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ინფრასტრუქტურის სამინისტრო

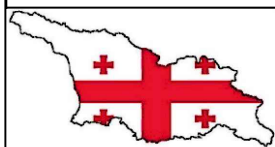
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Republic of Georgia

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Infrastructure

ROADS DEPARTMENT OF GEORGIA
Road Corridor Investment Program,
Tranche 3

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KHEVI-UBISA-SHORAPANI-ARGVETA SECTION (E60 HIGHWAY ROUTE) LOT F3



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<p>PREPARATION OF DETAILED DESIGN FOR NEW CONSTRUCTION OF BORITI-SHOROPANI SECTION (E60 HIGHWAY ROUTE), BIDDING DOCUMENTS, ENVIRONMENTAL IMPACT ASSESSMENT AND DETAILED LAND ACQUISITION AND RESETTLEMENT PLAN</p> <p>SECTION F3 ENVIRONMENTAL IMPACT ASSESSMENT REPORT</p>					
01	May 2018	FINAL SUBMISSION	Consultan	Team Leader	Project Director
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Appendices

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Appendix C	List of Consultation Attendees, January 2018

Appendix D	Consultation Presentation, January 2018
Appendix E	Chance Find Procedure
Appendix F	State Forest Fund
Appendix G	Noise Barrier Cost Estimate

Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AM	Accountability Mechanism
ADB	Asian Development Bank
AST	Above Ground Storage Tank
AT	Argveta - Tbilisi
AQP	Air Quality Plan
BAP	Borrow Pit Action Plan
BAT	Best Available Technology
BGL	Below ground level
BoQ	Bill of Quantities
BOD	Biological Oxygen Demand
BRI	Bridge
CAREC	Central Asia Regional Economic Cooperation
CAP	Corrective action plan
ccTV	Closed Circuit TV
CFC	Chlorofluorocarbon
CIS	Commonwealth of Independent States
CO	Carbon monoxide
COD	Chemical Oxygen Demand
CO ₂	Carbon Dioxide
Cr	Chromium
dBA	decibel
DD	Detailed Design
EA	Executing Agency
EAC	Environmental Assessment Code
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EHS	Environmental Health and Safety
EMP	Environmental Management Plan
EM	Environment Manager
ERP	Emergency Response Plan
ES	Executive Summary
ESIA	Environmental and Social Impact Assessment
EU	European Union
EWB	East West Highway
EWHPs	East West Highway Improvement Projects
FE	Iron
FS	Feasibility Study
GAA	Georgian American Alloys
GDP	Gross Domestic Product
GEOSTAT	National Statistics Office of Georgia
GEL	Georgian Lari
GHG	Greenhouse Gases
GoG	Government of Georgia
GOST	Technical Standard
GRM	Grievance Redress Mechanism
GRCE	Grievance Redress Committee
ha	Hectare
H&S	Health and Safety
HC	Hydrocarbon

HP	Horse Power
HZ	Hertz
IBA	Important Bird Area
IBC	Intermediate bulk storage containers
IFC	International Finance Corporation
IFI	International Finance Institutions
IEE	Initial Environmental Examination
IES	International Environmental Specialist
in/sec	Inch per second (25.4mm/sec)
IUCN	International Union for Conservation of Nature
km	Kilometer
km/h	Kilometers per Hour
Km ²	Square kilometer
LARP	Land Acquisition and Resettlement Plan
LC	Least Concern
LCF	Local Consulting Firm
L _{eq}	Equivalent Continuous Level
MELT	Modified Eccentric Loader Terminal
mg/l	Milligram per liter
mg/m ³	Milligram per cubic meter
mg/kg	Milligram per kilogram
m ³ /s	Cubic meters per second
m ³ /h	Cubic meters per hour
m ³ /d	Cubic meter per day
m	Meter
m ²	Square meter
m ³	Cubic Meter
m ³ /s	Cubic meter per second
MAC	Maximum Allowable Concentrations
MCA	Multi-criteria analysis
MoEPA	Ministry of Environment Protection and Agriculture
MoESD	Ministry of Economy and Sustainable Development
MPE	Maximum Permissible Emission
MPC	Maximum permissible concentrations
MPD	Maximum Permissible Discharges
MSDS	Material Safety Data Sheet
MtCO _{2e}	Million tons of CO ₂ equivalent
NES	National Environmental Specialist
NGO	Non-Governmental Organization
NH ₄ ⁺	Ammonium
Nm ³	Normal cubic meter
NO _x	Nitrogen oxides
NO ₂	Nitrogen Dioxide
NO ₃	Nitrate
Ni	Nickel
NT	Near Threatened
OHS	Occupational Health and Safety
PA	Per Annum
PAP	Project Affected Person
PAH	Polycyclic aromatic hydrocarbons
PCR	Physical and cultural resources
PPV	Peak Particle Velocity
Pb	Lead
PM	Particulate matter

POPs	Persistent organic pollutants
PO ₄	Phosphate
PMU	Project Managing Unit
PPE	Personal Protective Clothing
PPTA	Project Preparatory Technical Assistance
PPM	Parts per million
PSC	Pre-stressed concrete
SPM	Suspended Particulate Matter
RD	Road Department
RoW	Right of Way
SFF	State Forest Fund
SniP	Construction Standards
STD	Sexually transmitted diseases (such as HIV/AIDS)
SEMP	Specific Management Plan
SO ₂	Sulfur Dioxide
SPS	Safeguard Policy Statement
TA	Tbilisi - Argveta
TBP	Tunnel Blasting Plan
TEM	Trans-European North-South Motorway
TMP	Traffic Management Plan
TOR	Terms of Reference
TSP	Total Suspended Particulates
TSS	Total suspended solids
TUN	Tunnel
UNEP	United Nations Environment Program
USAID	United States Agency for International Development
USD	United States Dollar
UST	Underground Ground Storage Tank
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan
°C	Degrees Celsius
µg/m ³	Micrograms per cubic meter

Currency Exchange Rates as of 13th January, 2018:

1 US\$ = 2.56 (GEL)

(\$ refers in this report to US-Dollars)

Executive Summary

1. Introduction

This Environmental Impact Assessment (EIA) is part of the process of compliance with the Asian Development Bank (ADB) Safeguard Policy Statement (2009) and European Investment Bank (EIB) Statement of Environmental and Social Principles and Standards (2009) in relation to the construction of Section F3 of the new Khevi-Ubisa-Shorapani-Argveta section of the E60 Highway, or more simply, the “Project”.

The EIA provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the project. More specifically, the EIA:

- Describes the existing socio-environmental conditions within the Project area;
- Describes the project design, construction activities and operational parameters;
- Describes the extent, duration and severity of potential impacts;
- Analyzes all significant impacts; and
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP).

Based on the existing ADB Environmental Safeguards Policy (2009), this Project falls under ADB’s project Category A. EIB require the EU EIA Directive to be followed. This Project falls within Annex 1 of the Directive which requires an Environmental Impact Assessment.

2. Project Background

The Government of Georgia is endeavoring to make Georgia a regional and logistics hub and more attractive for businesses. The East West Highway (EWH), stretching 410 km from Sarpi on the Black Sea, at the border with Turkey, through the center of the country to the capital Tbilisi and on to the border with Azerbaijan, is the main inter-regional and international route between western and eastern Georgia, as well as its neighboring countries. Representing about 2% of Georgia’s road network and one fourth of its international roads, the EWH serves 8,000 to 10,000 vehicles per day and carries over 60% of the country’s international trade. The EWH will be an integral part of one of the six key CAREC corridors providing the shortest transit link to connect Central Asia with Europe and East Asia.

