table 21-4

Table 21-3 - In-combination effects - Construction

Receptor/ Topic	Air Quality	Groundwater	Surface Water	Geology and Soils	Noise and Vibration	Biodiversity	Landscape and Visual	Social	Property and Livelihood	Cultural Heritage	In-combination effect
Ground and Surface water bodies		X	X	X							Minor
Fauna and habitats	X				X	X	**X**				Minor
Residents Dolno Strogomishte and visitors to the cemetery	X				X		**X**	X	X	X	Major (due to visual impact)
Residents on or directly adjacent to the Project	X				X		**X**		X		Major (due to visual impact)
Residents in the region	X				X		**X**	X	X	X	Minor
Road Users							X				Minor

Table 21-4 - In-combination Effects - Operation

Receptor/ Topic	Air Quality	Groundwater	Surface Water	Geology and Soils	Noise and Vibration	Biodiversity	Landscape	Social	Property and Livelihood	Cultural Heritage	In-combination effect
Ground and Surface water bodies		X	X								Minor
Fauna and habitats	X				X	X					Minor
Residents Dolno Strogomishte and visitors to the cemetery	X				X		**X**		X	X	Major (due to visual impact)
Residents on or directly adjacent to the Project	X				X		**X**				Major (due to visual impact)
Residents in the region	X				X		X	X			Minor
Road Users							X				Minor

21.5 CUMULATIVE EFFECTS

Cumulative Effects on Air Quality

21.5.1. Cumulative effects affecting air quality may arise from the combination of the following projects in the construction phase: The Project; the A2 Kichevo-Ohrid Motorway, Kichevo - Lin railway and the Skopje-Gostivar-Kichevo pipeline, if the construction phases overlap. They will generate fugitive emissions of dust and exhaust gases from construction activities.

21.5.2. The cumulative effects on air quality during construction are expected to be of **moderate significance** as effects are likely only to be locally significant but that further work is required to ensure suitable mitigation is in place. If the construction phases overlap, the Contractor for the Project will be required to liaise with the Contractors for cumulative schemes, and together ensure that mitigation for their respective projects minimises the potential for cumulative effects, with support from the PESR, where required. As outlined in Chapter 23 – ESMP, the Contractor for the Project will need to liaise with the contractors constructing the cumulative schemes to ensure appropriate mitigation is in place.

21.5.3. During the operational phase traffic using the A2 Kichevo – Ohrid Motorway, A2 Gorna Gjonovica - Bukojchani section (Phase 3) and will generate in-combination emissions, however the effects are expected to be **minor (not significant).** The electrification of the modernisation of Railway: Kichevo – Gostivar will have a beneficial air quality effect. The Kichevo - Lin railway will be electrified, so no cumulative operational air quality effects due to this scheme is anticipated.

Cumulative Effects on Climate

21.5.4. Cumulative effects on climate may be caused if there are simultaneous construction activities due to: The Project, the A2 Ohrid – Kichevo Motorway, the Kichevo - Lin railway and the Skopje-Gostivar-Kichevo pipeline. The cumulative construction effects on climate are expected to be **minor (not significant).** The effects associated with the Project in isolation are minor, and the cumulative effects are unlikely to become issues on whether the project design should be selected so are considered to be minor.

21.5.5. Cumulative effects as a result of operational emissions may also occur as a result of the following schemes: the A2 Ohrid – Kichevo Motorway; A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3); and A2 Motorway, subsection Gostivar – Gorna Gjonovica (Phase 2). The electrification of the Kichevo - Gostivar Railway will have a beneficial Climate effect. The cumulative operational effects on climate are expected to be **minor (not significant).**

Cumulative Effects on Surface Water

21.5.6. Cumulative effects may occur if contamination occurs a result of construction activities at any of the cumulative schemes located along the same surface water bodies as the Project, such as the Zajaska (which then feeds into the Treska River, which is near the A2 Kichevo – Ohrid scheme) or Sushica River. The A2 Kichevo – Ohrid Motorway is located immediately adjacent to the Project and may result in cumulative effects. The Skopje-Gostivar-Kichevo pipeline will be constructed near the River Zajaska. The potential for construction effects will be managed though the ESMPs for these schemes, so cumulative effects are expected to be **minor (not significant).**

21.5.7. The A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3) will be designed in line with current standards and will have suitable drainage systems, thus reducing the chance of cumulative operational effects. The operational cumulative effects on surface water are expected to be **minor (not significant)** as the effects will managed though the drainage design and Operational Maintenance Plan.

Cumulative Effects on Groundwater

21.5.8. Cumulative effects may occur where contaminants enter groundwater during construction activities. Construction phase cumulative effects may occur as a result of the simultaneous construction of the Project, A2 Kichevo – Ohrid Motorway and the Skopje-Gostivar-Kichevo pipeline. The potential for effects will be managed though the ESMPs for these schemes, so cumulative effects are expected to be **minor (not significant).**

21.5.9. The A2 Kichevo – Ohrid Motorway and A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3) will be designed in line with current standards and will have suitable drainage systems, thus reducing the potential for cumulative operational effects on groundwater. The cumulative effects on groundwater are expected to be minor (not significant).

Cumulative Effects on Geology and Soil

21.5.10. Cumulative effects on geology and soil may occur as a result of construction of the Project, and the A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3) and the Skopje-Gostivar-Kichevo pipeline. Effects may occur due to the release of pre-existing contamination or as a result of leakage or spills during construction works. The potential for effects will be managed though the ESMPs for these schemes.

21.5.11. During the operational phase contaminants have the potential to be released from passing vehicles, however, this is considered unlikely to occur following the implementation of mitigation measures and an appropriate drainage strategy. It is assumed that the A2 Kichevo – Ohrid Motorway and A2 Motorway, subsection Gorna Gjonovica - Bukojchani (Phase 3) will also be designed with appropriate drainage systems.

21.5.12. The cumulative effects on geology and soil are expected to **be minor (not significant),** as the effects will likely only be of local significance at worst and will be managed though the ESMPs for these schemes.

21.5.13. The operational cumulative effects are anticipated to be not significant as the effects are expected to be local and project specific.

Cumulative Effects on Noise and Vibration

21.5.14. Cumulative effects on noise and vibration may occur from the combination of adjacent road sections. The most notable effects will occur where the Project links to the A2 Kichevo – Ohrid Motorway, if the construction phases overlap. If the construction phase of the Skopje-Gostivar-Kichevo pipeline there is the potential for cumulative noise and vibration effects to occur during construction.

21.5.15. Construction cumulative effects of up to a moderate significance may occur. Further mitigation may be required. If the construction phases overlap, the Contractor for the Project will be required to liaise with the Contractors for cumulative schemes, and together ensure that mitigation for their respective projects minimises the potential for cumulative effects, with support from the PESR, where required. As outlined in Chapter 23 – ESMP, the Contractor for the Project will need to liaise with contractors of the cumulative schemes to ensure appropriate mitigation is in place. The potential for effects will be managed though the ESMPs for these schemes, so cumulative effects are expected to be **minor (not significant).**

21.5.16. The operational cumulative effects are anticipated to be **minor (not significant)** as they will only have a locally effect at most.

Cumulative Effects on Waste and Resources

21.5.17. Waste will be generated as a result of the construction of all cumulative projects. If project activities run in parallel (A2 Kichevo – Ohrid Motorway, Skopje-Gostivar-Kichevo pipeline) this may put pressure on local and regional waste infrastructure and facilities.

21.5.18. Another potential source of waste is from excavated materials which have the potential to result in negative environmental impacts if not adequately managed. The Project includes disposal sites for excess soils, and it is unlikely that this cumulative effect will occur as a result of the Project.

21.5.19. The cumulative effects on waste are expected to be minor (not significant) as effects are likely to be local.

21.5.20. There are no cumulative operational effects (not significant) anticipated in relation to waste and resources.

Cumulative Effects on Biodiversity

21.5.21. The construction of the cumulative schemes has the potential to cause habitat fragmentation and vegetation removal. The most significant effects are likely to occur as a result of the construction of the A2 Bukojchani - Gorna Gjonovica subsection (Phase 3). There may also be cumulative effects due to the Skopje-Gostivar-Kichevo pipeline.

21.5.22. The A2 Bukojchani - Gorna Gjonovica subsection (Phase 3) is located close to the Ubavica[124] cave, which is protected as a monument of nature, as well as Important Plant Area (IPA) Bukovik - Straza. There is a permanent underground watercourse throughout the majority of the cave, with the exception of the entrance channel (85m). Cave fauna such as the genus Ceutnophies, called *Ceutnophies bukoviki* are present in the cave. The motorway alignment for the subsection is located close to the cave but is about 100m higher than the entrance.

21.5.23. The route of the road corridor A2 Bukojchani - Gorna Gjonovica subsection (Phase 3) enters the Important Plant Area (IPA) Bukovic - Straza[125]. The area includes significant habitats at the

[124] Source: Report on Strategic Environmental Assessment of the Feasibility Study for the viability of the concession for goods of general interest in the project for construction of the A2 highway (Corridor VIII) section Gostivar-Kichevo

[125] Source: Report on Strategic Environmental Assessment of the Feasibility Study for the viability of the concession for goods of general interest in the project for construction of the A2 highway (Corridor VIII) section Gostivar-Kichevo

European level according to the EUIS classification E4.34 (C2) and G1.69 (C2). Three significant plant species meet the criterion A (iv): **Solenanthus scardicus, Centaurea grbavacensis и Erodium guicciardii,** while *Ramonda serbica* meets the criterion A(ii).

21.5.24. Although Emerald areas have not been identified in the area of the A2 Bukojchani - Gorna Gjonovica subsection (Phase 3) and the Project, a large number of rare and endemic plants, fungi and significant fauna species are found. The area is an important linear corridor between the Mavrovo core area and the Cheloica - Suva Gora restoration area. This bio-corridor is important for the lynx, wolf, bear, hooves and small mammals.

21.5.25. It is expected that the cumulative effects would be of **minor significance** as the construction phases are not likely to overlap and provided that the A2 Bukojchani - Gorna Gjonovica subsection (Phase 3) adequately mitigates potential effects on existing habitats and protected areas (such as the Ubavica Cave).

21.5.26. There is the potential of cumulative biodiversity effects to occur as a result of temporary habitat loss associated with the Skopje-Gostivar-Kichevo pipeline, however, this is likely be very minor due to the narrow width of the scheme and the likely rate of construction.

21.5.27. No operational cumulative effects are anticipated as the cumulative schemes are expected to have ensured appropriate design-based mitigation has been put in place, such as crossing points for fauna and sufficient replacement habitat.

Cumulative effects on Landscape

21.5.28. Cumulative effects on landscape and visual changes will be caused by the construction the Project and the adjacent road sections A2 Kichevo – Ohrid Motorway and the Skopje-Gostivar-Kichevo pipeline. These projects are anticipated to mitigate their own landscape effects during operation and construction and therefore a minor cumulative effect **(not significant)** is anticipated. Visual impacts are likely to be locally significant at worst and so are **minor (not significant).**

Cumulative Effects on Social Aspects

Table 21-5 - Cumulative Socio-economic Effects

Key Issues	Cumulative Effects – Construction Phase
Property and Livelihood	The cumulative effects may occur between 2020 and 2025 as there is the potential that all linear infrastructure projects (A2 Kichevo – Ohrid Motorway, Kichevo – Lin Railway, the Skopje-Gostivar-Kichevo pipeline and the Project) will be under construction in the area. Significant numbers of local skilled workers may be engaged in construction of these projects. This will benefit the local economy as they may spend money locally. Adversely there may be a temporary reduction in the available workforce for other employers, but this will temporary and has the potential to result in benefits following the completion of the works. The workforce is likely to experience a positive cumulative effect as demand for workers is likely to increase.
	Some of the equipment and vehicles that will be used during construction will be acquired locally, and this may have a positive effect on the local economy of the region. The local economy will also benefit from the use of restaurants, hotels and catering services, although the workers in the construction camps are likely to use on-site

Key Issues	Cumulative Effects – Construction Phase
	services. There may, however, be an inflationary effect on prices. This will have a beneficial effect for the local business, but negative effect for local residents.
	The construction of the cumulative schemes will generate increased opportunities for businesses to increase sales revenue and overall viability through the supply of goods and services, including supplying the construction camps. Existing businesses may expand, and new businesses are likely to move to the region at least temporarily to provide services to projects under construction. The employment rate in the area is anticipated to increase.
	It is likely that infrastructure projects will increase the demand for communal services, such as drinking water and wastewater disposal and local roads. These potential cumulative social issues will require mitigation measures. As with the Project, the cumulative projects will need to mitigate their effects to reduce the burden on local utilities and facilities.
Social and Community	As the Project will provide suitable health and safety measures, there is not likely to be a significant cumulative effect on the community's health and safety during the construction of the cumulative schemes.
	It is highly likely the local health services will experience increased demand. With increased number of workers in the area, particularly in the construction industry where there are higher risks of workplace related injuries and communicable diseases. It is expected local health institutions would have an increased amount of work that will require financial resources. Mitigation measure will be provided. As with the Project, the cumulative schemes will need to ensure that suitable welfare (including health facilities) are provided for the workforce to ensure the local facilities are not overburdened.
Key Issues	Cumulative Effects – Operational Phase
Property and Livelihood	There is the potential for an adverse cumulative effect due to the decreased demand for workers once the projects are completed. This may lead to the migration of skilled workers away from the region. As with the Project, a Local Employment Plan will be prepared which will help workers gain employment to the extent feasible following the completion of the construction works, including the provision of references and training records.
	There is the potential for benefits to the local manufacturing and services sector through the completion of the Project and cumulative schemes as transport links will be improved resulting in a more reliable network for deliveries and travelling between destinations.
	Businesses may move to the area following the completion of the Project and the cumulative schemes as the improved transport links may be attractive to businesses outside the region.
Social and Community	It is assumed that the cumulative schemes will all be designed and constructed in compliance with national standards and using best practice techniques. It is likely that a beneficial effect will occur as a result of the operation of the Project and cumulative schemes.

21.5.29. Assuming all cumulative schemes will include suitable mitigation, the cumulative social effects are anticipated to be local only and therefore **minor (not significance)** for both the construction and operational phases.