In light of the traffic growth on EWH, the high percentage of truck traffic, and the difficult terrain and resulting geometric profiles, capacity expansion of the current 2-lane mountainous section between Chumateleti and Argveta is crucial to realizing full potential of the EWH with improvements to the highway either completed or underway on each side of this section.

Therefore, the Government has requested the Asian Development Bank (ADB) and several other development partners to finance the remaining bottleneck sections (Chumateleti - Argveta) on the EWH. A feasibility study financed under a World Bank project for the Chumateleti Argveta section (comprising four sections F1 through F4) of the EWH was completed in 2015. The detailed design of Section F1 and F4 has been completed and selection of the construction Contractor is on-going. Detailed design of sections F2 and F3 is now on-going and this report forms the EIA for detailed design phase of section F3 which will be followed by section F2.

3. Project Description

The Project involves construction of a new road section of the E-60 highway located in Imereti Region of central Georgia (see Figure 1). Section F3 forms the Boriti - Shorapani portion of the Khevi-Ubisa-Shorapani-Argveta section of the E-60. The length of the Project road is 13.0 kilometers.

Figure 1: Road Location Map



The Projects geometric design standards have been selected based on traffic flow, road category and relief to ensure safe and unimpeded traffic flow. The road design is based on Georgian National Standard SST 72: 2009 “Standard on Geometrical and Structural Requirements for the Public Motor Roads of Georgia” and TEM (Trans-European North-South Motorway) Standards.

The main technical parameters adopted in the detailed design are as follows:

- Design speed - 100 km/h;
- Number of traffic lanes – 4;
- Width of traffic lane - 3.75 m;
- Width of each carriageway - 7.5 m;
- Width of paved shoulder (emergency lane) - 2.5 m;
- Width of verge – 1.0 m;
- Width of central reserve- 5.0 m;
- Width of paved shoulder at the central reserve - 1.0 m;
- Total width of each paved platform – 11.0 m
- Width of road bed - 27.0 m;
- Carriageway cross-fall on straight sections - 2.5%;

- Minimum radius of horizontal curve - 400 m;
- Maximum longitudinal gradient - 4%;
- Minimum convex curve - 15 000 m;
- Minimum concaved curve - 15 000 m.

Thirty five bridges will be constructed during the project works. The total length of the bridges is 6,295 meters, the longest of which is 1,182 meters. The bridges are grouped into the following main typologies:

- Steel-concrete bridges – 14 bridges: maximum span length up to 60 m.
- Precast concrete bridges – 13 bridges: maximum span up to 33 m

Nine tunnels will be constructed with double tubes with total length of 13,860 meters lengths from 251 m to 1,625 m.

To construct the roadbed in the project section concrete retaining walls and reinforced concrete support structures will be required on several sections due to the difficult relief conditions of the project section.

There are two interchanges planned in F3 Section.

The following types of culverts will be constructed:

- Underpasses for rural roads, which are construction of cast in situ reinforced concrete structures of closed contours cross sections 6.0x4.5 m - for passing rural roads is envisaged in the design.
- Cattle passes, which ensure cattle cross the project road. Construction of cast in situ reinforced concrete structures of closed contours cross sections 4.0x2.5 m - is envisaged in the design.
- Culverts, for which cast in situ reinforced concrete culverts cross section 2.0x2.5 m -, 4.0x2.5m - is envisaged in the design to provide water discharge from ravines and canals.

Underpasses and overpasses will be constructed using reinforced concrete culverts.

Two different pavement structures will be used:

- Concrete pavement structure for the motorway and interchanges; and
- Asphalt pavement structure for all Slip Roads and all Minor Roads and bridges.

4. Alternatives

The “No Action” Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project Road. The “No Action” Alternative would result in the continued deterioration of the road, bridges and drainage structures along the RoW, thereby impeding the economic development of the Project Area and the Imereti region. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area. In light of these considerations, the “No Action” Alternative is deemed to be neither prudent nor in the best interest of Georgia or those with an interest in, and attempting to assist restoration of, Georgia’s well being.

Given the complex topography of the region and Georgia in general, there are no other feasible alternative corridors that would be able to compete with the existing corridor in terms of travel times. In addition the Project forms part of the overarching program to upgrade the

E-60 motorway which includes many sections that have recently been upgraded, or are in the process of upgrading (or detailed design), including the sections of road joining the start and end points of the Project road.

As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F3) is one of the last remaining sections of the road requiring upgrading. Accordingly, the Project is focusing on the upgrading of the E-60 and will not consider any other transport mode as an alternative.

During the Projects Feasibility Phase a number of alignments were considered that broadly follow the existing E-60 corridor. The result of the Feasibility Report was a draft final corridor which the detailed design would use as a basis for the final road alignment (horizontal and vertical). During the detailed design phase a number of factors were taken into account to determine the final alignment, they included the consideration of potential resettlement issues and social aspects such as access and noise.

Only one pavement type was considered for the main pavement; rigid concrete mainly due to the fact that concrete pavements are already constructed on preceding sections of the E60 Highway. Asphalt pavement structure will however be used for all Slip Roads, bridges and all Minor Roads and bridges.

Several locations were identified for the disposal of spoil material from cuts and tunnels. Four locations have been considered as potential location for of spoil material. The location originally proposed, Kutaisi bypass, has been eliminated due to a lack of space for all of the material and the costs of transporting the waste to the site as well as environmental considerations of a huge amount of truck journeys through Zestaphoni. Three other potential locations closer to section F3 were screened to determine the potential environmental impacts of these areas. Two of these areas have been eliminated based on the fact a large number of trees would need to be felled in these areas. The remaining site, close to Boriti, is considered a possible option for the disposal material given the large volumes of spoil to be generated by the Project. **Section C.6 – Alternative Spoil Disposal Locations** discusses this issue further.

5. Description of the Environment

The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucas Mountains. The Project corridor is set within a landscape of mountains and rolling hills. The existing road is located within the bottom of the river valley, elevation varies between 200 and 300 meters above sea level.

Generally, the landslides do not affect the project alignment except for two mass movements that have been identified at around KM1.4 to KM1.6 and at KM6.4. The first one affects TUN 3.0.01-TA/AT and caused the realignment of the tunnel in order to have its western portals outside the landslide area. The second smaller one affects the western abutments of BRI 3.1.06-TA/AT and the eastern portals of TUN 3.0.05-TA/AT. According to the Seismic Hazard Map of Building Norms and Rules effective in Georgia the study area is located in the 8-point earthquake zone (MSK 64 scale).

Annual precipitation in Zestafoni (nearest weather station) is around 1,200 mm. Rainfall is highest in the Winter, Autumn and Spring, although rainfall can still be observed during the hotter summer months. The monthly temperature for Zestafoni which ranges on average, from 5 °C in the winter months to around 25 °C in the summer. The dominant wind direction is from the east. However, strong winds from the west are also experienced quite frequently.

A climate risk and vulnerability assessment was prepared by ADB as part of the overall Project. The assessment concluded that the number of hot days (above 25°C) is anticipated to increase and mean precipitation will decrease by 4.5% by 2050. The number of days with heavy rainfall will also increase while annual river run-off is anticipated to decrease by 13%. The assessment also indicated that the Project area is in a high-risk range for landslides.