22 SUMMARY OF EFFECTS

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Air Quality					
Air Quality	Construction	Construction Emissions	Moderate adverse (significant)	Construction Air Quality Management Plan Construction Traffic Management Plan	Slight adverse (not significant)
	Operation	Traffic Emissions	Slight beneficial (not significant) and slight adverse (not significant)	Operational Air Quality Management Plan Tunnel Operational Management Plan Operational Stakeholder Engagement Plan	Neutral
Climate – Greenhouse Gases	Construction	Construction emissions	Minor significant	Materials and Waste Management Plan (MWMP); The following measures will be considered: • Design optimisation to reflect the carbon reduction hierarchy; • Incorporating material resource efficiency and water minimisation best practice into design; • Select and engage with material suppliers and construction contractors taking into account their policies and commitments to reduction of GHG emissions, including embodied emission in materials; • Prepare and implement a • Minimise energy consumption including fuel usage by, for example, minimising plant use, idling and specifying efficient plant (or hybrid or electric plant); and • Maximise the local sourcing of materials and the use of local waste management facilities.	Minor significant
	Operation	Operational emissions	Minor significant	Operate, maintain and refurbish the Project using best-practice efficient approaches and equipment Lighting will be optimised (energy-efficient lighting) will be specified at the detailed design stage.	Minor significant
Climate - Resilience	Construction	Heatstroke leading to delays	Moderate adverse	Health and safety measures for the workforce are included in the ESMP.	Not significant
	Operation	Drying out and cracking of substrate leading to damage to pavement	Moderate Adverse	Take the latest projections of future rainfall into account when specifying pavement material and designing drainage.	Not significant
		Die-off of vegetation leading to slope destabilisation	Moderate Adverse	Take projected (reduction in overall) rainfall into account when specifying vegetation for slopes. Ensure drought-resistant species are chosen	Not significant
		Deformation of pavement	Moderate Adverse	Take projections of future rainfall into account when specifying pavement material. Ensure thermal tolerance of specified materials is above projected extreme temperature.	Not significant
		Melting of pavement	Moderate Adverse		Not significant

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Drying out and cracking of substrate leading to damage to foundations	Moderate Adverse	Take projections of future rainfall into account when specifying foundation depth. Ensure thermal tolerance of specified materials is above projected extreme temperature.	Not significant
		Increase in expansion leading to structural damage	Moderate Adverse	Take projections of future average and extreme temperature into account when designing expansion joints.	Not significant
		Increase in earth pressure for bridge foundations	Moderate Adverse	Take projections of future average and extreme temperature into account when designing foundations.	Not significant
		Increase in wind loading leading to destabilisation	Moderate Adverse	Take projections of future wind speed into account when calculating wind loading.	Not significant
		Drying out of soils and cracking of materials in the tunnel	Moderate Adverse	Take projections of future average and extreme temperature into account when specifying tunnel construction materials.	Not significant
		Overheating in the tunnel	Minor Adverse	Take projections of future average and extreme temperature into account when specifying cooling and ventilation systems.	Not significant
Groundwater					
Groundwater	Construction	Alteration of groundwater hydrology	Moderate adverse (significant)	Water Resources Management Plan (to include monitoring)	Slight adverse (not significant)
		Alteration of groundwater quality due to input of pollutants	Moderate adverse (significant)		Slight adverse (not significant)
	Operation	Alteration of groundwater quality due to input of pollutants	Moderate adverse (significant)	Detailed Design measures including oil interceptors and suitable drainage design. Operational Management Plan. Operational Drainage Management Plan. Surface and groundwater monitoring.	Slight adverse (not significant)
Surface Water					
Surface Water	Construction	Input of Pollutants	Moderate adverse (significant)	Water Resources Management Plan Biodiversity Management Plan	Slight adverse (not significant)
		Alteration of river bed morphology and/or physical water quality	Moderate adverse (significant)		Slight adverse (not significant)
		Alteration of river bed and floodplain habitat ecology	Moderate (not significant)		Slight adverse (not significant)
		Abstraction of water from surface water sources during construction	Neutral (not significant)		Neutral (not significant)
	Operation	Input of Pollutants	Moderate adverse (significant)	Detailed design – oil interceptors Operational Maintenance Plan Operational Drainage Management Plan	Slight adverse (not significant)
		Alteration of flow patterns and sediment deposition during flooding periods	Slight adverse (not significant)		Slight adverse (not significant)
Geology and Soils					

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
Geology and Soils	Construction	Degradation of Topsoil and Made Ground Quality	Slight Adverse (not significant) to Moderate Adverse (significant)	A Soil Management Plan (including Spoil Disposal Plan). A Waste and Materials Management Plan. A Land Restoration Plan. An Emergency Preparedness and Response Plan (including a Spill Management Plan).	Neutral (not significant)
		Soil Erosion and Compaction	Moderate Adverse (significant)		Slight Adverse (not significant)
		Soil Loss and Degradation (borrow pits and excavated material disposal sites)	Moderate Adverse (significant)		Slight Adverse (not significant)
		Loss of Fertile Topsoil	Moderate Adverse to Large Adverse (significant)		Slight Adverse (not significant)
		Stability and Risk of Landslides	Moderate Adverse (significant)		Slight Adverse (not significant)
		Excavation of Potentially Contaminated Soils and impacts to the environment, the community and workers.	Moderate Adverse (significant) to Large Adverse (significant)		Slight Adverse (not significant)
	Operation	Degradation of Topsoil and Made Ground Quality	Slight Adverse (not significant).	Development and implementation of an Emergency Preparedness and Response Plan. Appropriate drainage design specified at detailed design stage.	Slight Adverse (not significant)
		Soil Erosion	Slight Adverse (not significant)	Operational Maintenance Plan. Operational Soil Management Plan.	Neutral (not significant)
		Seismic Activity	Neutral (not significant)	Design measures as outlined in Chapter 2 – Description of the Project. An Emergency Preparedness and Response Plan	Neutral (not significant)
Waste Generation and Resource Efficiency					
Waste Generation and Resource Efficiency	Construction	Material resource consumption	Large adverse (significant)	Waste and Materials Management Plan Soil Management Plan Reasonably practicable measures to re-use site won arisings and maximise the secondary or recycled content of materials.	Potential to be not significant However, likely to be constrained by existing recovery infrastructure with North Macedonia.
		Waste generation and disposal	Very Large adverse (significant)	Waste and Materials Management Plan	Potential to be not significant

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
				Soil Management Plan Reasonably practicable measures to minimise waste generation.	However, likely to be constrained by existing waste recovery and landfill infrastructure within North Macedonia.
Noise and Vibration					
Noise and Vibration	Construction	Noise emissions from construction vehicles and machinery	Large (significant)	Noise and Vibration Management Plan	Moderate (significant)
	Operation	Traffic noise emission	Large (significant)	Operational Noise Management Plan	Moderate (significant)
Biodiversity					
Biodiversity	Construction	Loss of Habitats	Moderate adverse (significant)	Biodiversity Management Plan (BMP) Including: Woodland Clearance Plan Land Restoration Plan (including replanting to achieve no net loss/net gain as required)	Neutral – Slight positive (not significant)
		Breeding cycle interruption	Slight adverse (significant)		Neutral (not significant)
		Alteration, disruption or destruction of amphibian and fish habitats	Up to major adverse (significant)		Neutral (not significant)
		Disturbance due to construction activities	Slight adverse (significant)		Neutral (not significant)
	Operation	Loss of Habitats	Slight adverse (not significant)	Detailed design. Regular maintenance activities, as set out in the Operational Management Plan	Neutral (not significant)
		Protected and Designated Areas	Neutral	No specific mitigation required	Neutral (not significant)
		Bio-corridors	Neutral		Neutral (not significant)
Landscape and Visual					
Landscape and Visual	Construction	Landscape	Moderate Adverse (significant)	Detailed Design	Slight Adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Visual	Slight Adverse (not significant) to Very Large Adverse (significant)	Landscape and Visual Management Plan	Slight Adverse (not significant) to Large Adverse (significant)
	Operation	Landscape	Slight Adverse (not significant) to Moderate Adverse (significant)	Detailed Design (expropriation option) Operational Maintenance Plan	Slight Adverse (not significant)
		Visual	Neutral (not significant) to Very Large Adverse (significant)		Neutral (not significant) to Large Adverse (significant)
Social and Community					
Social and Community	Construction	Construction Community Cohesion and Wellbeing	Moderate Adverse (significant) to Large Adverse (significant)	• A Code of Conduct for Construction Workers. • A Community Health, Safety and Security Plan. • A Community Access and Infrastructure Plan. • An Emergency Preparedness and Response Plan. • A Traffic Management Plan. • A Construction Workers' Accommodation Management Plan. • A SEP.	Slight Adverse (not significant)
		Construction related Local Community Health and Accidents	Moderate Adverse (significant) to Large Adverse (significant)		Slight Adverse (not significant)
		Construction Traffic	Large Adverse (significant)		Slight Adverse (not significant)
		Access to Education Facilities, Social Welfare Support Facilities and Healthcare Facilities	Large Adverse (significant)		Slight Adverse (not significant)
	Operation	Operational Community Cohesion and Wellbeing	Slight Adverse (not significant) or Moderate Adverse (significant)	• An Operational Community Health and Safety Management Plan. • An Operational Worker Health and Safety Management Plan. • Road Safety Audits. • An Emergency Preparedness and Response Plan. • A SEP.	Slight Adverse (not significant)
		Operational Local Community Incidents and Accidents	Moderate or Large Beneficial		Large Beneficial
Occupational Health, Safety and Security					
Occupational Health, Safety and Security	Construction	Construction Workers employment rights and working conditions	Moderate Adverse (significant)	• Occupational Health and Safety Management System. • An Occupational Health and Safety Plan. • A Code of Conduct for Construction Workers. • A Local Employment and Procurement Plan.	Slight Adverse (not significant)
		Employment of Construction Workers (HSE management on site and HSE training among workers)	Large Adverse (significant) or Very Large Adverse (significant)		Slight Adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Construction Worker Incidents and Accidents (Labour and Working Conditions)	Moderate or Large Adverse (significant)	• A Construction Workers' Accommodation Management Plan. • Labour And working Conditions Management Plan (LWCMP) • Provision of construction workers training and construction workers contracts.	Slight Adverse (not significant)
		Construction Workers' Accommodation (HSE management on site and HSE training among workers)	Slight Adverse (not significant) or Moderate Adverse (significant)		Slight Adverse (not significant)
	Operation	Subsequent Employment of Construction Workers	Minor to Moderate Beneficial	All employees will be provided with a reference/ confirmation of employment letter and a skills/ training log, to enhance their subsequent employment prospects.	Moderate Beneficial
Property and Livelihood					
Property and Livelihood	Construction	Access to Rural Settlements, Land and Property	Moderate or Large Adverse (significant)	Land Acquisition Plan (LAP). A Local Employment and Procurement Plan A Code of Conduct for Construction Workers A Community Health, Safety and Security Plan A Community Access and Infrastructure Plan	Slight Adverse (not significant)
		Utilities Provision	Slight Adverse (not significant) or Moderate Adverse (significant)		Slight Adverse (not significant)
		Deterioration of Local Roads	Moderate Adverse (significant)		Slight Adverse (not significant)
		Physical Displacement/Resettlement	Moderate Adverse (significant)		Slight Adverse (not significant)
		Loss of Agricultural Land	Moderate Adverse (significant)		Slight Adverse (not significant)
		Foraging of plants and Fungi	Slight Adverse (significant)		Slight Adverse (not significant)
		Construction Employment and Economic Growth	Moderate Beneficial		Large Beneficial
	Operational	Employment and Economic Growth	Moderate Beneficial	Local Employment and Procurement Plan (LEPP). Workers training records and letters confirming their skills and employment on the Project.	Moderate beneficial
Cultural Heritage					
Cultural Heritage	Construction	Disturbance at Cemeteries	Moderate or Large Adverse (significant)	A Cultural Heritage Management Plan.	Slight Adverse (not significant)

Topic	Phase	Potential Impacts	Effect (without mitigation	Mitigation Measures	Residual Effect
		Works in Dolno Strogomishte Cemetery	Variant 0 Moderate or Large Adverse (significant)	A Grave Relocation Plan (if not designed out at Detailed Design Stage). Cultural Heritage Management Plan	Moderate Adverse (significant)
			Variants 1 and 2 Slight (significant)		Minor Adverse (not significant) if effect is designed-out
		Potential Loss of Partial Damage to Undiscovered Below-Ground Heritage Assets	Moderate or Large Adverse (significant)	A Chance Finds Procedure.	Slight Adverse (not significant)
	Operation	Improved Setting to the Albanian Mother Memorial	Slight Beneficial (not significant)	None required	Slight Beneficial (not significant)
		Setting of the Cemetery at Dolno Strogomishte	Large Adverse (significant)	None available See Chapter 14 – Noise and Vibration and Chapter 16 – Landscape and Visual	Large Adverse (significant)

Topic	Stage	Significance of effect
Cumulative Effects		
Air Quality	Construction	Minor adverse (not significant
	Operation	Minor adverse (not significant
Climate	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Surface Water	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Groundwater	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Geology and Soils	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)

Noise and Vibration	Construction	Minor adverse (not significant
	Operation	Minor adverse (not significant)
Waste and Materials	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Biodiversity	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Landscape and Visual	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)
Socio-economics	Construction	Minor adverse (not significant)
	Operation	Minor adverse (not significant)

23 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

23.1 OBJECTIVES, STRUCTURE AND CONTENT

23.1.1. The objectives of the Environmental and Social Management Plan (ESMP), including the Monitoring Plan, are:

- To ensure project components are conducted in compliance with the national laws and regulations as well as the requirements of the European Bank for Reconstruction and Development (EBRD) (the Lenders);
- To measure the success of proposed mitigation measures in minimising and/or reducing potential environmental, health, safety and social impacts;
- To control the changes to baseline environmental, health, safety and social conditions during pre-construction, construction and operation activities;
- To facilitate a continual review of activities based on performance data and consultation feedback; and
- To implement corrective actions or new adaptive management programs, as required.

23.1.2. The ESMP sets out the measures required during the two development phases of the project:

- Pre-construction and construction; and
- Operation, including an Environmental and Social Monitoring Plan.

23.1.3. The ESMP sets out:

- The environmental aspects that need to be managed;
- Proposed mitigation measures;
- Responsibilities for implementing and monitoring the measures;
- Targets and / or indicators of success; and
- Estimated costs (where appropriate).

23.2 LENDER REQUIREMENTS

23.2.1. This ESMP has been developed in accordance with all the Lenders' requirements. The Construction Environmental and Social Management Plan (CESMP) and sub-plans set out in this ESMP, will be developed by the Contractor in accordance with the relevant Lenders' requirements, at a contract level.

23.2.2. The Lenders' requirements are described below.

23.2.3. EBRD – Performance Requirements (PRs):

- **PR 1: Assessment and Management of Environmental and Social Impacts and Issues**
  - Establishes the importance of integrated assessment to identify project-specific environmental and social impacts and the requirement to implement an Environmental and Social Management System (ESMS) to effectively manage these impacts.

- **PR 2: Labour and Working Conditions**
  - Outlines the need to respect and protect the fundamental principles and rights of workers.
- **PR 3: Resource Efficiency and Pollution Prevention and Control**
  - Sets out how resource efficiency and pollution prevention and control are essential elements of environmental and social sustainability and that projects must meet Good International Practice (GIP).
- **PR 4: Health and Safety**
  - Outlines the need to protect and promote the health and safety of workers by ensuring healthy and safe working conditions and requires the implementation a project-specific health and safety management system.
- **PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement**
  - Recognises the need to avoid, or when unavoidable, minimise involuntary resettlement by exploring alternative project designs. This PR also outlines the need to minimise adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land.
- **PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources**
  - To project and conserve biodiversity using a precautionary approach, implementing the mitigation hierarchy and promoting GIP.
- **PR 8: Cultural Heritage**
  - Recognises the importance of cultural heritage for present and future generations. The aim is to protect cultural heritage and to guide clients in avoiding or mitigating adverse impacts on cultural heritage in the course of their business operations.
- **PR 10: Information Disclosure and Stakeholder Engagement**
  - Recognises the importance of open and transparent engagement between the client and their stakeholders, in particular local communities directly affected by the project.

23.2.4. PR 7 (Indigenous Peoples) and PR 9 (Financial Intermediaries) are not applicable to this project.

23.3 ROLES AND RESPONSIBILITIES

23.3.1. The following roles and responsibilities have been established for implementation and management of this ESMP.

THE EBRD

23.3.2. The EBRD are financing but not directly developing the Project. Responsibility is therefore passed to the Project Owner, although reports will be required to be submitted to the EBRD on the status of the ESAP, resolution of grievances and EHSS performance of the project.

PUBLIC ENTERPRISE FOR STATE ROADS (PESR)

23.3.3. The PESR will have ultimate responsibility for the project and will oversee the implementation of the EBRD project requirements during construction and operation, overseeing the contractor, subcontractors and other involved third parties. They will be responsible for creating a Project Implementation Unit.

PROJECT IMPLEMENTATION UNIT (PIU)

23.3.4. The PESR will establish a project implementation unit (PIU) to assist the PESR in implementing the Project in compliance with the EBRD Environmental and Social Policy.

23.3.5. The PIU, as Project Implementing Authority (IA) will be responsible for ensuring the implementation of all national and international environmental, health, safety and social policies, guidelines and performance requirements of both the Republic of North Macedonia and the EBRD.

23.3.6. The PIU will be responsible for the overall implementation of the mitigation measures and requirements, specified within the disclosure package for the Project, and implementing the Environmental and Social Management System (ESMS). They will be required to oversee the implementation of the Contractors CESMP, which will be developed by the contractor to ensure they fulfil all the identified environmental, health, safety and social requirements under the loan agreement for the Project. The PIU are responsible for ensuring roles and responsibilities are clearly identified and allocated for environmental, health, safety and social (including gender), both within the PIU itself and within the contractors' arrangements, including sub-contractors and contracted organisations. The PESR will appoint a Supervising Engineer to supervise the Contractor.

23.3.7. In relation to land acquisition and resettlement, the PIU will be responsible for the full implementation of the Land Acquisition Plan (LAP) following approval by the EBRD and the Government of North Macedonia. In addition, the PIU will be responsible for the implementation and conformance of the grievance mechanism (GM) to ensure that all grievances and/or objections (if any raised by the local community and/or workers) are received, acknowledged and addressed as per the grievance procedure presented in the Stakeholder Engagement Plan (SEP) and LAP.

23.3.8. The PIU shall appoint a Community Liaison Officer (CLO) to manage consultations and implement the developed SEP. The PIU will be responsible for reviewing the licence, permit and agreement documentation prepared by the Contractor.

SUPERVISING ENGINEER

23.3.9. The Supervising Engineer will be responsible for supervising the Contractor to ensure that recommendations and requirements, as set out in this ESMP and other documentation are applied. They will be responsible for continuous monitoring of the processes and activities undertaken by the Contractor, and specifying measures to be implemented by the Contractor, to address any areas of non-compliance. This requirement will be included in Tender Documents.

LENDERS TECHNICAL ADVISOR

23.3.10. The EBRD will appoint a Technical Advisor who will be responsible for reviewing documentation on behalf of the lender, and who will monitor the Contractor's implementation of the activities specified in the ESMP on a quarterly basis. They will be responsible for providing a monitoring report to the Lenders that evaluates compliance with both the ESMP and Lenders requirements and provides recommendations to the Supervising Engineer and Contractor to address any areas of non-compliance.

CONTRA0CTOR

23.3.11. The Contractor will be responsible for implementing the construction phase measures in the ESMP.

23.3.12. The Contractor will also be responsible for implementing any environmental, health, safety and social measures identified in the ESIA, that the PIU has developed for submission to the Ministry of Environment and Physical Planning (MOEPP).

23.3.13. The Contractor will be responsible for submission of relevant reports to the Supervising Engineer, for subsequent approval by the Supervising Engineer, PIU/PESR, EBRD and/or the Ministry of Environment and Physical Planning (MOEPP), as appropriate.

23.3.14. The Contractor will be responsible for appointing technical specialists to ensure environmental and social mitigation is implemented correctly, in line with best practice and national and international requirements. Specialists include:

- Environmental Engineer – responsible for ensuring that mitigation is implemented as per this ESMP. They will be suitably competent, have a knowledge of ecological issues, and have a strong understanding of environmental best practice.
- Health and Safety Officer – responsible for undertaking health and safety tasks as set out in the Contract and ESMP.
- Other social, safety, environmental and/or specialists may be engaged to provide support as necessary.

23.3.15. The Contractor will be responsible for preparing the licence, permit and agreement documentation.

23.4 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM (ESMS)

23.4.1. PESR shall prepare an overarching ESMS for this project. The ESMS will be submitted to PESR Management for approval. The key Environmental and Social covenants will be set out in the tender documents, during the Contractor selection process, for inclusion in the Contractor ESMS.

23.4.2. The Contractor will be responsible for implementing an ESMS that is in line with International Standards, lender requirements, and the PESR's ESMS. The Contractor will be required to appoint appropriately qualified specialists with the following expertise, to ensure is the ESMS is implemented to the required standards:

- Environmental;
- Health and safety;
- Social; and
- Land acquisition and resettlement.

The Contractor must conduct an initial safety induction course for construction workers regarding: health and safety measures; and emergency response in case of accidents, fire, earthquakes, landslides, flash flooding, environmental and community interactions, etc. They must also develop and implement a safety and security training program and conduct safety meetings on a monthly basis.

23.5 CONSTRUCTION ACTIVITIES

Table 23-1 - Environmental and Social Management Plan – Pre-construction and Construction Stage

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
PESR Environmental & Social Management Activities					
P1	Development of an Environmental and Social Management System (ESMS) by PESR	The PIU in the PESR, with additional expertise, if required, will implement an ESMS to international standards.	Preparation: PIU in the PESR/ the PESR Approval: Senior Management of the PESR	PESR Reported to EBRD in monthly environmental, social, health and safety (ESHS) reports.	PR1, PR2, PR3, PR4, PR5, PR6, PR8 and PR10 ESMS audited and approved.
P3	Environmental, Health, Safety and Social Incident Reporting Procedure	Set-up, maintain and continually review an Environmental, Health, Safety and Social (EHSS) Incident Reporting Procedure (or equivalent) to ensure accidents and incidents are accurately recorded, maintained and reported. The procedure must be fully integrated into the Project and communicated to the contractors, who will have clearly specified responsibilities.	Preparation: PIU in the PESR/ the PESR Approval: Senior Management of the PESR	PESR to report to EBRD in the monthly ESHS Report. This should include details on working-hours and accidents / incidents including near misses. Non-compliance to the remedied by Senior Management of the PESR.	Requirements for an Incident Reporting Procedure in tender documents for Contractor. PR1
P4	Disclosure of project information and community consultation through Stakeholder Engagement Plan (SEP)	Elaborate and implement the Stakeholder Engagement Plan (SEP) and Supplementary SEP[126]. Together with Contractor(s), organise regular consultation activities with local communities, regularly notifying them about any expected significant or noisy works and the dates and timing of such works' implementation (through local authorities and also through posters displayed in key locations). If the Dolno Strogomishte bridge design is confirmed to fringe the D. Strogomishte gravesite area, as part of the SEP implementation process, PESR will prepare a Grave Relocation Plan which will be disclosed to local communities. The PESR/ social consultants on behalf of the PESR will undertake the following process: 1. Confirm the relevant Regulating and Permitting Bodies 2. Engagement with the Relevant Authorities and Organisations 3. Relationship Mapping 4. Public Consultation 5. Baseline Data Collection	PESR, PIU	PESR SEP and GRP updates to be reported to EBRD in monthly ESHS report. Non-compliance to the remedied by Senior Management of the PESR.	SEP elaborated prior to the tender process for the Contractor. CLO appointed prior to the commencement of construction. Grave Relocation Plan finalised upon confirmation of bridge design at D. Strogomishte and implemented prior to the commencement of construction at this location. PR10

[126] Full details of the activities undertaken during the disclosure period are provided in the Supplementary Stakeholder Engagement Plan (SEP). This Supplementary SEP details the engagement activities undertaken with stakeholders in light of the COVID-19 restrictions in place during the 120-day disclosure period.

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
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		6. The Preparation of a Grave Relocation Plan (GRP). A CLO will be appointed by PESR (within the PIU) as specified in 3.4.5. Further details on CLO's role and responsibilities can be found in the SEP in Sections 3.4, 8.1 and 8.2 and Table 6. Update SEP quarterly throughout the Project as per PR10.			
P5	Grievance Mechanisms (GM)	Prior to start of works, the PESR shall: Establish and communicate to local communities and workers, in both Macedonian and Albanian languages a GM and relevant contact details, as described in the ESIA and SEP. The PESR will set-up and publicise a hotline / email service for grievances and feedback (to operate during working-hours throughout the construction period) Ensure that GM's email addresses, telephone number details, genders and other relevant GM details of the PESR and contractors are placed on the notice boards outside the construction site.	PESR / PIU	PESR/ PIU PESR to report to EBRD in the monthly ESHS Report. Non-compliance to the remedied by Senior Management of the PESR.	GM Established prior to the start of work. 24-Hour hotline requirement in tender documents for Contractor PESR to check that Notice boards with relevant GM details are located at construction sites, prior to the start of works and quarterly. PR10
P6	Land Acquisition Plan (LAP).	Prior to construction, the PESR will develop a Land Acquisition Plan (LAP) which should be aligned with the already prepared Land Acquisition Framework LAF). The LAP should cover the route alignment, the access roads to the Project, and the planned construction access roads, and should be implemented before any Project related land take and restrictions to accessing livelihoods takes place. No access to private properties will take place before due compensation is agreed and paid to project affected people. The process for preparing the LAP process is set out in the LAF. For consultations on Land Acquisition, see Section 8 in the LAF. Arrange for the independent completion of an audit of the land acquisition and compensation process, in line with LAF, national legislation and Lenders' requirements. Auditors will be appropriately trained in land acquisition in line with IFI requirements.	PESR will prepare LAP and their Contractor will implement LAP. Independent auditor – the auditors will be appropriately trained in land acquisition in line with IFI requirements. The audit will be commissioned by the PESR and will be complete both prior to the start of Land Acquisition activities and after the activities have taken place.	PESR to report to EBRD in the monthly ESHS Report. Survey reports LAP social monitoring indicators Consultation Meetings Non-compliance to the remedied by Senior Management of the PESR.	LAP is prepared in compliance with the process in the LAF, prior to the commencement of construction. LAP is disclosed and project affected people are consulted on the LAP and its implementation. PR5 compliance Independent audit demonstrates compliance
P7	Biodiversity Management Plan (including a Woodland Clearance Plan and Land Restoration Plan)	The BMP (Land Restoration Plan) prepared by the PESR will include: habitat replacement activities; specify the type of species; and the specific locations for replacement. This information should also be included in the Bill of Quantities and tender documentation for the Contractor. It will also set out the measures that the PESR will ensure are included in the detailed design. The PESR will include the BMP in the tender documentation, and the Contractor will be required to	The PESR will prepare the BMP, which will be implemented and elaborated by their Contractor.	PESR to report to EBRD in the monthly ESHS Report.	Biodiversity Management Plan Bill of Quantities with habitat replacement included PR6

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		elaborate prior to commencing construction, with the measures detailed in C13. Habitat replacement activities. The habitat replacement requirements are as follows (minimum requirements): Italian and Turkey oak forests 3.59 ha Riparian black alder belts and woodland 7.94 ha Riparian willow belts 1.46 ha These figures will be recalculated on the final detailed design for the Project. If any additional habitat is required for the Project, the area of replacement habitat will need to be recalculated using the same replacement ratios used in the ESIA, namely at least like-for-like replacement for PBF habitat losses and a net gain for CH (ratio 2:1). Once the habitat replacement requirements are defined the location will need to be identified. These locations will be as close as feasibly possible to where it is lost, and within and around the Ecologically Appropriate Area of Analysis (EAA). The EAAs are identified in Figure 15-9 of Chapter 15 – Biodiversity of the ESIA. The land required for replanting will be secured by the PESR, and will be maintained as the specified habitat type in the long-term (i.e. for the lifetime of the Project), through commitments secured from the landowners by PESR The materials required for habitat replacement will be included in the Bill of Quantities. Plant stock should be locally sourced, where possible, to maintain genetic identity of local communities. Recommended trees for revegetation are the following ones: *Quercus frainetto, Q. cerris, Carpinus betulus, Pyrus amygdaliformis, Acer pseudoplatanus, A. campestre, Crataegus monogyna, Ulmus minor, Prunus spinosa, Alnus glutinosa, Salix alba, S. fragilis* etc. Measures to be included in the detailed design include: The design of the bridge and box and pipe culverts will provide for connectivity of habitats and will not create obstacles for migration of animal species. Box and pipe culverts will: Be adapted to facilitate the passage of small animals. Be embedded into the streambed to at least 20% of the culvert height at the downstream invert. Be used only on "flat" streambeds (slopes no steeper than 3%).			

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		Have openings with at least 1.25 times the width of the stream channel bed. This width is measured bank to bank at the ordinary high-water level or edges of terrestrial, rooted vegetation. Ensure that water depths and velocities at low flows, are the same as they are in natural areas upstream and downstream of the crossing. Use natural substrate within the crossing, matching the upstream and downstream substrates; the substrate should resist displacement during floods and should be designed so that appropriate material is maintained during normal flows. The bridges will be designed and constructed to cause the least disturbance of the waterway and banks. Retention basins or grassed filter zones will be constructed to trap sediments and other contaminants and remove them, before the water is then discharged at the road drain discharge points, so as to reduce the pollution risk to the water bodies they will discharge to. The retention basins will be located outside areas of high biodiversity sensitivity. Disturbed areas not occupied by permanent structures will be reinstated by shaping the terrain to that of the surrounding land morphology and revegetating with plant species appropriate to the surrounding area. Separate documents on slope stabilisation and erosion control shall be developed. The mitigation measures to minimise the effect of fragmentation mainly consist of the establishment of enough wildlife crossings to increase the permeability of the Project alignment as follows: Afforestation activities to be performed in line with the No net loss principle, i.e. the Land Restoration Plan. Riparian vegetation along the streams of Zajaska Reka, Strogomishka Reka, Sushica and Rechishte to be restored to achieve No Net Loss. The undersides of bridges will be vegetated so as to create vegetal screens that hide the bridges structure (e.g. shrubs and small trees in the area of the abutments). Fenced areas will be vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings. The BMP will provide sufficient detail such that mitigation measures are clear and deliverable and a monitoring programme that can report back on the efficacy of measures described. The BMP should include mechanisms for adaptive management such that mitigation can be tweaked to achieve the desired results if it is demonstrated that it is not effective at any point.			

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Contractor Environmental and Social Management Activities					
C1	Development of a Contractor Construction Environmental and Social Management Plan (CESMP).	The Contractor will prepare a Construction Environmental and Social Management Plan (CESMP), which must be aligned with the over-arching PESR PIU ESMS and the Contractors ESMS. The CESMP will be submitted to the Supervising Engineer and PIU for approval at least 30 days before taking possession of any work site. **No access to the site will be allowed until the CESMP is approved by the Supervising Engineer and the PIU.** New topic specific or site specific ESMPs may also need to be developed by the Contractor during the construction phase. These new plans will also need to be approved by the Supervising Engineer and the PIU. The CESMP will include a **Design Change and Management Procedure (DCMP)**. Any changes that occur to the project following the completion of the ESIA and development of the ESMP will require review by the Supervising Engineer and PESR. The DCMP will record the changes that have been considered and will set out a screening methodology in line with best practice and will outline any changes required to the environmental and social mitigation. The DCMP will include the provision for public disclosure for any material changes. As part of the CESMP, the Contractor will need to liaise with the contractors of any adjacent construction projects (with the support of the PESR, if required), to reduce the potential for cumulative effects. Key consideration should be made in relation to borrow pits, depot areas, noise and air quality.	Preparation: Contractor's Environmental and Social experts Approval: Supervising Engineer for PESR	The Contractor will prepare monthly reports for the PESR on the status of the CESMP and environmental, social, health and safety performance The PESR / Supervising Engineer will prepare the monthly ESHS reports for the EBRD, drawing on the Contractors monthly reports.	Contractor's CESMP approved by PESR (PIU) / Supervising Engineer Design Change and Management Procedure implemented and approved by PESR (PIU) / Supervising Engineer. PR1, PR 3, PR 4, PR10 compliance
C2	Development of sub-plans as part of the Contractor's CESMP	Prior to start of site works and as part of CESMP, the Contractor shall prepare the following sub-plans in line with the EBRD requirements and national legislation, this ESMP and the PESR's over-arching ESMS (further details for these plans are provided in section (C6 to C26): ▪ Waste and Materials Management Plan (WMMP) Asbestos Disposal Management Plan127 ▪ Soil Management Plan, including Spoil Disposal Plan ▪ Water Resources Management Plan, including Ground Water Management and Waste Water Management ▪ Air Quality Management Plan (AQMP), including Air Quality Control Plan for the tunnel ▪ Noise and Vibration Management Plan (NVMP), including Pre-Commencement Condition Surveys	Preparation: Contractor Approval: Supervising Engineer and PESR/PIU	Supervising Engineer / PESR and Ministry of Environment and Physical Planning (MoEPP) (where appropriate) The Contractor will prepare monthly reports for the PESR on the status of the CESMP, sub-plans, and environmental, social, health and safety performance	Plans approved as part of the Contractor's CESMP by relevant parties PR 1, PR2, PR3, PR4, PR6, PR8 compliance

[127] No Asbestos will be used to construct the project, in compliance with EBRD requirements. Any asbestos that is found during the project will be managed in accordance with the Asbestos Disposal Management Plan.