Within the Project area the main sources of air emissions are from transport, including vehicles on the existing Project road. Air quality monitoring was carried out at six different locations during early 2018 to characterize the current air quality within the Study Area. The results of the ambient air quality monitoring show that in all instances the parameters monitored were below national, and where applicable, IFC standards. The most noticeable factor was the higher levels of PM recorded at the first four monitoring stations which are adjacent to the existing road. This suggests that these levels PM₁₀ and PM_{2.5} are attributable to vehicle movements on the existing road.

The main river in the Project area is the Dzirula. The river heads at 1,252 m above sea level where several brooks merge on the western slopes of Likhi Range and flow into the river Kvirila from its left bank. The length of the river is 89 km, its total fall is 1,052 m and the area of its catch basin is 1,270 km². The river comprises 1,386 tributaries with the total length of 1,677 km. Within the Project area the main tributaries are; 1) Chkherimela River; 2) Macharula River; 3) Gezrula River; and 4) Khelmosmula River.

To assess the status of water quality in the Project area, including the Kvirila and Dzirula rivers, monitoring of surface water was undertaken in March 2018. The results of the monitoring exercise show that the Dzirula river meets the national Maximum Allowable Concentrations (MACs) for surface water quality.

The project road crosses the natural forest areas, agricultural land plots, hilly forest slopes, residential areas and riparian ecosystems. Due to anthropogenic impact in the main part of the area natural vegetation is lost to agricultural and other development. In these areas arable lands and pastures have developed. Some of the animal species typical for the area moved to other areas in search of a safe shelter. Over the time the fauna of the region has changed significantly. Animals currently found in the area of interest are mainly presented by those species that live in forested areas and/or can tolerate presence of humans.

According to available information there are three species considered as vulnerable in Georgia (Georgian Red List) that may be found within the Project area, the Otter (*Lutra lutra*) and the Caucasian squirrel (*Sciurus anomalus*) and the Mediterranean turtle (*Testudo graeca* Linnaeus). Site surveys did not reveal the presence of squirrels or turtles in the Project area. In addition, the review of the habitat along the alignment indicates that it is not optimum for existence of the Caucasian squirrel. Site surveys undertaken by local ecologists did not reveal evidence of otters in the Project area, such as otter holts or spraints. However, anecdotal and photographic evidence provided by the ADB for the F2 section EIA did show that otters are present within the F2 Project area, notably at the confluence of the Rikotula and Dzirula rivers. This suggests that otters may also be present within the F3 Project area.

The nearest protected area in the region is the Borjomi Nature Reserve which is located more than 15 kilometers south of the Project road. The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road.

The Project road is located within Zestaphoni and Kharagauli Municipalities within the Imereti Region. The main urban areas within the Project area include Boriti, Ubisa, Shrosha, Dzirula and Achara.

According to the most recent census data (2014), Imereti has a population of 533,906 which is a significant decrease from the 2002 census when the population was recorded as 699,666. The population of Zestafoni was 58,401 in 2014 of which the majority was classified as rural population. The population of Kharagauli was much smaller (19,473) the majority of which is also classified as rural and only 1,965 as 'urban'.

According to data provided by the RD, during the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured spread over the E-60 corridor, from km 18 to km 302 (284 km in total, from Tbilisi to Khobi) with some notable cluster locations. In other words, it means 1 collision every 16 hours, 1 person killed every 4 days and 1 person injured every 9 hours. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F3 section 115 collisions occurred, with 23 persons killed and 226 persons injured.

The social survey undertaken as part of this Project found that 11.4% of those interviewed had a very low income such as 300 GEL per month. 21% declared an income between 305 and 600 GEL, while only 3.2% reported an income between 605 and 100 GEL. The confirmation about the results can be matched with the fact that almost 20% of those interviewed declared an income derived from a pension, only 21% from a regular salary and 9.5% from an owned business.

Two educational facilities are located within the Project area. Boriti school is located adjacent to the existing road and new alignment at KM0.0. Shrosha school is located adjacent to the existing road, but more than 450 meters from the new alignment.

Viticulture is the main economic activity in the municipality of Zestaphoni providing 80% of agricultural output. Its development is supported by favorable soil-climatic conditions. Agricultural land plots cover 7,027 ha of the municipality or 46% of the whole territory. 5,159 ha out of the above-mentioned area are arable lands. 1.5% of the total area of Kharagauli municipality is used for agricultural purposes. 70.9% of this territory is occupied by pastures and 29.1% is used for ploughing and sowing, annual crops grow over 22.5% of the area, permanent plantings grow over 11.5% and perennial plants grow over 6.6% of the area. Kharagauli municipality is the leading municipality of bee-keeping in Georgia. No significant industrial activities are present within the Project area. A popular pottery / ceramics market is located adjacent to the existing road close to Shrosha.

Tourism plays an important role in the economics of the Kharagauli, with Borjomi-Kharagauli National Park and Nunisi resort being popular destinations. Zestaphoni is not considered an important or significant area for tourism and recreation. A recent study of foreign visitors to Imereti region indicated that less than 2% of the visitors visited Zestafoni for recreation or vacation.

The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed onto the E-60 in Zestafoni, and these roads vary in condition from good to very poor. The main line from Tbilisi to Batumi runs close to the Project road (within 200 m) from around KM 11.4 until the end of the road. The Project road crosses the rail line once at KM 12.0. Georgian Railways own and operate the rail services in Georgia. There are two live lines on the route within the Project area, one on a higher elevation and one on a lower elevation. The line on the higher elevation operates 4 trips per day, the lower line accommodates approximately 40 journeys per day.

Previously there was a landfill site in Zestafoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m³/year of waste. However, the Solid Waste Management Company of Georgia closed the Zestaphoni municipal landfill in 2016 due to

the fact that it was overloaded. Kharagauli Municipality previously used Boriti landfill located in Boriti Village. The landfill was put into operation in 2005 but is currently closed. As such there appears to be no landfill within the Project area for hazardous and non-hazardous waste.

Within the Project area a number of physical cultural resources (PCR) have been identified including St Georges Monastery in Ubisa. None of the identified PCR, including the monastery is within close proximity of the Project road itself, with the exception a religious monument located at KM0.5 within 20 meters of the new alignment, close to Bridge BRI 3.1.02-TA.

Vibration values in the Project area are currently too low to cause any structural or cosmetic damage and/or cause nuisance of the residents. According to the national standard the values are ranked as weak and non-perceptible. The results of the ambient noise monitoring show that the noise levels next to the existing road are currently elevated above IFC and national standards in all but one out of the thirteen samples. In addition, a noise model of the baseline noise levels was also prepared. The model shows that ambient noise levels are generally above IFC standards, with only nine of the fifty modeled receptors being below the standards.

6. Impact Identification

The following provides a summary of the potential impacts associated with the roads:

Design / Preconstruction Phase

Air Quality – lack of foresight in the siting of construction camps, rock crushing plants and concrete batching plants in the pre-construction phase could lead to significant air quality impacts in the construction phase, especially to sensitive receptors.

Soils – Productive soils can also be impacted without due consideration of their value when locating access roads, camps, plant, etc. Soil erosion can also occur on embankments and around structures if adequate consideration of this issue is not taken into account in the design phase.

Three petrol stations were noted within the Project corridor. All of these petrol stations will need to be demolished to make way for the new alignment. Two of the petrol stations are located beneath the new alignment below bridges and as such structural demolition will be limited to above ground structures thereby eliminating the requirement for any significant excavation of soils and the removal of any underground storage tanks (UST). Any above ground storage tanks (AST) will need to be removed as hazardous waste. Partial excavation of soils from the area around the petrol stations will be required to construct bridge piers. The remaining petrol station will need to be demolished in its entirety and it is likely that any AST/UST at this site will need to be removed. Contaminated soils and water may be encountered around fuel dispensers, piping, and tanks during excavation. Depending on the type and concentration of contaminants present, small quantities of soils or liquids may need to be managed as a hazardous waste.

Landslides - Generally, the landslides do not affect continuously the project alignment, except for two mass movements that have been identified at around KM1.4 to KM1.6 and at KM6.4. The first identified landslide area at TUN 3.0.01-TA/AT resulted in the realignment of the tunnel in order to have its western portals outside the landslide area. The second smaller landslide affects the western abutments of BRI 3.1.06-TA/AT and the eastern portals of TUN 3.0.05-TA/AT. The Bridge piers will be constructed on piles that will eliminate impacts to the

bridge, while the tunnel portal will be strengthened for a distance of 6 meters to ensure the landslide does not affect the tunnel.

Seismicity - The Detailed Design Consultants have experience of designing roads in seismically active areas and have ensured that all designs are compliant with the relevant seismic standards of Georgia.

Land Use - As the road involves construction of an almost entirely new alignment land acquisition and resettlement could be anticipated to be extensive. However, the approach to design the road bypassing most residential areas and the construction of numerous tunnels reduces the level of resettlement and compensation that would otherwise be expected if the existing alignment was being upgraded.

Hydrology - During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges. Accordingly, failure of structures is not anticipated.

Health safety – Failure to incorporate a full range of safety measures into the road design may result in accidents and even deaths on the road, especially close to schools.

Construction Phase

Air Quality - During construction of the road, air quality may be degraded by a range of operational activities including; exhaust emissions from construction machinery; open burning of waste materials; and dust generated from haul roads, unpaved roads, exposed soils, material stock-piles, etc. This can lead to health impacts to locals and impacts to ecology and crops.

Soils - Potential soil contamination is a possibility in the construction phase resulting from poorly managed fuels, oils and other hazardous liquids used during the project works. It is also possible, that without adequate protection measures soil erosion could occur on road and bridge embankments.

Surface Water – Impacts to surface water and groundwater could occur through improper operation of construction camps, asphalt plants, etc. Poor construction management around bridges and close to surface watercourses could also lead to pollution incidents. Without due care temporary drainage structures may also fail, or get obstructed with construction debris, leading to flooding of property and access roads. Technical water may be sourced from the Dzirula river. The required amount, potentially 200 m³ per day (0.002 m³/s) is insignificant given the flow rates of this major river.

Groundwater – Impacts to groundwater include spills and leaks of hazardous liquids used at construction sites and camps and potential impacts to groundwater resources during tunnel construction (discussed in more detail below).

Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the ecology of rivers and aquatic wildlife.

Flora & State Forest Fund – A number of trees will need to be cut within the Project area, both on private land and within State Forest Fund areas. In addition, other trees (potentially including Georgian red-listed species) are located adjacent to the boundary of the site and may be damaged accidentally by construction works. A total of 9,709 trees greater than 8cm in diameter have been identified in State Forest Fund areas. Of these, 657 are Georgian

Red-listed species. The trees cut in these areas will need to follow the procedures for de-listing, cutting and removal as described below. Trees that will be cut located on private land will require compensation to be paid to the landowners. The compensation will be made according to the Project LARP.

51. Biodiversity – A range of Project related activities may have negative impacts upon fauna in the Project area, including site clearance, pollution and waste generation, light pollution and a lack of regulation. These activities may degrade habitat and impact significantly upon wildlife in the Project area. Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife. □ Impacts to habitat were unavoidable given the constraints of the Project corridor and the need to design a safe road to a modern standard. It is estimated that approximately 33 hectares can be classified as natural habitat within the Project buffer – all of the land in this area will be cleared for construction works. Almost all of these areas comprise the State Forest Fund areas that will be de-listed as per the national requirements outlined in this report. Approximately 19 hectares of SFF will be de-listed, including 9,709 trees over 8cm in diameter.

Protected Areas - The nearest protected area, Borjomi Nature Reserve, is located more than 15 kilometers south of the road and will not be impacted by Project works.

Infrastructure - The main impacts resulting from Project works will be road diversions and some temporary blocking of access routes. However, the road has been designed in a way so that it has relatively little impact upon the existing road, or other local roads due to the fact that it is a new alignment often passing through tunnels and over bridges. In some locations road closure will be needed and may occur for periods between one and two hours and as such is not a significant issue as long as the local population are given notice of the delays and suitable detours are provided. The new alignment also crosses above and adjacent to the existing railway line at a couple of locations. The bridge works above the railway line at KM12.0 may cause specific issues due to its close proximity to railway.

Utilities - Medium and low voltage power lines, water supply and gas pipes are located within the Project corridor. It is possible that these utilities will need to be temporarily removed during construction.

Waste - Road construction will inevitably generate solid and liquid waste products including inert waste (e.g. concrete, wood, plastics, etc.) and hazardous waste (e.g. waste oils, batteries, etc.). In addition, uncontrolled discharges of sewage and 'grey water' (e.g. from washrooms and canteens) from construction sites and worker's camps may also cause odors and pollute local water resources.

Tunnel & Embankment Spoil Material - A large volume of spoil material will be generated from the tunneling works. Estimates provided by the Detailed Design Consultant indicate that as around 1,510,000 m³ of spoil material will be generated from the tunnels, 278,000 m³ from tunnel portals, 400,000 m³ from local roads / interchanges / bridges and 1,247,000 m³ from cut in side slopes. Where practical the spoil will be re-used as embankment material at the Project site. Estimates indicate that approximately 516,000 m³ can be re-used as embankment material, which would leave approximately 2,919,000 m³ as static balance.

The average journey distance to transport the spoil material from tunnels to the embankment areas may be around 5 kilometers. To transport material to the embankment areas approximately 28,000 return truck journeys will be required (based on 12m³ of material in each truck), or an average of 31 a day over the 30 month construction period.

Construction Camps - Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities.

Tunnel Construction - The main typical environmental problems linked to the construction of underground works are; a) Triggering of surface settlements, structures collapses and slope instabilities, b) Drying up of springs and groundwater alterations, c) Storage and use of excavated materials, d) Noise, e) Vibrations, f) Pollution of groundwater, mainly after the realization of stabilization works by injections.

Community Health and Safety – Construction activities may result in an increase in road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles. There will also be short term impacts to noise and air quality, which may impact upon health. Migrant workers may also increase community health and safety risks, for example, through the spread of sexually transmitted diseases.

Occupational Health and Safety - Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions.

Landscape - The Project Area largely consists of valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations. The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, and storing of material in stockpiles and dumping at the waste disposal areas. The elevated interchanges and retaining walls in some sections may also have an aesthetic impact.

Physical and Cultural Resources - No physical cultural resources have been identified within the Project corridor that are likely to be significantly impacted by Project works with the exception of the religious monument located at KM0.2.

Noise - The potential noise related issue during construction of the project is disturbance to sensitive receptors in the Project area. The main sources of noise and vibration during construction of the project included; a) Construction machinery, b) Drilling activities, c) Haulage and general vehicle movements, d) Concrete mixing and aggregate production systems; and e) Construction Camps / Ancillary Facilities.

Vibration - Vibration from the construction activities is a cause for concern to the community. The effects of vibration varies and depends on the magnitude of the vibration source, the particular ground conditions between the source and receiver, presence of rocks or other large structures in the area. The intensity, duration, frequency and number of occurrences of a vibration all play an important role in both the annoyance levels caused and the strains induced in structures. It is possible that construction works will impact upon structures within the Project area, potentially causing cosmetic damage.