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		▪ Cultural Heritage Management Plan, including Chance Find Procedure ▪ Biodiversity Management Plan (BMP), including Woodland Clearance Plan and Land Restoration Plan ▪ Landscape and Visual Management Plan ▪ Stakeholder Engagement Plan, including GMs ▪ Implement the relevant provisions of the Grave Relocation Plan prepared by the PESR (should the design confirm that the gravesite will be directly impacted by the bridge in Dolno Strogomishte) ▪ Code of Conduct (CoC) for Workers ▪ Community Health, Safety and Security Plan including Community Access and Infrastructure Plan; ▪ Labour and Working Conditions Management Plan (LWCMP), including Local Employment and Procurement Plan (LEPP) Construction Traffic Management Plan (CTMP) ▪ Occupational Health and Safety Plan, including specific measures for the construction of bridges and the tunnel ▪ Emergency Response Plan, including measures for: Natural Disaster Response, Tunnel Emergency Response Plan and Spill Management ▪ Construction Workers' Accommodation Management Plan ▪ Construction plans and Method Statements covering: Bridge Construction, Tunnel Construction, Tunnel Handover Plan, Slope Stabilisation Plan, and Blasting Management Plan ▪ Method Statements for Temporary Activities, including: Storage Areas, River Crossings, Storage and Access Roads. ▪ The Contractor will also implement the measures defined in the LAP, prepared by PESR, including measures pertaining to temporary land use impacts and any requirements that relate to local cemeteries. Blasting Management Plan		The PESR / Supervising Engineer will prepare the monthly ESHS reports for the EBRD, drawing on the Contractors monthly report.	
C3	Obtaining licences, permits and agreement (Section 3.3.3 of Chapter 3 of the ESIA)	▪ All necessary licences and permits in relation to environment, safety and labour must be obtained prior to starting the activity that they apply to. ▪ A database tracking all permits and consents shall be developed and maintained by the Contractor and be visible to the Engineer and PESR (PIU). ▪ Maximum allowable concentration of substances discharged into the surface water body must be agreed with (approved by) the MoEPP (where relevant). ▪ Volume of water abstraction, and sources, must be agreed with the MoEPP (where relevant). ▪ Prior to commencement of works, agreement(s) with company/companies authorized for management of hazardous waste must be signed. If none are available,	Implementation: Contractor Approval: PESR, MoEPP or other relevant authority/ies	PESR, MoEPP, other authority/ies Information included in monthly ESHS reports to EBRD	Copies of licences, permits and agreements. PR1, PR3, PR4, PR5, PR6

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		measures for the selection of suitable sites, and processes for the safe disposal of hazardous waste must be set out and implemented. For disposal of non-hazardous domestic waste, agreement with a solid Waste Management Company must be signed.			
C4	Labour and Working Conditions Management Plan (LWCMP) Including – ▪ Local Employment and Procurement Plan (LEPP)	The Labour and Working Conditions Management Plan (LWCMP) should be prepared by Contractor(s) in line with EBRD PR2. The plan will ensure that child labour or forced labour are not permitted. Workers conditions and benefits, including; working hours, minimum wage, minimum age, freedom of collective bargaining and equality and non-discrimination will be outlined. The Contractor will conduct induction training for all workers prior to the start of civil works in a format easily understood by the workforce. The workforce induction and documentation should specifically include: worker rights and responsibilities, including the worker grievance procedure, cultural context induction, and interaction / engagement with community members. The induction needs to apply for all workers (anyone working on the project site). The above measures will be secured through contractual mechanisms and measures in the Contractor's CESMP, which will be approved by the Engineer and PESR. The LWCMP will align with the Grievance Mechanism (GM) – see C4. The contractor will supply and/or employ workers with appropriate skills / competencies and qualifications. ▪ On completion of the works, construction workers must be supplied with a reference/ confirmation of employment letter and a skills/ training log, to enhance their employment prospects.	Contractor(s) Contractor Code of Conduct Labour audit. Complaints log. Worker's Training Register The Supervising Engineer / PESR will undertake a labour audit during the first month of the construction phase to confirm compliance with National Labour regulations	Safety induction completed. Contractor's 24-hour hotline / email service for workers' complaints. PESR hotline / email service (during working hours throughout the construction period) Regular training provided. No findings in the labour audit. Information included in monthly ESHS reports to EBRD	GM established. Macedonian Labour Laws International Labour Organisation (ILO) requirements PR2
C5	Sub-contractors	The Contractor shall ensure that: ▪ Provisions will be incorporated into all subcontracts to ensure the compliance with lender requirements, Macedonian legislation and the CESMP and its associated sub-plans at all tiers of the sub-contracting. ▪ All environmental, social and safety requirements for the Contractor will apply to the sub-contractors. ▪ All Project sub-contractors will be supplied with copies of the CESMP, and sub plans. ▪ All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective subcontract, unless the Supervising Engineer's approval for the Contractor's	Contractor Approval by Supervising Engineer/ PESR	All plans and contracts approved by the relevant parties. Information – included in monthly ESHS reports to EBRD.	Copies of sub-contractor agreements. Supply Chain Management Plan approved by PESR and reported to EBRD. PR1, PR3, PR4

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		safety representative to undertake take this role, is given in writing. These actions will be covered in a **Supply Chain Management Plan** to be prepared by the Contractor and to be approved by the Supervising Engineer / PESR, to ensure compliance with EBRD PRs.			
Further details on Environmental Management Sub-Plans – as listed in Item C2 above:					
C6	Waste and Materials Management Plan (WMMP) Including – ▪ Asbestos Disposal Management Plan[128] Contaminated Land Management Plan	The WMMP will set out the procedures for the delivery, logistics, storage and use for all construction materials used during construction. The plan will include: ▪ Quantities of generated waste from constructive activities; ▪ Quantities of material that is intended for re-use on embankments on local, regional roads in the area in consultation with the competent institutions (local self-governments, etc.) in the region; ▪ It may be necessary to open new disposal sites (for spoil) in addition to the three planned along the Project alignment, Disposal sites are required where topsoil / spoil is not suitable for re-use along the Project alignment. If this is required, their locations will be confirmed with the municipality of Kichevo and be in accordance with the planning requirements of the region, as well as the annual waste management programmes / plans of the municipality of Kichevo. The Contractor will undertake an assessment of environmental effects in line with national legislation and EBRD requirements. ▪ When defining the locations of the disposal sites, the geological substrate, the groundwater level and the proximity to surface watercourses will be key considerations. If disposal sites are required in the vicinity of surface watercourses, necessary measures such as lining with geosynthetic materials and drainage will be made in line with the Water Resources Management Plan. After the closure of disposal sites, they will be stabilised where required; ▪ The contractor will prepare special Elaborates (permissions) for each disposal site (the 3 included within the project and any additional ones if required) with planned capacity, and measures for regulation (for protection from heavy rainfall, protection of the ground,	Preparation: Contractor Approval: Supervising Engineer, PESR (PIU)	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD	Plan approved by relevant parties as part of the Contractor's CESMP. PR1, PR2, PR3

[128] No Asbestos will be used to construct the Project in accordance with EBRD requirements, however there is the possibility that asbestos may be encountered during site preparation, particularly as existing buildings may need to be demolished.

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		stability measures) as well as a plan for re-cultivation after the completed period of exploitation; ▪ Waste deposited at disposal sites will be placed and compacted so in order to be structurally stable; ▪ Spoil/ soil heaps will be vegetated to avoid erosion; ▪ Waste will be managed in accordance with legal and good practice requirements, to ensure it is disposed of in an environmentally sound manner and associated environmental harmfulness is reduced as far as practicable; ▪ Contractors used for the disposal of waste and the waste disposal sites must be reputable, legitimate enterprises, licenced by the relevant regulatory authorities, and operating to acceptable standards; and ▪ Measures to ensure the use of hazardous substance and materials is (where practicable) avoided or justifiably minimised. Where avoidance is not possible, appropriate risk management measure will need to be implemented. ▪ The WMMP will include an Asbestos Disposal Management Plan and a Contaminated Land Management Plan. No asbestos will be used to construct the Project, in accordance with EBRD requirements, however there is the possibility that asbestos may be encountered during site preparation, particularly as existing buildings may need to be demolished. ▪ The contractor will develop a Soil Management Plan, including Spoil Disposal Plan for approval by the Ministry of Environmental and Physical Planning (MoEPP) (and Department of Forestry, if the locations affect access to woodland). The Soil Management Plan will describe how soil (earthworks) will be managed to ensure the highest value for potential re-use. The Spoil Disposal Plan will encourage re-use of material in landscaping and ensure the deposit areas are suitable. ▪ The Contaminated Land Management Plan will include measures for the discovery of contaminated land including measures to remove, store and disposal. Contaminated soils will be tested against international Generic Assessment Criteria (such as CL:AIRE Generic Assessment Criteria (GAC) ▪ Other measures to include, but not limited to: • Keep agreements with hazardous waste management companies active. • Undertake regular collection and disposal of household waste. • Provide bins and facilities within the project site for temporary storage of domestic solid waste and construction waste. • Separate hazardous, non-hazardous and reusable waste streams.			

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		• Ensure non-hazardous/ inert waste management procedures are in place. • Train staff in waste management best practice. Regular reporting on waste and materials handling quantities and locations.			
C7	Soil Management Plan Including: Spoil Disposal Plan	The Soil Management Plan shall describe the following measures applied by the Contractor: ▪ Unwanted materials from topsoil such as roots of trees, rubble and waste will be removed prior to stockpiling. ▪ To ensure stability, soil stacks shall not be higher than 2m, with a slope gradient of less than 25%. Soil stacks must be placed and managed to avoid erosion and soil washing off the pile. Drainage trenches must be established to divert surface water runoff from the site. ▪ Soil compaction must be minimised by strictly keeping to temporary roads, construction camp / construction area boundaries. ▪ Embankments and slopes with disturbed vegetation must be replanted immediately after the construction/disturbance stops ▪ The Contractor will confine operation of heavy equipment within the area of works to avoid soil compaction and damage to privately owned land. If private lands are disturbed, the contractor must promptly inform the owner and agree on the ways to remedy the situation. ▪ The Soil Management Plan will describe how soil (earthworks) will be managed to ensure the highest value for potential re-use. The Spoil Disposal Plan will be developed based on site specific topo-geodetic, geotechnical, hydrological data, environmental and social data, to ensure disposal it is located away from sensitive environmental areas. The Spoil Disposal Plan must be developed in association with the Environmental Engineer to drive re-use of the material in landscaping and ensure that the disposal locations are suitable. The plans will be approved by the Ministry of Environmental and Physical Planning (MoEPP) (and Department of Forestry, if the locations affect access to woodland). The Plan will set out the location of topsoil disposal sites, the design of the earth works (including maximum heights and gradient), logistics and landscaping once complete. Measures to prevent soil contamination due to accidental spills are set out in the Water Resources Management Plan and measures to address contaminated materials are included in the Waste and Materials Plan.	Preparation: Contractor Approval: Engineer, PESR (PIU)	PESR/ Supervising Engineer.	Plan approved as part of the CESMP by relevant parties. PR1, PR2, PR3, PR6

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C8	Water Resources Management Plan Including; Ground Water Management Waste Water Management	The Plan must include calculations for the water demand for construction including water required for: ▪ Construction (e.g. concrete mixing); ▪ Dust suppression; ▪ Cleaning equipment; ▪ Potable water for construction workers; and ▪ Use in construction camps (if these will be used). ▪ The plan must include measures to minimise water usage in the first instance, and also opportunities for reuse of water where possible. The Contractor will undertake a capacity study of available water resources along the alignment, including the location and quality of water resources used by settlements, to identify suitable resources, with sufficient availability to avoid any impact on the availability of resource to communities and businesses along the alignment. Water resources used by the local communities will be maintained at all times, including rapid provision of alternative temporary supplies in the event of disruption to usual supply. Consultation with Public Water supply Enterprise “Studenchica” – Kichevo. A review and audit of all water sources along the route will be undertaken prior to commencement of works, to identify all existing water sources used by the communities near the alignment. Pipes/ culverts will be included within the design of the road, at the location of existing water sources, to ensure continued access to water sources. Water abstraction must be designed in accordance with the requirements of the Biodiversity Management Plan to minimise impacts to habitats reliant upon groundwater. The Water Resources Management Plan must also provide details on predicted waste water (sewage) volumes, disposal scheme, information on capacity and type of waste water treatment facility, location of the discharge point/points with indication of coordinates. A discharge permit will be sought from the MoEPP and Maximum Allowable Discharge Limits (MADLs) will be set which the project must then comply with. The Plan will ensure that liquid wastes are removed by an appropriately authorised and licensed company and disposed of in an environmentally responsible manner in accordance with the Waste and Materials Management Plan. An ongoing contract with the authorised company responsible for removal of the liquid waste will be maintained. If the welfare facilities are equipped with a sewage treatment plant this must be operated and maintained according to manufacturer’s instructions. Other measures include, but are not limited to:	Preparation: Contractor Approval: Engineer and PESR,	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD.	Plan approved by relevant parties as part of the Contractor’s CESMP. PR1, PR2, PR3

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		▪ Onsite repairs /maintenance/fuelling activities shall be limited. Priority shall be given to offsite commercial facilities. If impossible, a designated area and/or secondary containment for the on-site repair or maintenance activities must be provided. ▪ Securing high-risk areas/features (e.g. refuelling areas, chemical storage, stockpiles, etc.). ▪ Polluting substances like fuel, grease, oil and/or lubricant will be stored on an impermeable base, at a distance of at least 10 m from surface water bodies or 50 m from any source area, in a space with protection against leakage equivalent to at least 110% of the volume of the pollutants stored. ▪ Discharge of any untreated water into the surface water body must be strictly prohibited. Treated water discharge must comply with EU requirements for effluent discharge, as well as national standards. ▪ Controlling water movement through/off the site through appropriate drainage plan (i.e. to include diversion ditches, cut-off drains, etc.). ▪ Maintaining an adequate buffer distance of works from watercourses and drainage paths. ▪ Discharge of cement contaminated water must be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life. ▪ Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full. ▪ To prevent runoff contamination, paving should be performed only in dry weather. ▪ Any temporary fuel tank (if contractor decided to have small stock of fuel on the site) shall be placed in a covered area with berms or dikes to contain any spills and within at least 100m from any surface water body. Capacity of containment must be 110% of capacity of the tank. Any spill shall be immediately contained and cleaned up with absorbent material. ▪ Emergency spill containment kits shall be kept available at all times at locations where they can be quickly and easily deployed, and workers trained in their use. ▪ On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site. ▪ Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment. Drip pans or			

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		absorbent materials shall be provided. On small spills, absorbent materials shall be used. ▪ All valves and trigger guns shall be resistant to unauthorised interference and vandalism and be turned off and securely locked when not in use. ▪ Diverting run off from exposed soils. ▪ Minimising erosion of exposed soils through vegetation retention or temporary protection measures. ▪ Use of "coffer dam" (or "open caisson"), i.e. wide impermeable chamber, open in the bottom which is placed in where required This solution provides a greater level of protection from construction activities (like input of sediments/ material, pollution of the river water and degradation of the riverbank habitat, Wastewater facilities (including construction waste water and sewage) shall be maintained by authorized companies which will process the water correctly, in line with national and EU requirements.			
C9	Air Quality Management Plan (AQMP) Including Air Quality Control Plan for the tunnel	The Air Quality Management Plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimise impacts to sensitive receptors due to the presence of the camp, construction works, sourcing and transport of construction materials, and other project-related activities. Measures include, but are not limited to: ▪ Hoarding/temporary fencing to be constructed around the construction sites to minimise the spread of dust and particulate matter, where sensitive receptors are located nearby; ▪ Accesses and construction sites should be kept moist to reduce dust formation. Water sprays to be implemented during drilling and excavation activities. It is recommended that water spraying is undertaken a minimum of three times per day; ▪ During dry weather conditions, water spraying will be increased, and hygroscopic additives will be used in water sprays to increase ground moisture and reduce the spread of dry matter and dust from the construction surface; ▪ Dust-generating activities to be slowed down or ceased on days of strong wind; ▪ In windy and dry conditions, earth stock piles to be moistened to prevent the distribution of dust particles; ▪ As soon as a surface is no longer in use or is finished it should be vegetated to prevent dust emissions; ▪ Particular care should be paid to watering after vegetation' ▪ The surface should be moistened during loading and unloading of aggregates in trucks; ▪ Intense spraying should be carefully monitored to avoid land erosion;	Preparation: Contractor Approval: Engineer, PESR	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD	Plan approved by relevant parties as part of the Contractor's CESMP. PR1, PR3, PR4, PR6

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			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
		▪ Truck dumpers carrying dusty materials to be covered with tarpaulin cloth; ▪ Work areas should be large enough to allow storage of the excavated tunnel material, access of trucks and truck loading operations; ▪ The tunnel should be ventilated during the excavation works using particulate filters, which need to be regularly maintained. ▪ Ensure all machinery and vehicles are maintained to minimise exhaust emissions. Vehicles and equipment that emit smoke shall be removed from the project, if they can't be fixed. ▪ Implement a regular vehicle maintenance and repair program, utilising the manufacturer recommended engine maintenance programs. ▪ Undertake immediate repairs of any malfunctioning vehicles and equipment. ▪ Use construction equipment and vehicles that meet national emission standard and give priority to fuel efficient machinery. ▪ Wherever possible, use electrically-powered equipment rather than gas or diesel-powered equipment. ▪ Ensure that all diesel and petrol machinery used, is equipped with catalytic convertors. ▪ Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors and ensure the air emissions do not breach local standards. ▪ Locate support facilities and spoil disposal sites so to reduce vehicle trip numbers and distance, and therefore emissions – as far as feasible. Other protection measures for locating spoil disposal sites are included in section C5. ▪ Provide truck-washing facilities at tunnel portal and at 'safe' distance from the bridge construction sites to prevent truck-out of mud and dust. ▪ All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins. ▪ Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. Surface water run-off from the watering activities, shall be managed in accordance with the measures in the Water Resources Management Plan (C8). ▪ Earthwork operations to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community. ▪ Provide vegetation planting along roadsides to stabilise soils and reduce air quality impacts.			

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		Prior to commencement of works, likely emissions from crushers, concrete production facilities and other emissions generating activities must be calculated and agreed with the MoEPP. A separate plan/schedule for air quality control in the tunnel must be provided.			
C10	Noise and Vibration Management Plan (NVMP) Including Pre-Commencement Condition Surveys	The Noise and Vibration Management Plan (NVMP) must specify the need to undertake condition surveys no later than 28 days before the commencement of construction works. The NVMP will set out the process for this. The Contractor and the Supervising Engineer will carry out joint condition surveys of all buildings within 25 metres of the road alignment that, in the opinion of the Supervising Engineer, might be affected by vibration resulting from the Contractor's construction operations. The surveys shall be conducted in the presence of and with the permission of the property owners. The findings of the pre-construction noise surveys will determine the noise threshold levels in line with BS 5228-1:2009 (45dB at night, 55dB in the evenings and weekends and 65dB during the day). These thresholds are more stringent for the most sensitive time periods than those outlined in the Rulebook no. 147/2008 (55dB at night, 60dB in the evenings and weekends and 60dB during the day). The findings of the building condition surveys shall be recorded in the reports and will contain the following information, as a minimum: Building address and location; ▪ A description of the building condition and any cosmetic and/or structural damage; ▪ Sketches and photographs showing the location and extent of any damage; ▪ High resolution video recordings of the surveyed buildings; and ▪ Verification of the report by the building owner. ▪ Measures to include, but not limited to in the NVMP: ▪ Construction site layout considerations. ▪ Construct temporary noise barriers between noisy activities and noise-sensitive receivers. ▪ Routing construction traffic away from residential streets, where possible. Streets with the fewest residential properties will be prioritised. ▪ Use of enclosures around especially noisy activities, or clusters of noisy equipment. For example, shields can be used around pavement breakers, loaded vinyl curtains can be draped under elevated structures. Sequence of operation:	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD.	Plan approved by relevant parties as part of the Contractor's CESMP. PR1, PR3, PR4

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		▪ Time operations to occur during periods of high background noise levels (potentially combining activities if required). ▪ Construction works during the night to be avoided except under special circumstances; as sensitivity to noise increases during the night-time hours in residential neighbourhoods. Standard operations on site shall be restricted to the period between 0700 -1900. Alternative construction methods: ▪ Avoid impact pile driving where possible in noise-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter alternatives where geological conditions permit their use. ▪ Use low noise equipment, such as enclosed air compressors and mufflers on all engines. ▪ Select quieter demolition methods, where possible. For example, sawing bridge decks into sections that can be loaded onto trucks results in lower cumulative noise levels than impact demolition by pavement breakers. ▪ All vehicles and machinery used at construction sites will be subject to regular maintenance. Vehicles and machines which emit excessive noise due to poor engine adjustment or damaged noise control devices shall not be operated until corrective measures are taken; ▪ Construction equipment will comply with the requirements of EU Directive 2000/14/EC on noise emissions in the environment by equipment used outdoors (there is a lack of national legislation on outdoor equipment emission noise levels). All equipment shall bear the CE marking and indication of the guaranteed sound power level and shall be accompanied by an EC declaration of conformity; ▪ The equipment will be fitted with appropriate noise muting devices that will reduce sound levels; ▪ Every effort shall be made for compliance with the correspondent noise limits for each area where the construction works will take place; ▪ Affected local residents will be informed (to the best of the project's efforts) on the time of the planned works and the vibration and noise levels, as well as the time when these are expected; ▪ The location of equipment emitting excess noise will be chosen as far as possible from sensitive receptors (residential properties, workplaces, schools and hospitals). When near sensitive receptors, construction works will be scheduled and provided with the necessary resources so that the time of exposure is as short as possible; ▪ In the case when construction works would need to be performed at night, due to special circumstances, or during a longer period than one day at a given site, an appropriate noise barrier will be placed around the working area;			

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		■ Monitoring of vibration during works (e.g. foundations of bridge structures, tunnel excavations) will be performed where buildings are located within 30 m of the works. Should buildings be damaged as a result of vibration generated by the construction works, the damaged buildings will be repaired, or compensation will be paid; ■ Earth excavation equipment operating on the construction site will be located as far from vibration-sensitive receptors as possible; ■ Activities such as demolition, excavation and ground-impacting operations will be scheduled not to occur in the same time period. Unlike noise, the total vibration level produced can be significantly less, when each vibration source operates separately; Decrease dynamic loads from construction sources such as: ■ Blasting. Explosive type and weight, delay-timing variations, size and number of holes, distance between holes and rows, method and direction of blast initiation; ■ Select demolition methods not involving impact, where possible; ■ Avoid vibratory rollers and packers near sensitive receptors. ■ Use well maintained construction equipment and vehicles. ■ Use construction equipment and vehicles fitted with appropriate noise suppression. Fit all pneumatic tools with an effective silencer on their air exhaust port. ■ Use temporary noise barriers while working in sensitive locations if allowable noise limits are expected to be exceeded. ■ Impose speed limits on the project vehicles to minimise noise emission while moving along/across the sensitive areas <25km/hr. ■ Keep to no horn policy unless vitally necessary. ■ Wherever possible, use quiet equipment and working method: e.g. Diesel hammer piling – substituted with drill piling. ■ Whenever possible: enclose noisy equipment, restrict non-stop operation of noisy equipment, and avoid simultaneous operation of noise generating equipment. ■ Consider seasons sensitive for birds and other wildlife while planning noise-generating works. ■ Train staff in best practice. ■ Inform community on schedule and duration of construction activities. ■ Implement community complaints mechanism. ■ Limit truck speed - not to exceed 40 km/hr, when driving through communities, and not to exceed 80 km/hr when driving on highways. ■ Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. When operating close to sensitive areas (within 250 meters) such as			

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		residential, nursery, or medical facilities, the Contractor's hours of working shall be limited to 8 AM to 6 PM. ▪ Blasting and other highly disturbing activities will not be allowed on Fridays, which is a day of prayer for the local Muslim population. ▪ Noise protection kits such as ear plugs, earmuffs, will be provided for workers who are working in areas where noise levels are higher than 85 dB(A). The Contractor must respond to any noise and vibration grievances and implement remediation measures as soon as practical in line with the SEP and GM. Where the results of the vibration monitoring show that the specified construction vibration limit is reached at a particular location, the Contractor shall suspend the construction activities that generate the excessive vibration at such location, notify the Engineer and with the approval of the Engineer take mitigative actions necessary to keep the construction vibration within the specified limit.			
C11	Noise barriers and designed in mitigation	Undertake further refined noise modelling during the preparation of the final design of the Project, this is required to determine the specification and precise locations of the proposed noise barriers as well as specific measures to be undertaken, such as: installation of noise barriers. The barriers must be included in the detailed design, prior to the commencement of construction. The installation of noise barriers has the potential to reduce noise levels by 5-15 dB (A). Wherever possible, operational noise barriers should be completed early where they will reduce construction phase noise.	Design Engineer	PESR/ Supervising Engineer	Model refined and specific measures aimed at reduction of noise delivered.
C12	Cultural Heritage Management Plan Including Chance Find Procedure	The Cultural Heritage Plan will include details of identified cultural heritage within the project construction area (including location maps) and describe measures to prevent impacts on these locations / items. The Plan will also include a chance find procedure detailing the actions to be taken if buried archaeology or other heritage items are discovered during construction activities. Monitoring of vibration effects adjacent to sensitive receptors such as mosques and monuments will be undertaken in accordance with the Noise & Vibration Management Plan. The boundaries of the worksite will be strictly observed. The Plan will include induction training for workers on chance finds. Such training needs to also include training on the appropriate process of identification and a procedure for excavation and due care and compliance with religious	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer Information – included in monthly ESHS reports to EBRD.	Plan approved by relevant parties as part of the Contractor's CESMP. PR1, PR8

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		customs and protocols of the local communities. The training will also cover immediate stoppage of works and notification of the public institution responsible for the protection of cultural heritage. Works would only be allowed to proceed in accordance with any instructions from the authorities.			
C13	Biodiversity Management Plan (BMP) Including: Woodland Clearance Plan Land Restoration Plan	The Contractor will elaborate and implement the Biodiversity Management Plan (BMP) prepared by the PESR, including, but not limited to the measures set out in this section. It will include actions to safeguard and conserve biodiversity, that could be affected by the planned activity. Compliance with the plan will be the responsibility of the Environmental Engineer and other experts and monitored by the Supervising Engineer. The BMP will include specific actions to be implemented through the lifetime of the project to protect and enhance biodiversity in the area. These actions will have associated monitoring commitments to ensure their long-term relevance and effectiveness. The BMP will be linked to the Landscape and Visual Management Plan, with regards to land restoration and selection of suitable species. An Ecological Clerk of Works (ECoW) will be engaged to support delivery of mitigation measures at the Project site during construction. This role will vary depending upon ongoing Project requirements but will include as a minimum the following measures: ▪ Pre-construction checks (including nesting bird checks); ▪ Identification and maintenance of exclusion zones around ecological sensitivities; ▪ Regular audits of construction activities to ensure compliance with ecological mitigation/commitments. A Precautionary Method of Works (PMoW) will be applied for protected species by a suitably experienced ecologist. The PMoWs will contain the following specifications to enable vegetation clearance to be undertaken in a sensitive manner: ▪ Vegetation clearance will be undertaken under the supervision of an experienced ecologist. ▪ The supervising ecologist will provide a Toolbox Talk to contractors working on site, to explain the ecological sensitivities present and working methods to be used to protect these. ▪ The timings of work to avoid the breeding bird season. ▪ Specification on the machinery to be used to clear vegetation. ▪ The location of features on site which may be used by reptiles and amphibians, which should be retained where possible, for example hibernacula, ponds or basking locations. This will include methods for protecting these features during construction works including fencing off of these. it will also include the procedure for when a	BMP Elaboration and implementation: Contractor's Environmental Engineer, Biodiversity expert BMP Elaboration and Implementation Approval: Supervision Engineer, PESR, EBRD	BMP: PESR/ Supervising Engineer. Annual reporting on BMP actions / monitoring outcomes. ECOW approval reports that alignments have been checked and cleared prior to access Information – included in monthly ESHS reports to EBRD.	BMP Plan Elaboration and Implementation approved as part of the CESMP by relevant parties. Training Records PR1, PR2, PR3, PR4, PR6

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		breeding bird, reptile or amphibian is discovered during construction works. Rehabilitation of all areas where vegetation has been damaged will take place on a like-for-like basis. The riparian vegetation around the bridge areas will be restored and vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings. The rehabilitation program should incorporate a wide variety of species typical of the regional ecosystem. All areas necessary for construction but not required for the operational phase of the road will be rehabilitated on a like-for-like basis. such as areas disturbed by construction of the bridges and the tunnel. Rehabilitation will be undertaken to re-establish the original regional ecosystems present prior to disturbance and will be staged where necessary. It will be the Contractor's responsibility to restore all land used during construction to its original condition. The mitigation measures to minimise the effect of fragmentation mainly consist of the establishment of enough wildlife crossings to increase the permeability of the Project alignment as follows: ▪ Afforestation activities to be performed in line with the No net loss principle, i.e. the Land Restoration Plan. Riparian vegetation along the streams of Zajaska Reka, Strogomishka Reka, Sushica and Rechishte to be restored to achieve No Net Loss. ▪ The undersides of bridges will be vegetated so as to create vegetal screens that hide the bridges structure (e.g. shrubs and small trees in the area of the abutments). ▪ Fenced areas will be vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wildlife crossings. Specific actions include (these will be further documented within the detailed BMP and other plans above): ▪ The Environmental Engineer and/or biodiversity expert will be required to both map and supervise the clearance of the route in advance of construction works. Their role should include identification of areas that need translocation, bird nesting areas, and locations where schedules need to be altered etc. ▪ Their responsibility will include surveys to inform the development of additional mitigation (if required) such as bat surveys and other species-specific surveys, and surveys to help ensure that specific mitigation is applied within the project Right of Way (RoW) in advance of			