Operational Phase

Air Quality – The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_x; hydrocarbons (HC); SO₂; carbon dioxide (CO₂); and particulate matter (PM). An air dispersion model was prepared for this EIA to assess the potential operational impacts of the road on air quality in the future. The

analysis of the impact on operational phase air quality determined by the traffic on the new road suggests that there are no negative impacts on the environment.

Climate Change - The climate risk and vulnerability assessment classified portions of the Project according to the risk of them being affected by climate change. Bridges, tunnels, cut sections and drainage structures were deemed to be at high and moderate risk from climate change. Road surface, road embankments, road base and interchanges were deemed to be at low risk from climate change. All of the items identified have been assessed by the Detailed Design Consultant and none of the issues identified are considered to represent a significant risk given the design measures already included as part of the Project.

Hydrology – In rare circumstances there could be a major spill of oil / fuel from tanker trucks. Such spills could impact significantly on the Dzirula and Rikotula rivers given the proximity of the road to these surface water courses in many locations along the alignment. Drainage of run-off from bridge decks could flow directly to the rivers if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

Employment and Businesses - Although the existing road will remain open for almost its entire extent and interchanges will be constructed to access the existing road from the new alignment, it is likely that a number of roadside market traders will be impacted by the reduced traffic levels on the existing road, including the pottery and ceramics traders around Shrosha.

After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations.

Health and safety – Rehabilitation of the road will result in numerous beneficial health and safety impacts, including; reduced dust levels, faster emergency response times; improved pedestrian crossing facilities and improved road geometry. However, higher speeds on the road could give rise to more traffic accidents, especially as speeds increase along with vehicle numbers.

Visual Impact - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go some way to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.

Noise – A noise model developed for the EIA shows that there are many locations where IFC guideline limits for daytime and nighttime noise would be exceeded in 2037 given the predicted increase in traffic over this period. There are also many locations where the predicted noise is more than 3 decibels above the modeled ambient. The model also shows that noise abatement, in the form of a 4 meter high solid noise barrier can reduce noise levels, but in some instances, even with the noise barrier the road noise still exceeds IFC guideline limits.

Vibration - Highway traffic is not likely to have any measurable impact on the structures or on comfort.

Induced Impacts – It is possible that construction of the new road could induce development along the corridor to some extent, but in general the purpose of the Project is to improve the

existing E-60 corridor to provide safer and quicker journey times which will help facilitate the movement of people and goods locally and regionally. It is considered unlikely that significant new commercial, industrial or residential developments would arise along this portion of the corridor as a result of the Project that in turn may lead to; a) conversion of agricultural land, b) Increased population living within the corridor which may lead to stress on social services, such as schools, hospitals, etc, b) Required upgrading or expansion of utilities, such as electricity supply, and c) Stresses on water availability, specifically groundwater. It is also noted that the Project does not increase accessibility to forests.

7. Mitigation and Management Actions

The summary mitigation measures for the potential impacts identified above for the Roads include:

Design / Preconstruction Phase

Site Specific Environmental Management Plan – To ensure that all of the potential mitigation measures are applied during the construction phase, the Contractor shall be responsible in the pre-construction phase for the preparation of his Specific Environmental Management Plans (SEMP). The SEMP will also include the following plans:

- Topic Specific Plans:
 - Waste Management Plan.
 - Spoil Disposal Plan for Arrangement of Spoil Disposal Area.
 - Re-cultivation Plan.
 - Traffic Management Plan.
 - Occupational Health and Safety Plan.
 - Emergency Response Plan.
 - Air Quality Plan.
 - Spill Response Plan.
 - Vibration Monitoring Plan.
 - Clearance, Re-vegetation and Restoration Management□Plan.
 - Groundwater Management Plan.
 - Tunnel Blasting Plan.
 - Noise Management Plan.
 - Biodiversity Management Plan.
- Site Specific Plans:
 - Construction Camp Plan.
 - Asphalt Plant Plan.
 - Rock Crushing Plant Plan.
 - Concrete Batching Plant Plan.

The Construction Supervision Consultant (forthwith known as the 'Engineer') shall be responsible for reviewing and approving the SEMP and its associated plans.

Permits – The Contractor shall be responsible for obtaining all of the required environmental permits prior to the start of construction. All permits will be reviewed by the Engineer before construction work commences.

Siting of Facilities – Locations for rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, MoEPA and the RD during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan

(TMP). To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc).

Air Quality - To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan.

Soils – Removal operations of any USTs, ASTs, and connected piping should include the procedures recommended in this EIA by the World Bank Group including removal of any hazardous waste for disposal at a licensed facility.

Bridge Design - The bridge designs considered where possible, to avoid placing bridge piers in rivers. However, it is important to point out that the Project road is located in a complicated orography (a narrow valley with a central river) and that the geometric standards of the route have imposed strong constraints that oblige to pass over the river, to have no greater environmental impact on forests or populated areas. Bridge designs will ensure that drainage from bridge decks over 50 meters do not discharge directly to the watercourses beneath the bridges. Discharge waters will lead to an oil/grease interceptor tank or filter pond adjacent to the bridge in order to trap oil and grease run-off. In addition, the bridge design and layout must be aesthetically pleasing and in harmony with the existing environment.

Drainage Design - Consideration in the design phase has to be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed or in those areas identified as flood prone by the Project FS. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges.

It is also strongly recommended that the Road Department (RD) considers including the use of oil separators within the road drainage system to capture any spills of oil / fuel and also to filter hydrocarbon run-off from the road in general.

General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. If any of these trees are identified the contractor will be required to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

Cutting of Trees – Cutting of trees can be addressed under two headings:

- Private Land - Compensation shall be paid to all affected tree owners as per the Project LARP.
- State Forest Fund (SFF) – An inventory of the species to be de-listed has been prepared as part of this EIA. The RD is responsible for supplying this information to the National Forest Agency in writing in order to complete the de-listing process. The RD shall also apply to the Ministry of Environmental Protection and Agriculture (MoEPA) in writing regarding the identified Red-List species in the project area so that they may also be de-listed from the SFF. Compensation payments for the tree cutting in SFF areas will be paid to the Government by the RD according to Government of Georgia (GoG) regulations prior

to any tree cutting. No compensation in the form of re-planting is required under this resolution unless specified by the MoEPA in the Conclusion of Ecological Expertise.

Biodiversity – Prior to any land clearing activities, bridge works, or works in tunnels, site surveys shall be undertaken by national specialists to determine the presence of any species that may be impacted in these areas including bats, birds, otters, squirrels, herpetofauna and turtles. Management plans for identified species noted in the area will be prepared by the Contractors specialists and implemented prior to the start of any land clearing / construction works.

As noted above, 9,709 trees over 8cm in diameter will be de-listed and felled in SFF areas. Tree replanting on a basis of 1:3 should be undertaken, meaning that 30,000 seedlings will be replanted as part of the Project. The Contractor will coordinate with MoEPA and the National Forest Agency to identify a site, or sites, within the Project area where the trees can be re-planted (including the spoil disposal site in Boriti). Where practical trees should be replanted as close to their original location as possible as a 'restoration' measure. The Contractor shall also coordinate with MoEPA and the National Forest Agency to determine the composition of species to be replanted and to ensure they include the Georgian Red-list species identified in the SFF inventory. The Contractor shall include this information as part of his Clearance, Re-vegetation and Restoration Management Plan. The plan shall clearly identify the approved locations for tree-replanting and restoration, the species and numbers to re-plant and the schedule for re-planting and maintenance. The plan will be submitted to MoEPA and the National Forest Agency for comment before submission to the Engineer for approval.