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		vegetation clearance. They would ensure implementation of the Biodiversity Management Plan. Key actions include: ▪ Construction lighting to use low wattage lamps, directing light downwards and away from sensitive habitats. ▪ Access will be prohibited to all sensitive habitat areas, except where it is necessary to construct the Project. ▪ Good construction controls, including measures to reduce noise, vibration, dust and effluent/ water with high levels of sediment, ▪ Adhere to no horn policy to avoid disturbance of wildlife. ▪ Impose speed limits on the project vehicles within construction areas to minimise risk of road kills (< 20km/hr). ▪ Fence trenches or pits to avoid entrapping and injuries of the fauna species. Bright coloured ribbons may be used for big animals (e.g. cattle), while metal plastic and other shields/fences may be used for small animals. ▪ Upon completion of the shift put planks or medium size twigs in the trenches to allow small animals to escape if entrapped. Larger excavations may use earth ramps if the pit is large enough. ▪ Check pits and trenches daily for fauna that may have fallen in and remove them to a place of safety prior to filling the excavations up. ▪ Check trees that are to be felled so as to advise on the timing of felling. Tree-felling should be timed to avoid effects on roosting bats and nesting birds. Where a tree is identified as having the potential to support such features, felling/removal should only take place between mid-July and mid-September. In case bat roosts are found arrangement of bat boxes can be considered as mitigation. Implement tree felling/house demolition works from late September till mid-November to avoid impact on bats and breeding birds (nesting/hatching). ▪ Implement monitoring of water quality (visual detection of turbidity increase, analysis - upstream and downstream of worksites which could affect watercourses). ▪ Implement mitigation measures set for preservation of water quality and bank erosion (soil stability). ▪ Prohibit poaching, killing of fauna and foraging – by construction workforce including plant/seed/fruit collection. **Land Restoration Plan** The **Land Restoration Plan** prepared by the PESR, will include confirmation of the areas of habitat replacement, specify the type of species and specific locations for replacement. The habitat planting requirements will be			

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		included in the Tender documents for the Contractor and Bill of Quantities (see ESAP). State owned woodland will involve financial compensation to the Public Enterprise for National Forests for: reforestation, loss of timber, reproduction and disturbance of their forest system. Loss of privately held woodland will involve financial compensation to the owners, but the owners are not asked to provide habitat replacement. The **Land Restoration Plan** will incorporate a wide variety of species typical of the regional ecosystem. All woodland replacement will be detailed within the **Land Restoration Plan in the BMP,** along with ongoing monitoring and management plans for this mitigation. The BMP will also include a mechanism for adaptive management to ensure long-term viability of this mitigation Plant stock should be locally sourced, where possible, to maintain genetic identity of local communities. Recommended trees for revegetation are the following ones: *Quercus frainetto, Q. cerris, Carpinus betulus, Pyrus amygdaliformis, Acer pseudoplatanus, A. campestre, Crataegus monogyna, Ulmus minor, Prunus spinosa, Alnus glutinosa, Salix alba, S. fragilis* etc. Further net gains for aquatic habitat should be sought through the improvement of the riverbank environment and the removal of sources of pollution and sedimentation (such as the removal of waste). This will be discussed and agreed with the Ministry of Environmental and Physical Planning. **Woodland Clearance Plan** Afforestation activities to be performed in line with the No net loss principle, i.e. preparation and implementation of Land Restoration Plan. Riparian vegetation along the streams of Zajaska Reka, Strogomishka Reka, Sushica and Rechishte to be restored to achieve No Net Loss (the revegetation plan should consider a minimum 2:1 revegetation ratio, for example for 2.7 ha of riparian black alder belts and woodland will be lost which will have to be replaced by 5.4 ha of the same species. This includes Priority Biodiversity Feature species. The areas beneath bridges will be vegetated so as to create vegetal screens that hide the bridges structure (e.g. shrubs and small trees in the area of the abutments). Fenced areas will be vegetated with native plant species that are attractive to local fauna and with plantation patterns designed to lead the animals towards the wild life crossings.			

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		The Woodland Clear Plan will outline the following: ▪ The roles and responsibilities of those working on site, including the supervising ecologist and contractors clearing vegetation. ▪ A map showing the extent of the woodland loss, including access routes, compounds and locations for the storage of equipment and plant. ▪ A prescribed working corridor through the use of, where practicable, temporary barriers to minimise the damage to habitats and potential direct mortality and disturbance to animals located within and adjacent to the Project corridor. ▪ For trees to be retained during the construction works, Root Protection Areas (RPA) will be mapped, and protective fencing will be erected around the RPA to reduce risks associated with vehicles trafficking over roots system or beneath canopies and to prevent soil compaction. ▪ Selective removal of lower branches of trees will be conducted to reduce risk of damage by construction plant and vehicles. ▪ Vegetation buffer strips (where practicable) will be maintained to protect retained trees. ▪ Any tree felling will be carried out by experienced contractors. ▪ Where loss of trees is unavoidable, the trees will be soft-felled and sections placed within retained habitats to provide a continued deadwood resource ▪ Planting will be undertaken to replace any trees that were intended to be retained which are felled or die as a result of construction works. ▪ Vegetation clearance will be conducted outside of the breeding bird season to avoid impacts to these species. ▪ Trenches, holes and pits will be kept covered at night or a means of escape for mammals that may become entrapped will be provided, such as earth ramps. Gates to compound areas will be designed to prevent mammals from gaining access and will be closed at night.			
C14	Landscape and Visual Management Plan	During finalisation of the road design and fixing the route and right of way, the designers will: ▪ Use locally native plant species. ▪ Replace trees where lost as part of the Project in compliance with applicable legislation. ▪ Choose colours of above ground sections of new structures and at tunnel exits so they merge with environment. ▪ Give priority to use of geotextile against shotcrete. ▪ Use irregular shape stones for rubble. ▪ Avoid use of white concrete.	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer. Information – included in monthly ESHS report to the EBRD.	Plan approved by relevant parties as part of the Contractor's CESMP. PR1

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		▪ Ensure new lighting does not result in light spill/ light pollution. ▪ Use full horizontal cut off glass lens luminaires, installed at 0o uplift. ▪ Use of lighting shields/ louvres when light spill cannot be avoided in lighting design/ placement ▪ Where possible use lower lamp heights, provided it does not compromise safety aspects, such as the need to see road signs. ▪ Minimise the extent of earthworks, where practicable; ▪ Minimise the use of artificial lighting along the Project alignment and where needed, use directional lighting; ▪ Reflect the nature of the existing landforms within the earthworks, where practicable, such as through: ▪ Integrate aesthetically the structural parts of the viaducts and the bridges (e.g. the decks and piers), through the use of construction materials with colours and textures that blend well with those of the surrounding landscapes; ▪ Design the three disposal sites for the disposal of excavated material so that the integrated with the surrounding landscapes; ▪ Retain mature vegetation, where practicable; ▪ Planting of native vegetation along sections of the Project alignment which is complementary to the surrounding landscapes in order to provide visual screening; and ▪ Provide native boundary vegetation or fencing to provide screening for the affected cemeteries, and screening of middle-distance views of the main alignment from the 'Albanian Mother' War Memorial. The landscape design of the scheme will need to cross reference the Biodiversity Management Plan. All construction site lighting shall be turned off when construction activities have ceased for the day. The use of sodium light bulbs should be prohibited, Light Emitting Diode (LED) lights with a "neutral" colour temperature of 4000K should be installed.			
Community Liaison, Labour and Safety Management Sub Plans (as part of Contractor's CESMP)					
C15	Stakeholder Engagement Plan (SEP) prepared by Contractor(s)	Prior to start of site works, the Contractor shall: Develop and maintain a contractor SEP (aligned with the overarching Project/PESR SEP) and train workers in the grievance mechanism requirements; Contractor to follow PESR's GM procedure and keep track record of all grievances received/closed/ongoing/ and report regularly to PESR on each category and take actions to address concerns Publicise Contractors24-hour hotline/ email address for complaints and PESRs hotline / email address (during working hours throughout the construction period).	Preparation: Contractor Approval - PESR, Supervising Engineer.	PESR/PIU, PIU Support Consultant Information on SEP, GM – included in PESRs monthly ESHS reports to EBRD.	All GM actions addressed or responded to within 10 working days Contractor's 24-Hour hotline established and maintained GM information provided on notice boards located at construction sites. Consultation completed with the identified stakeholders

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		Contractor SEP to be updated throughout the construction phase as per PR10.			PR10
C16	Code of Conduct (CoC)	The Contractor shall prepare a code of conduct and publish it, describing the commitment of the project to meet Lenders employment and labour standards on Environmental and social protection and anti-bribery and corruption controls. The CoC will be provided in hard copy to all employees. Ensure measures outlined in specific management plans (Biodiversity Management Plan, Stakeholder Engagement Plan, Emergency Response Plan, Community Health, Safety and Security Plan, Waste and Materials Management, Water Resources Management Plan etc) are referenced within the CoC. Special attention will be given to the prevention of gender-based violence and the promotion of a gender-sensitive working environment on construction sites, in line with the Local Employment and Procurement Plan (LEPP). A specific training session will be delivered on the Code of Conduct provisions on sexual harassment, abuse and exploitation at the moment of induction. Construction workers will be prohibited from poaching, killing of fauna and plant/seed/fruit/ fungi collection.	Implementation: Contractor Approval: Engineer, PESR	PESR/PIU, Engineer Information – included in monthly ESHS reports to EBRD	Completion of CoC and its ongoing implementation PR2, PR4
C17	Community Health, Safety and Security Plan Including: Community Access and Infrastructure Plan	As part of the project preparation prior to the start of construction activities, Contractor(s) will prepare and implement a Community Health, Safety and Security Management Plan. This will include: a review of matters including existing medical facilities and access to them, which is to be unrestricted by the planned works, potential disease and health risks to the local community as a result of workers' influx. The plan will cover both existing risks and risks related to the Project - in-migration of construction workers can subsequently lead to potential for transfer of communicable or infectious diseases, such as hepatitis, polio, influenza, HIV/AIDS, etc), crime levels, instances of alcoholism and drug use amongst others. This includes increased impacts to women and vulnerable groups, including the possibility of gender based violence. This plan will aim to safeguard the health and wellbeing of the local community during construction. The plan will set out measures for the prevention of unauthorised access to the construction sites, construction compounds and the construction workers' accommodation.	PESR Contractor to develop Community Health, Safety and Security Management Plan Approval – Supervising Engineer	Review of health risks and updated in response to changes on site including road safety, influx management. PESR	Availability of Community Health, Safety and Security Management Plan Social Risk Register in the ESMS. Community Health, Safety and Security Management Plan is implemented PR4

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		The plan will also outline a health and safety campaign for the local communities, with measures to target the safety and risk education of children. The Community Health, Safety and Security Plan will cross reference the Noise and Vibration Management Plan and Air Quality Management Plan. The Community Access and Infrastructure Plan (CAIP) will be developed by the Contractor. The plan will set out methods to maintain community access and the operation local/ national infrastructure throughout the construction period. The plan will be prepared by a specialist safety consultant and will be aligned with international best practice. The plan will be informed by consultation with the local community, the railway operator and local businesses. The CAIP will link to the Occupational Health and Safety Plan , the Construction Traffic Management Plan and Method Statement for working on/ adjacent to the railway line . The Contractor shall consult with local residents to establish processes and locations for safe livestock crossing of the proposed access roads. The Community Access and Infrastructure Plan will outline the specifications for a temporary railway crossing, that will be constructed prior to the commencement of the construction of the Strogmishte interchange. The temporary crossing will be designed through consultation with the railway operator, safety auditors and the local community, prior to the commencement of construction. This will either be in the form of a temporary level crossing or a temporary bridge structure. The existing informal crossing will be closed off permanently, as both the temporary crossing and the overpass that form part of the Project will provide safer alternatives The Contractor will be required to create safe pedestrian and traffic corridors through the construction site, at the request of the local community and residents. The same corridors will be marked with visible signs, but also communicated with the representatives of local communities, as well as local schools Community utilities (electricity, gas, water, telephone) will be maintained at all times. If accidentally affected by the construction works, temporary alternatives will be provided, and the connection repaired as soon as safe to do so. The construction works will be programmed to ensure that the overpass over the railway line is completed as early in the construction phase as possible, to avoid the need to use the existing box culvert and informal level crossing. Repair of damage to local roads to ensure that they are returned to their original state (pre-construction). Local roads			

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		will be regularly monitored and damaged repaired as soon as safe to do so.			
C18	Land Acquisition Plan (LAP)	For temporary land use impacts, Contractor(s) implement the relevant mitigation measures defined in the LAP which will be prepared by PESR (see P5 above)	Contractors to implement temporary land use-related mitigation measures outlined in the LAP	Contractors to implement mitigation measures aimed at reducing temporary land use impacts	National Laws on Compensation for temporary impacts during construction and EBRD PR5 compliance
C19	Construction Traffic Management Plan (CTMP)	The plan shall be designed to ensure that traffic congestion and traffic safety impacts due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimised. The plan shall be prepared in consultation with traffic officials. The plan will cover both on-site and off-site traffic movements. The plan shall identify traffic diversion and management issues, traffic schedules, traffic arrangements showing all detours/lane diversions, modifications to signalling at intersections, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists and other road users in the affected areas. The Contractor shall provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 24 hours before the disruptions. Construction site access roads which are also used by local traffic shall include safe passing places every 200 m where the roads are narrow. As part of the Construction Traffic Management Plan, the Contractor shall consult with local residents to establish processes and locations for safe livestock crossing of the proposed access roads.	Preparation: Contractor Approval: Engineer, Competent authority (MoI)	PESR/ Ministry of Interior (MoI) / Supervising Engineer. Information – included in reports to EBRD.	Plan approved by relevant parties as part of the Contractor's CESMP. PR4
C20	Occupational Health and Safety (OHS) Plan To include ▪ Specific measures for the construction of bridges and tunnels ▪ Measures for crossing the existing railway line. ▪ Measures for working on/ beside the railway. ▪ H&S requirements	As part of managing the Environmental, Social, Health, Safety risks of the Project (ESAP item 1.2) this plan will be developed in a format consistent with international standards (e.g., World Bank Group Environmental, Health, and Safety Guidelines, 2007). The Plan shall address health and safety hazards associated with construction activities (e.g. excavations, tunnelling, slope works etc.), use of heavy equipment, work in confined spaces and at height, transport of materials and other hazards associated with various construction activities, including both risk to site personnel and to the community. The document to be read together with the Construction Workers' Accommodation Management Plan, and other activity-specific sub-plans.	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD	Plan approved by relevant parties as part of the Contractor's CESMP. PR2, PR4

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
		The plan will include: ▪ Roles and responsibilities; ▪ Job and task specific hazard analysis, risk assessment and control; ▪ Personal Protection Equipment (PPE) requirements and enforcement mechanisms ▪ Safety training for all personnel in their own language(s); ▪ Mandatory reporting by Contractor to PESR on any HSE aspects; ▪ Record-keeping by a Contractor, including total work-hours, lost work-hours due to accidents/incidents, description of lost-time incidents, hospitalisations, fatalities; The Contractor will also develop and implement a safety and security training program including toolbox talks, safety briefings, and issue specific training. The Contractor will conduct safety meetings on monthly / regular basis. The Contractor will employ a suitably qualified health and safety officer. The Plan will include measures for working on and over the existing railway line. The plan will be prepared through consultation with the railway operator to ensure that safe working conditions are maintained at all times. The programming of the works will ensure that a suitable overpass at Dolno Strogomishte is constructed before any works starts at this location, removing the need to cross the railway line. The following health and safety measures will be included to ensure safe working conditions during peak summer weather: ▪ Ensure workforce have appropriate PPE including hats, sunglasses, long sleeved, light clothing, sun cream. ▪ Ensure rest breaks are taken during heatwaves. ▪ Provide suitable rest areas and drinking water facilities for workforce. ▪ Ensure a first aider trained in recognising and treating the effects of heatstroke is on site.			
C21	Emergency Preparedness and Response Plan (EPRP) Including – ▪ Natural Disaster Response ▪ Tunnel Emergency Response Plan ▪ Spill Management Plan	The EPRP should include measures for prevention, mitigation and response to emergency scenarios, at a minimum covering: ▪ Road and traffic accidents; ▪ Other accidents and injuries; ▪ Uncovering/ discovery of pre-existing contamination ▪ spills of hazardous substances; ▪ fire and natural disasters (earthquake, landslip, flood, extreme weather events, etc.); ▪ Measures within the plan will include: ▪ Maintenance and quality control processes; ▪ Leak/ spill management;	Preparation: Contractor Approval: Supervising Engineer and PESR,	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD.	Plan approved by relevant parties as part of the Contractor's CESMP. PR2, PR3, PR4

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
		▪ Procedure to be followed to prevent pollution / contamination of soil and groundwater; ▪ Document-control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets; ▪ Details of the emergency response team(s) who will assess the risk of hazardous material releases and working to avoid any harmful effects in the event of an accidents or incident; and ▪ The details and procedure for reporting emergencies, including coordination with the national relevant authorities. The plan will consider delays to emergency response services, due to the current condition of the road and climatic factors that can disrupt access. The Spill Management Plan will include procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively respond to such incidents. The EPRP must be regularly reviewed and updated by a Contractor – as a minimum annually and after any emergencies or major accidents.			
Activity Specific Sub-Plans					
C22	Construction Workers' Accommodation Management Plan	Prior to the start of site works, an Environmental and Social Screening of potential camp locations will be undertaken to identify any sensitive environmental and social receptors and to ensure the camps are of sufficient distance from villages and local communities, but are able to access the required utilities and services. Consultation with local communities organised and implemented by a Contractor and PESR before the construction camp is developed is required, covering: ▪ Location of camps over one kilometre from any residential area and at least 50 m from any surface watercourse and not within 2 km of a protected area – any deviation from these separation distance must be supported by sufficient justification and additional mitigation measures, and the location and mitigations must be approved; ▪ Coordination of all construction camp activities with neighbouring land uses; ▪ confirmation as to whether workers can be accompanied by families or whether rosters will enable locally engaged workers to go home daily or not. The construction camps will be staffed and equipped with Accident & Emergency/medical emergency facilities for all	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer. Information – included in monthly ESHS reports to EBRD	Plan approved by relevant parties as part of the Contractor's CESMP. PR2 and PR4

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
		workers, to avoid straining the available health facilities that serve local communities. The Contractor will be responsible for maintenance and clean-up of campsites and respecting the rights of local land users. The plan will cover camp sites as well as any sites considered as associated facilities, and will require EBRD consideration, due diligence and approval. The plan will set out best practice measures, with a particular focus on the prevention of gender-based violence and the promotion of a gender-sensitive working environment. The construction camp shall be placed in compliance with all applicable national requirements and permits (e.g. environmental, water supply, waste water discharge, electricity, access roads etc).			
C23	Construction plans and Method Statements Including – Bridge Construction Plan Tunnel Construction Plan Tunnel Handover Plan Slope Stabilisation Plan	Plans will outline the specific methods for each element of the Project. All workers will sign relevant plans to confirm they are understood. The Bridge Construction Plan will outline measures to minimise environmental impacts on surface waterbodies during works in water, such as those from sediment disturbance, flow impedance, pollution from cement and other materials, etc. It will also address the particular hazards from work in and over water, including potential risks from drowning and working at height. This plan shall follow water consent requirements issued by the MoEPP. The Tunnel Handover Plan will as a minimum include an operations handover process and the documentation required for handover; training requirements including commissioning and staffing requirements; occupational health and safety requirements and risk management and reporting. The Slope Stabilisation Plan will determine the specific areas of slope stabilisation works ahead of construction. The Stope Stabilisation Plan will include a monitoring plan/ risk assessment to be handed to the operational maintenance team following the completion of the Project. All Construction Plans will cross reference relevant; environmental, social and health and safety sub-plans.	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer Information – included in monthly ESHS reports to the EBRD.	Plans approved 14 days prior to commencement of works in these areas. PR1, PR2, PR3, PR4
C24	Method Statements for Temporary Activities Including – Storage Areas	The Contractor will be responsible for preparing a method statement for any temporary activities and infrastructure (e.g. temporary roads, temporary river crossings, temporary storage areas, working on/ adjacent to the railway line),	Preparation: Contractor Approval: Engineer, PESR Method Statement for working on/ adjacent to the railway line will be	PESR/ Supervising Engineer Information – included in reports to EBRD	Statement approved 14 days prior to commencement of works in these areas. PR1, PR2, PR3, PR4

Ref	Environmental or Social Aspect/Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Target / Indicator / EBRD Performance Requirement	Target / Indicator / EBRD Performance Requirement	
	River crossings Roads/ Access Roads Working on/ adjacent to the railway line.	including establishment, operation and reinstatement of the facilities. The Method Statements for working on/ adjacent to the railway line with be prepared in consultation with the rail line provider and rail operator. The Method Statement will align with these organisations standard risk assessment requirements and will establish what protection measures must be maintained during construction. No works on or adjacent to the railway line will commence prior to the completion of this Method Statement. The Method Statements will cross reference Occupational Health and Safety (OHS) Plan and the Community Health, Safety and Security Plan.	agreed with the Public Enterprise for Railway Infrastructure		
C25	Blasting Management Plan	The Blasting Management Plan will set out measures including; ▪ The safe and secure storage of blasting equipment (including explosives) when not in use. ▪ Pre and Post blast surveys ▪ The Contactor must appoint an authorised blasting contractor. The PESR/ Supervising Engineer to review the contractor's licence. ▪ Throughout the blasting activity, if required, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. ▪ Use blasting design with consideration of safety, blast geometry, free faces, burden, spacing, initiation pattern (delayed blasting) and angled holes. Use multi deck blasting technique is considered as efficient method creating lower vibration. ▪ Develop and implement suitable procedures for management of explosives, including security and storage arrangements. ▪ The plan must be produced in accordance with the requirements of the Biodiversity Management Plan (e.g. regarding avoidance of impacts to nesting birds and roosting bats, etc.). ▪ Communities (within the area impacted by blasting related impacts) will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule ▪ The plan will include the licences for the companies appointed for blasting works. ▪ Blasting activities will not be allowed on Fridays, which is a day of prayer for the local Muslim population	Preparation: Contractor Approval: Supervising Engineer, PESR	PESR/ Supervising Engineer Information – included in monthly ESHS reports to the Lenders	Plans approved 14 days prior to commencement of works in these areas. PR1, PR2, PR3, PR4

23.6 OPERATION ACTIVITIES

Table 23-2 - Overall Operational Environmental & Social Management Plan (OESMP)

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
O1	Development of an Operational Environmental and Social Management Plan (OESMP)	The PESR shall prepare an over-arching operational phase Environmental and Social Management Plan (OESMP). The OESMP will Set out processes and responsibilities for implementation of the requirements of permits, licences, lenders and regulations associated with operation and maintenance of the Project after construction include all of the sub-plans listed below ▪ Operational Stakeholder Engagement Plan (SEP) and Grievance Mechanism ▪ Operational Community Health and Safety Management Plan ▪ Operational Worker Health and Safety Management Plan ▪ Road Safety Audits ▪ Operational Maintenance Plan ▪ Tunnel Operational Management Plan ▪ Emergency Preparedness and Response Plans (EPRP), including Tunnel Emergency Response Plan ▪ Operational Drainage Management Plan ▪ Operational Biodiversity Management Plan ▪ Operational Waste Management Plan ▪ Operational Air Quality Management Plan ▪ Operational Noise Management Plan ▪ Operational Soil Management Plan The PESRs PIU will implement a ESMS in line with national and international EHSS Standards. This OESMP should be costed so that an annual budget can be established	PESR and/or contracted party/ies	PESR Information – included in annual ESHS reports to EBRD.	OESMP and plans developed prior to the completion of construction and implemented PR 1, PR2, PR3, PR4, PR6, PR8
Community, Health and Safety Management Plans					
O2	Operational Stakeholder Engagement Plan (SEP)	▪ Update the Project SEP and Grievance Mechanism for the operational phase. ▪ Implement the SEP and organise regular consultation activities with local communities. ▪ A Community Liaison Officer (CLO) shall be appointed to manage consultations and implement the developed SEP with local communities. ▪ Organise consultation events for men, women and children (including vulnerable groups) as and when required. ▪ Develop outreach and campaign promoting gender-responsive road safety. This includes understanding masculinities and men's behaviours in relation to road safety so as to better target potential campaigns. ▪ Safe road crossings for children including adequate signals to alert presence of children and families. ▪ Adequate lighting in public spaces around the road should be provided to improve road and personal safety risks at night. ▪ Update SEP on annual basis.	PESR and/or contracted party/ies Approval: Senior management in the PESR	PESR Information – included in annual ESHS reports to EBRD	Consultation completed with the identified stakeholders per the SEP and results of consultations approved by the PESR and reported to EBRD.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
O3	Operational Community Health, Safety and Security Management Plan	▪ Co-ordinate with police by the PESR to ensure regular patrolling as per other international roads. ▪ Install warning signs, and other measures, as per the recommendations of the Road Safety Audit. ▪ Consult with local households, community groups, police, and emergency services as per the SEP. Investigate all community concerns related to road safety during road operation. ▪ Inform community about any hazards and/or restrictions. ▪ Provide road signs in accordance with national regulations and the recommendations of the Road Safety Audit ▪ Ensure lighting in public places is adequate and is maintained, particularly to reduce road safety risks at night, ▪ Provide safe road crossings for children including adequate signals to alert presence of children and families. ▪ Maintain an accident log and review regularly to identify potential to reduce future accidents.	PESR and/or contracted party/ies	PESR Information – included in annual ESHS reports to EBRD.	Road included in police patrols. Inclusion of rest areas. Plan prepared by the PESR and reported to the EBRD.
O4	Operational Worker Health and Safety Management Plan	This will be developed in a format and with content consistent with international standards (e.g., World Bank Group Environmental, Health, and Safety Guidelines, 2007). The Plan shall address health and safety hazards to workers associated with maintenance of roads, bridges, tunnels, etc. The plan should include, among others: ▪ Specific risk assessments of activities (inclusive of all ESHS topics); ▪ Specific procedures and operational controls to minimise risks and impacts; ▪ Training and competence of personnel; ▪ Emergency planning; ▪ Welfare provisions (water, sanitation, etc.); ▪ Incident reporting and investigation; ▪ Safety equipment; ▪ Site and personnel security; ▪ Traffic controls; and ▪ Community health and safety. All workers (including sub-contractors) will receive a formal induction ahead of starting works, in a language(s) and format easily understood by the workforce. This will include information on health and safety measures, emergency response in case of accidents, fire, earthquakes, landslides, flash foods, disease etc, and minimisation of environmental and community impacts. The plan will include controls for Traffic Management, Health and Welfare, PPE, Excavations, Plant and Equipment, Work at Heights and Confined Spaces, Lifting Operations, Electrical Works and Equipment, Hazardous Materials, Extreme Temperatures Exposure and Site Illumination.	PESR and/or contracted party/ies	PESR Information – included in annual ESHS reports to EBRD.	Plan prepared by the PESR and reported to the EBRD.
O5	Road Safety Audits and Inspections	Develop and implement a program of road safety audits to assess safety performance along the alignment and village access roads, and to identify any unsafe conditions. This should include a Road Safety Audit at Pre-Opening / Post Construction to confirm recommendations accepted during the design stage Road Safety Audit have been implemented. The findings of	PESR Specialist consultant	PESR, Information – included in reports to EBRD.	No accidents. Plan prepared by the PESR and reported to the EBRD.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
		the Road Safety Audit will need to feed back into the design of the Project. Accident logs will be reviewed, and corrective measures put in place, where appropriate. A further Road Safety Inspection should be undertaken prior to road commissioning, and then periodically every 3 years to assess road traffic collisions along the road and identify any trends / blackspots that required remedial actions. Road safety audits /inspections shall factor gender perspectives and identify potential gender adverse impacts and risks. The accident log in the Operational Community Health, Safety and Security Management Plan will also be reviewed as part of the audits and inspections.			
O6	Operational Maintenance Plan	Develop and implement a robust maintenance regime for roads, barriers, bridges, drainage and safety features. Inspections must be conducted and managed by suitably qualified and experienced engineers and in line with appropriate Macedonian and international standards. A specific programme of inspection and maintenance will also be developed for the tunnels. All maintenance operations will be conducted in accordance with the Operational Worker Health and Safety Management Plan This plan will set out the storage requirements for materials required for the maintenance of the project, including storage locations and procedures. The Operational Maintenance Plan will cross reference all topic specific maintenance plans. The Operational Maintenance Plan will outline the monitoring requirements for the Project (cross referencing topic specific maintenance plans).	Maintenance department of PESR	PESR Information – included in annual ESHS reports to EBRD.	No accidents. Plan prepared by the PESR and reported to the EBRD.
O7	Tunnel Operational Management Plan	▪ Maintain ventilation in working condition. ▪ Provide firefighting equipment and other facilities in working order. ▪ Ensure tunnel staff are adequately trained in case of emergencies, including rescue, recovery and prevention of access to additional vehicles. ▪ Ensure the tunnel is cleaned regularly. ▪ Ensure that exit doors to the gallery and the passages are not blocked. ▪ Specification of inspection routine.	Maintenance department of PESR	PESR Information – included in annual ESHS reports to EBRD.	No accidents. Plan prepared by the PESR and reported to the EBRD.
O8	Emergency Preparedness and Response Plans (EPRP) Including Tunnel Emergency Response Plan	Develop and implement EPRPs for the operational phase, including a specific plan for tunnel emergencies. These should include measures for prevention, mitigation and response to emergency scenarios, at a minimum covering: ▪ Road and traffic accidents; ▪ Other accidents and injuries; ▪ Spills of hazardous substances; ▪ Fire; ▪ Natural disasters (earthquake, landslip, flood, extreme weather events, etc.); ▪ Accidents in the tunnel (e.g., tunnel collapse, tunnel fires, gas release, etc.).	PESR, Consultants on behalf of PESR	PESR Information – included in annual ESHS reports to EBRD	Plan prepared by the PESR and reported to the EBRD.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
		The EPRP should describe roles and responsibilities for prevention and response, required resources and procedures for responding to different scenarios (fire, flood, traffic accident, etc.) The EPRP must be regularly reviewed and updated – as a minimum annually and after any emergencies or accidents.			
Environmental Management Plans					
O9	Operational Drainage Management Plan	▪ Ensure clean up and waste removal from carriageway and roadsides. ▪ Store hazardous and potentially contaminating materials (chemicals, fuels, oils, etc.) in areas with watertight flooring, roofing, security fencing and access control and drainage/wastewater collection systems. ▪ Maintain integrity and permeability of storm water drainage system to avoid blockage, overflow and direct discharge of untreated runoff into the rivers. ▪ Ensure tunnel operation staff are aware of material and waste management requirements. ▪ Ensure maintenance and timely clean-up/removal of sediments accumulated in runoff treatment facilities and drainage systems. ▪ Perform maintenance paving in dry weather to prevent runoff contamination. ▪ During maintenance works, apply the same measures as per construction stage.	Maintenance department of PESR Bridge operation staff Tunnel Operation Staff	PESR Information – included in reports to EBRD.	No reduction in water quality.
O10	Operational Biodiversity Management Plan	The Operational Biodiversity Management Plan will: ▪ Register and analyse road kills. Develop additional mitigation measures if found to be necessary. e.g. install reflectors /local fencing, warning signs, speed reduction etc.). Liaise with state forest authorities to inform supplementary feeding for carnivores should road kill incidents occur. ▪ Ensure carriageway and adjacent strip are waste free. ▪ Prohibit poaching/plant and seed collection (ensure that tunnel operator staff are also aware of the ban). ▪ Remove all materials, equipment, tools from the area after completion of works. ▪ Reinstate the sites disturbed during maintenance works, using species of local/regional provenance.	PESR, PESR Consultant	PESR Information – included in reports to EBRD	Consultation completed with the identified stakeholders per the SEP and results of consultations presented to PESR and EBRD.
O11	Operational Waste Management Plan	The Operational Waste Management Plan will: ▪ Include wastes generated at operational facilities (tunnel cabins, maintenance depots, etc.), by road users, and during maintenance operations ▪ describe waste streams and estimated amounts of each, ▪ describe recycling / reuse methods for each material, ▪ identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling, ▪ specify responsibilities for managing and disposal of waste	Maintenance department of PESR, or third party/ies	PESR Information – included in reports to EBRD, other authorities.	Reduced waste-based pollution.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
O12	Operational Air Quality Management Plan,	The Operational Air Quality Management Plan should include provisions to: ▪ Keep roadside vegetation intact to ensure areas of bare soil are minimised. ▪ Check air quality in sensitive receptor locations seasonally. Pay particular attention to measurements in tunnel exits. ▪ Ensure of tunnel ventilation system is properly maintained. ▪ Filter air before exhaust to environment (tunnel sections). ▪ Apply the same mitigation measures during maintenance activities to reduce dust and emissions as the construction phase.	Maintenance department of PESR Tunnel operation staff	PESR Information – included in annual reports to EBRD, other authorities.	Road vegetation maintained. Tunnel ventilation system operational.
O13	Operational Noise Management Plan	During detailed design, further noise modelling will take place to ensure suitable mitigation (barriers, low noise surfacing) is utilised to ensure compliance with EU/ WHO noise levels/ standards. The Operational Noise Management Plan should include provisions to: ▪ Monitor noise levels at annual intervals and, depending on the results, implement noise abatement measures when the noise level exceed the acceptable limits / criteria during the operation phase. If noise exceedances occur, further mitigation may be required including the upgrade of noise barriers, low noise surfacing, sections of reduced speeds, alternative barrier types and upgrades to glazing/ facades. ▪ Maintain the grievance redress mechanism to allow identification of other potential locations where noise protection may become necessary during the operation of the infrastructure. Where issues are raised, check the noise level in the location indicated by the complainant to verify the claim and develop relevant mitigation measures. ▪ Depending on the results of noise monitoring and/or based on justified complaints, additional mitigation measures shall be considered as necessary. ▪ Appropriate maintenance activities will be carried out to assess the barriers' effectiveness of sound attenuation (in line with ISO 10847:1997).	Maintenance department of PESR or third party/ies	PESR Information – included in reports to EBRD, other authorities.	Low number of post completion complaints.
O14	Operational Soil Management Plan	▪ Maintain sediment traps and basins, drainage channels and treatment systems; and ▪ Maintain slope (cuttings and embankment) ▪ Monitor slopes, in particular after strong rains and snowmelt for possible traces of erosion. ▪ Implement best practice for sediment / erosion control when undertaking repair/ maintenance works. ▪ Analysis of soil following any intensive salt spreading during periods of high snow fall/ ice. ▪ Keep vegetation strip between the edge of embankment and cultivated land plots. ▪ Monitor soil quality for presence of heavy metals – Pb, Cd, Zn.	Maintenance department of PESR	PESR Information – included in annual ESHS reports to EBRD.	No degradation of soil quality.