Infrastructure - A road condition survey will also be conducted by the Engineer prior to construction in order to gauge the damage to the road as a result of the intensive heavy traffic. Before completion of the Project the Engineer shall repeat the survey to determine which, if any roads need to be repaired by the Contractor. The Contractor will also submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his Specific Environmental Management Plan (SEMP).

Waste Management – The Contractor shall prepare and submit a waste management plan outlining measures to manage and disposal of all waste streams, including hazardous waste and methods for recycling waste. The plan will clearly identify how and where hazardous wastes will be disposed of.

Spoil Disposal – The responsibility for identifying the final disposal areas for tunnel and embankment spoil material lies with the Contractor. However, initial assessment of this issue has been undertaken for this EIA and environmental screening of several potential spoil disposal sites have been undertaken. Two sites, one close to Boriti, and one close to the new market area have fewer significant environmental and social impacts and it is possible that the spoil material could be placed in these locations. If the Contractor chooses to use this location, or another, he will be responsible for the preparation of a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan. This plan shall be prepared in accordance with regulation N 424 on Approval the Rules for Removal, Storage and Use of Topsoil and Re-cultivation. The Contractor will also complete an EIA for this location to satisfy the national EIA regulations. All relevant permits will be needed before any spoil can be placed in the identified area. The Plans will also be provided to the RD and the Engineer as part of his SEMP. No spoil storage will be allowed until the RD and the Engineer have approved the plan.

Tunnels – The Contractor will develop a ground water management plan for each tunnel under which shall be submitted for approval by the Engineer at least four weeks prior to the

start of tunnelling works. The plan shall include routine monitoring of the groundwater levels in wells against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating.

Emergency Response - The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to; a) Containment of hazardous materials, b) Oil and fuel spills, c) Fire, gas leaks and explosions, d) Work-site accidents; and e) Earthquake and other natural hazards.

Loss of Land, Property and Livelihoods - The Employer must prepare the LARP. Then, the Employer will implement the plan and acquire the land before the commencement of the construction works at any part of the site. As part of the Project a new road side market area will be constructed. The new market area, located between bridges BRI-3.0.07 AT/TA and BRI-3.0.08 AT/TA, has been created for market stall holders along the existing alignment to relocate to this area, including the pottery and ceramics traders at Shrosha.

Noise - Correct siting of construction camps and ancillary facilities will reduce the potential for elevated noise levels to affect sensitive receptors. Locating these facilities more than 500 meters downwind of sensitive receptors will limit potential noise impacts. In addition to the above, prior to the start of construction, and as part of his SEMP, the Contractor will develop a noise management plan.

Vibration - The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule. The TBP shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel and will include the results of all of the surveys undertaken. The TBP will also include a vibration monitoring plan to monitoring vibration levels and frequency around the blasting sites.

Construction Phase

Air Quality - Proper control, siting and maintenance of equipment, including concrete batching plants, shall mitigate emissions impacts. Spraying of roads with water during dry periods and covering of friable materials will also help prevent dust impacts.

Soils – Standard measures are outlined within the EMP to reduce the impacts of potential spills and leaks. They include storing hazardous liquids in special storage areas within concrete bunds and the provision on spill kits in these areas. Erosion control measures and measures to preserve topsoil are also recommended within the EMP.

Surface water – Proper design, siting and management of facilities (including construction camps and concrete batching plants) will help reduce impacts to water quality. Accidental spills could occur and provisions are recommended in the EMP to manage such accidents. Temporary drainage in villages will be kept clear of construction debris to prevent flooding at work sites.

Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. Should any operation being performed by the Contractor interrupt existing irrigation systems, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor.

The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

Biodiversity – Specific mitigation measures have been prepared for International Union for Conservation of Nature (IUCN) and Georgian Re-list species identified as part of this report. In addition, a range of general mitigation measures have been prepared to limit impacts to fauna, including for example, prohibiting hunting and poaching.

Regarding tree re-planting, plant maintenance will be carried out for at least two years in the plantation areas. The Contractor will be responsible for the maintenance of these areas. If the maintenance period extends after the completion of the Contractors contract period the RD will be responsible for contracting an operator to maintain the trees for the remaining period. During the Construction phase the Engineer will undertake monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% the Contractor will re-plant on a 1:1 basis to compensate for losses. The Contractor will be responsible for paying for any compensational re-planting.

Protected Areas - No construction activities, including camps, haul routes, etc. will be allowed within, or through protected areas, or reserves.

Landscape – The following mitigation measures are proposed to reduce the visual impact of the Project; a) minimize disturbance to, or movement of, soil and vegetation; b) undertake landscaping after the completion of the activities to match in with surrounding landscape; □and c) Reinstatement vegetation.

Infrastructure - To mitigate the potential impacts the Contractor will submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP. The Contractor will also provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions and allow for adequate traffic flow around construction areas via diversions or temporary access roads. To prevent potential environmental, health and safety issues arising whilst working in the area above the railway line at KM12.0, the Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in these areas.

Utilities - During construction all utilities in the Project area shall be kept operational, particularly during the winter months.

Waste Management - The Contractor will be responsible for the safe collection and removal of all waste materials from his site. Accordingly, he shall prepare contracts with a suitably licensed waste management contractor for the removal of inert and hazardous wastes from his sites. The Contractor as proof of the shipment of these wastes shall also keep waste manifests.

Asphalt Plants, Concrete Batching Plants and Construction Camps – The EMP provides a range of detailed mitigation and management measures for these facilities. All of these measures are based on international best practice.

Bridge Construction – A range of measures are provided in the EIA to prevent impacts occurring at bridge construction site including for example; ensuring no waste materials are dumped in the river, including re-enforced concrete debris, ensuring that no hazardous liquids are placed within ten meters of the river, providing portable toilets at bridge construction sites to prevent defecation by workers into the river and provision of areas

where concrete mixers can wash out leftover concrete in the form of a lined settling pond at each bridge site. In addition, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to confirm the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period.

Tunnels - Routine monitoring of the groundwater levels in wells in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel under excavation. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the groundwater levels are recharged. The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase. The Contractor shall continue to monitor the water levels in the affected wells for a period of two months after construction is completed. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to recharge to pre-construction levels new boreholes, or alternative sources of water supply will be provided for the affected persons.

Blasting - The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it. In addition, no blasting will be carried out within 100 m of the portal of the tunnel, blasting will be scheduled during the day only and local communities will be informed of blasting timetable in advance.

Community Health and Safety – The Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period. The monthly meetings will be held in the villages along the alignment and will provide a forum for locals to discuss specific issues, such as noise and dust, with the Contractor before making complaints formal through the Grievance Redress Mechanism.

Occupational Health and Safety - Health and safety plans, training and HIV/AIDS and vector borne disease awareness programs will be provided by the Contractor. The Contractor shall also be responsible for providing adequate Personal Protective Equipment for all workers, including sub-contractors and site visitors. If groundwater is to be used as potable water it will be tested weekly to ensure that the water quality meets the GoG drinking water standards.

Physical and Cultural Resources - The cemetery identified close to the Project road is unlikely to be impacted by construction works, however, it is required that during the construction phase the northern boundary of the religious monument be fenced off to ensure that there is no encroachment into this area by construction workers or equipment. In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines.

Noise & Vibration – The Contractor will be responsible for implementing the range of good practice measures outlined in this EIA and its EMP to limit construction noise impacts, including time and activity constraints. Specific measures have been proposed in this EIA to manage vibration issues during the construction phase, they include building surveys,

consultations, real time monitoring, defining damage risk zones, and temporary relocation of affected people.

Operational Phase

Noise – The following mitigation measures are proposed for the Project:

- Noise Barriers – construction of four sections of 4 meter high noise barrier approximately 2400 meters long.
- Routine Noise Monitoring – Monitoring of identified Receptors should be undertaken on an annual basis to determine actual noise levels at these locations. If noise levels are above IFC limits, the RD shall consult with the effected owners to determine a suitable mitigation measures including for example; installation of sound proof windows in properties.

Climate Change – Although no significant risks have been identified, the Detailed Design Consultant shall ensure the items outlined in this report are included in the "Recommendations for the management of the highway" document.

Hydrology - During the operational phase of the Project, the RD will be responsible for monitoring drainage along the road to ensure that it does result in increased run-off and flooding. The RD will be responsible for rectifying this issue if it occurs.

Groundwater - The Contractor shall continue to monitor the water levels in any affected ground water wells for a period of 12 months after construction is completed at the tunnel sites. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties, this may include for example, increasing the depth of their wells, or piped water from another location, which, as noted above, appears to be a fairly effective option.

8. Monitoring Actions

To ensure that all of the above mitigation actions are completed according to the requirements of this EIA, monitoring shall be undertaken of Project works by the Engineer and by independent monitoring specialists. Specifically, both observational monitoring and instrumental monitoring shall be undertaken as follows:

Instrumental Monitoring – This shall be completed by independent specialists and will include:

- Routine air quality, water quality soil sampling and noise monitoring during the construction phase; and
- Annual noise monitoring throughout the Project operational lifecycle at the receptors identified as part of the noise model.

Schedules, parameters, locations are indicated by the EMP. The Engineer shall be responsible for contracting independent monitoring specialists during the construction phase. In addition, the Contractor will be responsible for real time monitoring of vibration during the Construction phase of the Project. The RD will be responsible for operational monitoring, e.g. hiring independent monitoring specialists.

Observational Monitoring – The Contractors actions shall be continually monitored by the Engineer throughout the Projects Construction phase. This will be achieved through weekly inspections of the Contractors environmental performance and his SEMP by national and international environmental specialists engaged by the Engineer throughout the construction

period. The Engineer shall have the right to suspend works or payments if the Contractor is in violation of any of his obligations under the EMP and this EIA.

9. Consultations

Two rounds of stakeholder consultations were undertaken in the Project area. The first round of consultations helped define the scope of the EIA. The second round of consultations were then undertaken on the draft EIA. During the consultations a number of issues were raised, such as disposal of tunnel spoil material, tree cutting and replanting, access to properties during construction and identification of sites of cultural heritage.

All of the issues identified in the consultations have been included within the impact assessment portion of the EIA and where practical, measures have been proposed to reduce the significance of, or mitigate impacts. **Section I** of the Report provides details of the consultation procedures and the main comments received.

10 Conclusions

This EIA has established that in general most environmental issues can be either totally prevented or adequately mitigated to levels acceptable GoG and international standards for Project activities.

However, several residual impacts have been identified, including:

- Greenhouse Gasses - Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road.
- Surface Water Drainage - It is noted that the Project requires interceptor tanks for bridge run-off and this should also be considered for the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.
- Employment - After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project.
- Visual Impacts - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go some way to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.
- Noise - Implementation of the recommended mitigation and management measures will help to reduce noise levels at many locations. However, at some receptors noise levels may rise above IFC standards during the operational phase of the Project. Monitoring of these sites will be required on an annual basis to determine actual noise levels in these areas. Where they exceed IFC standards the RD will consult with the affected owners to determine the most acceptable noise mitigation measures, including for example noise

proof windows. There may be some vibration and noise nuisance during the construction phase of the Project, due to unforeseen events, but in general the measures outlined should ensure that all issues are suitably management and mitigated to prevent any long term significant impacts.

The total estimate costs of the environmental mitigation and management to be funded by ADB has been calculated at approximately US\$4,198,680, or approximately 1.5% of the total project cost of \$330m.

11. Implementation

The EMP, its mitigation and monitoring programs, contained herewith will be included within the Project Bidding documents for project works. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

The Bid documents state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own Specific Environmental Management Plan (SEMP) which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors construction camp locations.

The EMP and all its requirements will also be added to the Contractors Contract, thereby making implementation of the EMP a legal requirement according to the Contract. He will then prepare his SEMP which will be approved and monitored by the Engineer. Should the Engineer, through routine monitoring by his national and international environmental specialists, note any non-conformance with the SEMP the Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the SEMP the Contractor will employ a national environmental specialist to monitor and report Project activities throughout the Project Construction phase.

A grievance redress mechanism (GRM) has also been prepared as part of the Project. The GRM provides a structure for stakeholders to make complaints and a mechanism for the complaints to be resolved both locally and centrally.

A. Introduction

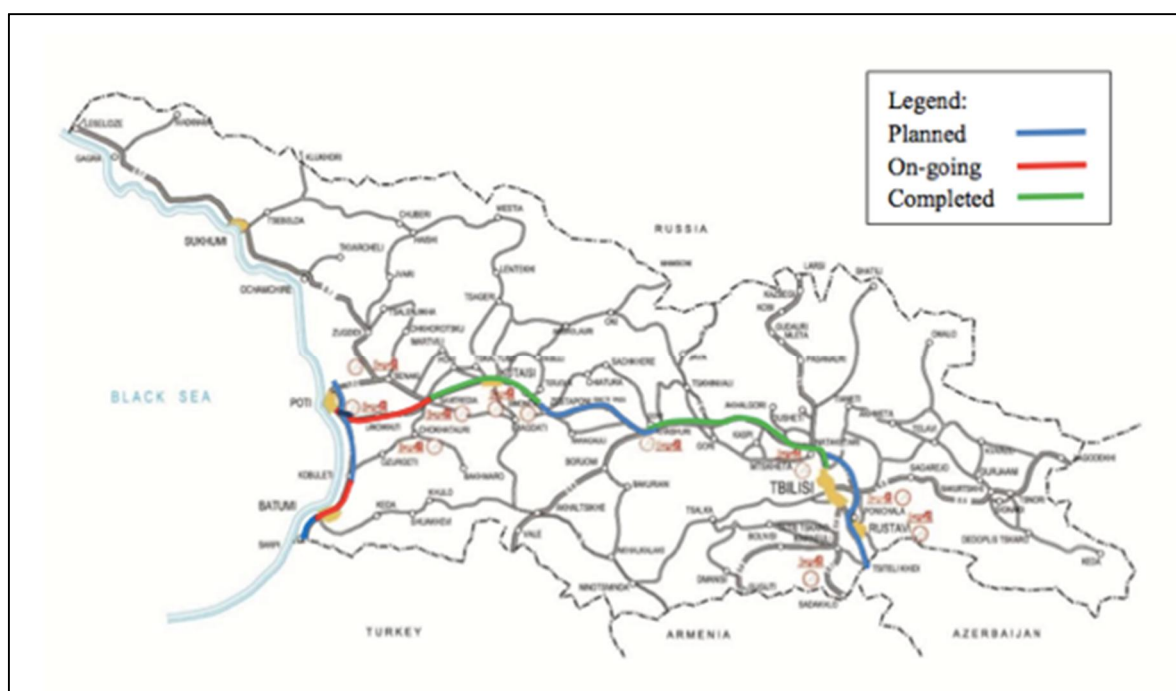
A.1 General

This section of the report; a) outlines the purpose of the EIA, b) provides a summary of the project, c) identifies the project proponent, d) describes the scope of the EIA, and C) describes the methodology used to complete the assessment.