23.7 MONITORING

Table 23-3 - Construction

Element (what)	Location (where)	Method (how)	Thresholds and Responses (applicable legislation /standards)	Frequency (when)	Responsibility (who)
Ambient air quality (Particulates PM_{10}, $PM_{2.5}$, NO_2, SO_2) ($\mu g/m^3$)	Areas for monitoring will include locations where the Project is in close proximity to sensitive receptors; Dolno Strogomishte, Osoj and Rashtani. This will be used as a baseline for construction phase monitoring.	Instrumental measurement	World Health Organisation/ EU standards Anticipated to be: Average: PM_{10} (yearly) - 50 $PM_{2.5}$ (yearly) - 25 NO_2 (yearly) - 40 SO_2 (24hr)– 125 **Response if thresholds exceeded:** See if construction methodology can be revised, or relocated away from sensitive receptors to reduce impact.	Monthly and in response to complaints	Contractor / Supervising Engineer to oversee and report PESR to report to EBRD
Day time and night time noise levels dB(A)	In proximity to sensitive receptors. Locations should include; Dolno Strogomishte, Osoj, Rashtani and Kolibari (due to tunnelling activities).	Instrumental measurement	Based on baseline levels. Based upon - BS5228-1:2009 Anticipated to be 45dB at night, 55dB in the evenings and weekends and 65dB during the day). These thresholds are more stringent for the most sensitive time periods than those outlined in the Rulebook no. 147/2008 (55dB at night, 60dB in the evenings and weekends and 60dB during the day). **Response if thresholds exceeded:** See if construction methodology can be revised, or relocated away from sensitive receptors to reduce impact.	Prior to construction to determine threshold levels. During construction in close proximity to sensitive receptors and in response to complaints during construction, also depends on the place of construction activities in compliance with contractor's Programme of Work (PoW)	Contractor / Supervising Engineer to oversee and report
Day time and night time vibration levels	In proximity to sensitive receptors. Locations should include; Dolno Strogomishte, Osoj, Rashtani and Kolibari (due to tunnelling activities).	Instrumental measurement	Defined by Noise and Vibration plan Threshold anticipated to be > 1.0mm/s Stop works if >10mm/s is recorded near sensitive receptors. **Response if thresholds exceeded:** See if construction methodology can be revised to reduce vibration levels, and /or use noise screens.	During construction activities adjacent to sensitive receptors.	Contractor / Engineer to oversee and report
Surface water quality (turbidity, pH, conductivity, total Oils and Grease, BOD, COD)	Upstream and downstream of activities that will affect rivers or streams (i.e. at new river crossings). 50m up and down-stream from works.	Analytical methods/ standards – ISO or similar Observation	Change from baseline conditions, including increased turbidity. **Response if thresholds exceeded:** Inspection of upstream activities. Halt works if significant change has occurred and introduce further measures to prevent pollution.	Weekly during project activities implemented close to rivers or streams.	Contractor / Engineer to oversee and report

Element (what)	Location (where)	Method (how)	Thresholds and Responses (applicable legislation /standards)	Frequency (when)	Responsibility (who)
	Oil/ grease to be tracked upstream to source and the location recorded...				
Subsidence	Regular monitoring of river and stream crossings, cuttings and embankments to ensure slopes remain stable, notably during the construction of the bridges and viaducts.	Observation	Slope shows signs of movement. **Response if thresholds exceeded:** Halt work immediately to reduce risk to workers and implement further check and stabilisation measures.	Daily	Contractor / Engineer to oversee and report
Ground water level and quality: pH; total dissolved solids, fuels/ oils, metals.	Cuttings/ tunnel construction/ deep excavations/ deep foundations. At locations investigated during the design stage, where the groundwater level is very shallow (<2.00m)	Instrumental measurement	Ground level – change from baseline. Default thresholds to be based upon Water Framework Directive standards. **Response if thresholds exceeded:** Seek potential sources of contamination nearby.	Seasonally During activities that affect groundwater.	Contractor / Engineer to oversee and report
Vegetation	All work locations	Visual observations / walkover surveys – changes from baseline/ existing conditions.	Defined by Biodiversity Management Plan. Change from baseline conditions. **Response if thresholds exceeded:** Provide additional fencing / protection. If damage is by accident it needs to be recorded and feedback into the management system to avoid repeat occurrence.	Seasonally/ as defined by Biodiversity Management Plan.	Contractor
Biodiversity – as detailed within the BMP.	As detailed within the BMP	As detailed within the BMP	Defined by Biodiversity Management Plan. Change from baseline. **Response if thresholds exceeded:** Environmental Engineer, with additional support from a biodiversity or Fish expert to develop additional measures to ensure the BMP is implemented.	For the duration of the construction phase	Contractor / Engineer to oversee and report
Subcontractor audits	N/a	Availability of employment contacts for all employees, timely payment of salaries, adherence to national Labour Regulations with regards to annual leave and other entitlements.	National Labour Regulations. **Response if thresholds exceeded:** Implement measures to ensure subcontractor adheres to requirements.	Dependent on type and duration of activity	Contractor / Engineer to oversee and report
Labour audit to monitor HSE Plans implementation	All work locations	Employees' HSE training records, number of HSE incidents and near misses and their category.	National Standards/ defined by Health and Safety (HSE) Plan **Response if thresholds exceeded:**	During the first month of the construction phase	PESR/PIU / Engineer

Element (what)	Location (where)	Method (how)	Thresholds and Responses (applicable legislation /standards)	Frequency (when)	Responsibility (who)
			Halt work, change working methods, provide additional training, implement health and safety shutdowns depending on the severity of the non-compliance.		
Waste company audits	Site / waste disposal locations	Observation	EU Waste Directive **Response if thresholds exceeded:** Do not use non-compliant locations, negotiate improvements with the site operator.	Dependent on hazard nature of waste and frequency of use	PESR/ PIU/ Contractor / Engineer to oversee and report
Regular inspection of scaffolds by competent persons	All work locations with scaffolds	Observation	Manufacturer's safety specifications **Response if thresholds exceeded**: If threshold exceeded – replacement of equipment.	After installation, weekly or following modification of inclement weather	Contractor / Engineer
Regular inspection of fall prevention devices.	All work locations	Observation	Manufacturer's safety specifications **Response if thresholds exceeded:** If threshold exceeded – replacement of equipment.	Before each use	Contractor / Engineer
Regular inspection and testing of all lifting equipment, including all straps, chains, shackles, etc	All work locations	Observation	Manufacturer's safety specifications **Response if thresholds exceeded:** If threshold exceeded – replacement of equipment.	Dependent on type of equipment	Contractor / Engineer to oversee
Inspection of dust control measures at concrete / asphalt plants	All work locations	Observation	Visible dust on vehicles/ windows **Response if thresholds exceeded:** If threshold exceeded – replacement of equipment.	Weekly	Contractor / Engineer / Competent Authorities to oversee and report
Wind speed monitoring (for dust control purposes)	All work locations	Instrumental measurement	N/A – dust can be caused at wind speeds of 14.5 km/hr **Response if thresholds exceeded:** If threshold exceeded – inspect areas of bare ground/ stockpiles and apply mitigation to reduce dust.	Daily and following significant increases in wind.	Contractor / engineer to oversee
Traffic and road conditions on construction site access roads and village access roads	Access roads	Observation	Deterioration from baseline condition **Response if thresholds exceeded:** If threshold exceeded – replacement of equipment.	Dependent on traffic volumes	Contractor / Engineer
Security patrols to prevent public access to hazardous areas	All work locations	Observation / cameras	Thresholds – unauthorised access. **Response if thresholds exceeded:** Review and update of security patrols.	Throughout construction	Contractor

Element (what)	Location (where)	Method (how)	Thresholds and Responses (applicable legislation /standards)	Frequency (when)	Responsibility (who)
Review the relevant employee documents: health status, qualifications, Review adherence to the occupational safety and health measures.	Office, On site	Review of documents	Thresholds – National employment standards. **Response if thresholds exceeded:** Implement measures to ensure adherence to requirements.	At the start of construction (to ensure measures are in place) Throughout Construction (to ensure measures are being applied)	PESR, supervision engineer, State Inspectorate for Occupational Safety and Health

Table 23-4 - Operation

Element (what)	Location (where)	Method (how)	Thresholds and Responses (applicable legislation /standards)	Frequency (when)	Responsibility (who)
Ambient air quality (Particulates PM_{10}, $PM_{2.5}$, NO_2)	Locations indicated by complaints Locations where the Project is in close proximity to sensitive receptors including the settlements of Dolno Strogmishte and Osoj.	Instrumental measurement	World Health Organisation/ EU standards Anticipated to be: Average: PM_{10} (yearly)- 50 $PM_{2.5}$ (yearly) - 25 NO_2 (yearly) - 40	Quarterly and in response to complaints	PIU/ PESR / third party on behalf of PIU/ PESR.
Day time and night time noise and vibration levels dB(A)	Locations indicated by complaints At locations close to noise sensitive receptors (such as those protected by noise barriers at Dolno Strogmishte and Osoj)	Instrumental measurement	National standards Response: Review of barriers and mitigation measures. Upgrade where required.	Quarterly and in other sites in response to complaints	PIU/ PESR / third party on behalf of PIU/ PESR
Surface water quality monitoring pH; Suspended Solids; Oil and Grease	In watercourses receiving runoff from the road (50 m upstream and 250 m downstream the point of discharge)	Analytical methods/ standards - ISO or similar Observation	National Standards Response: Upgrade pollution prevention measures.	Twice a year	PIU/ PESR / third party on behalf of PIU/ PESR
Ground water level and quality: pH; total dissolved solids, fuels/ oils, metals.	Cuttings/ tunnel construction/ deep excavations/ deep foundations. At locations investigated during the design stage, where the groundwater level is very shallow (<2.00m)	Instrumental measurement	National Standards Response: Upgrade pollution prevention measures.	Only in case of spillages or incidents	PIU/ PESR / third party on behalf of PIU/ PESR
Biodiversity – as detailed within the BMP	As detailed within the BMP	As detailed within the BMP	Defined by BMP.	As detailed within the BMP	PIU/ PESR / third party on behalf of PIU/ PESR
Slope stability monitoring for erosion	Whole alignment (including village access roads)	Observation	Defined by Slope Stabilisation Plan Response: Implement further soil stabilisation measures.	Twice a year and after heavy rain. Following complaints/ warnings raised through the GM.	PIU/ PESR / third party on behalf of PIU/ PESR

Tunnel inspection and maintenance programme	Tunnel	Observation Other methods as required	Defined by Tunnel Operational Management Plan	In line with international standards	PIU/ PESR / third party on behalf of PIU/ PESR
Maintenance regime for roads, barriers, bridges, drainage and safety features	Whole alignment (including village access roads)	Observation Other methods as required	Defined by Operational Maintenance Plan	In line with Macedonian and international standards	PIU/ PESR / third party on behalf of PIU/ PESR
Road safety audits	Whole alignment (including village access roads)	Observation	National/EU road safety standards	Once per year	PIU/ PESR / third party on behalf of PIU/ PESR / Specialist consultant
Regular inspection of scaffolds used during maintenance by competent persons	All work locations with scaffolds	Observation	Manufacturer's safety specifications Response if threshold exceeded – replacement of equipment.	After installation, weekly or following modification of inclement weather	PIU/ PESR / third party on behalf of PIU/ PESR
Regular inspection of fall prevention devices/ structures used during maintenance.	All locations with fall prevention devices/ structures.	Observation	Manufacturer's safety specifications Response if threshold exceeded – replacement of equipment.	Before each use	PIU/ PESR / third party on behalf of PIU/ PESR
Regular inspection and testing of all lifting equipment used during maintenance.	N/A – check equipment	Observation	Manufacturer's safety specifications Response if threshold exceeded – replacement of equipment.	Dependent on type of equipment	PIU/ PESR / third party on behalf of PIU/ PESR

Public Enterprise State Roads

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