A.2 Overview

The Government of Georgia is endeavoring to make Georgia a regional and logistics hub and more attractive for businesses. The East West Highway (EWH), stretching 410 km from Sarpi on the Black Sea, at the border with Turkey, through the center of the country to the capital Tbilisi and on to the border with Azerbaijan, is the main inter-regional and international route between western and eastern Georgia, as well as its neighboring countries. Representing about 2% of Georgia's road network and one fourth of its international roads, the EWH serves 8,000 to 10,000 vehicles per day and carries over 60% of the country's international trade. Georgia joined the Central Asia Regional Economic Cooperation (CAREC) program in October 2016. The EWH will be an integral part of one of the six key CAREC corridors providing the shortest transit link to connect Central Asia with Europe and East Asia. Figure 2 illustrates the current status of road construction and rehabilitation projects in Georgia.

Figure 2: Status of Road Construction / Rehabilitation Projects in Georgia



In light of the traffic growth on EWH, the high percentage of truck traffic, and the difficult terrain and resulting geometric profiles, capacity expansion of the current 2-lane mountainous section between Chumateleti and Argveta is crucial to realizing full potential of the EWH with improvements to the highway either completed or underway on each side of this section.

Therefore, the Government has requested the Asian Development Bank (ADB) and several other development partners, including the Japanese International Cooperation Agency (JICA) and the European Investment Bank (EIB) to finance the remaining bottleneck sections (Chumateleti - Argveta) on the EWH. A feasibility study financed under a World Bank (WB) project for the Chumateleti Argveta section (comprising four sections F1 through F4) of the EWH was completed in 2015.

Table 1: Chumateleti – Argveta Road Sections

Road Section	Location	Length (km)	Funding Agency
F1	Chumateleti-Khevi	11.10	WB
F2	Khevi-Ubisa	15.40	ADB
F3	Ubisa - Shorapani	10.50	EIB
F4	Shorapani - Argveta	15.80	JICA

The detailed design of Section F1 and F4 has been completed and selection of the construction Contractor is on-going. Detailed design of sections F2 and F3 is currently on-going. This EIA focuses on Section F3.

A.3 Purpose of the EIA report

This EIA is part of the process of compliance with the ADB Safeguard Policy Statement (2009) and EIB Statement of Environmental and Social Principles and Standards (2009) in relation to the construction of Section F3 of the new Khevi-Ubisa-Shorapani-Argveta section of the E60 Highway, or more simply, the “Project”.

The EIA provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the Project. The EIA provides a detailed description of the direct and indirect environmental effects associated with the proposed Project during key periods of work.

More specifically, the EIA:

- Describes the extent, duration and severity of the impacts;
- Describes the project design, construction activities and operational parameters;
- Analyzes all potential impacts, both positive and negative;
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP).

A.4 Category of Project

Based on the existing ADB Environmental Safeguards Policy (2009), this Project falls under ADB's project Category A. According to ADB this category is defined as “*A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.*”

EIB require the European Union (EU) EIA Directive to be followed. This Project falls within Annex 1 of the Directive which requires Environmental Impact Assessment for “*Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road or realigned and/or widened section of road would be 10 km or more in a continuous length.*”

A.5 Scope of the EIA

Scoping is the process of determining which are the most critical issues to study in the EIA and involve community participation. The scope of the EIA in hand is based upon four factors; 1) the EIA requirements of the ADB and specifically the IRD/SPEA Terms of Reference (ToR) for the Project; 2) the findings of scoping consultations; 3) the defined Project Area; and 4) other best practice guidelines, e.g. IFC EHS Guidelines / EU environmental law. The following section provides further details of each of these aspects.

A.5.1 Scoping Consultations

Scoping consultations were held in June, 2017 in Boriti. Participants in the consultations were given an overview of the proposed project and then asked what they thought may be the significant issues that would require detailed study as part of an EIA. The following summarizes the key comments received:

- How will you dispose of spoil material from tunnels?
- Roadside businesses should be protected from construction impacts, e.g. dust, restricted access.
- Cattle underpasses should be considered.
- Will all three construction lots be undertaken at the same time, or will they be phased? This could cause a lot of traffic disruption.
- Will access to properties be disrupted during construction?
- There are periods of very high flow in the river, this should be carefully considered during the detailed design to ensure that flooding does not occur.

Section I provides the full details of the scoping consultations. **Section G** discusses these potential impacts in more detail and provides mitigation measures where warranted.

A.5.2 Terms of Reference for the EIA

137. According to the ADB ToR for the Detailed Design (DD) Consultants (IRD/SPEA), the following actions are required:

1/ Based on the findings of the feasibility study, the Consultant shall identify the nature and scale of the potential environmental and social impacts of the road construction and operation and confirm that the proposed works fall under Environmental Category A as defined. The output of the Consultant's work will be an EIA report, including Environmental Management Plan (EMP). The Consultant shall review relevant sources of information to identify presence of any known archaeological sites within the road corridor.

The Consultant's assignment will comprise of the following tasks for preparation of EIA report:

- Identify sensitive environmental, social, and cultural heritage receptors within the corridor of East-West highway Khevi-Ubisa – Shorapani -Argveta, point out risks to the natural and social environment and to the cultural assets associated with the anticipated construction works in this section, and describe their nature and scope;
- Cooperate with the engineers in the process of defining exact alignment of the highway with the purpose of integrating environmental, social, and cultural heritage perspectives into the selection of the optimal route;
- Provide a set of detailed mitigation measures aimed at avoiding or decreasing expected negative impacts of construction on the natural, social, and cultural environment, and develop an environmental management plan including mitigation and monitoring plans;
- Produce an EIA report, including an environmental management plan, satisfactory to the RD and the ADB; and

- Assist the RD, as requested, during public consultations on the draft EIA report and through the process of obtaining an environmental permit from MoEPA.

2/ Key issues environmental and social issues may include:

- Describe Noise and Air emissions modeling using the traffic projections of the detailed design;
- Impacts of noise, vibration and air pollution near inhabited areas during construction and operation;
- Risks of uncovering archaeological material during excavation works;
- Risks related to temporary storage and final disposal of construction waste and excess material;
- Risks of soil degradation and erosion from cutting slopes;
- Identify the territories for spoiled soil disposal temporary and constantly storage, according to the Georgian Legislation;
- Risks of Landslide;
- Risks of ground water flows; and
- Risk of water pollution from construction near rivers and streams.

A.5.3 Best Practice

138. The World Bank Group (WBG) have prepared Environmental, Health and Safety Guidelines for a range of topics including noise, water quality, air quality, occupational health and safety, community health and safety, etc. Where relevant, the Project will include the recommendations of the WBG guidelines to ensure that the Project meets international best practice. In addition, instrumental monitoring of environmental parameters has also been assessed against EU standards for air quality, water quality and noise.

A.5.4 Structure of the Report

139. Given the findings of the scoping consultations, the recommendations of the ToR, best practices guidelines and the defined Project area the following structure will be followed:

Section A: Introduction – The section in hand provides the introductory information.

Section B: Description of the Project – Section D describes the Category of the Project, the Project need and its environmental setting. A scope of works is also provided indicating the type of engineering works required.

Section C: Analysis of Alternatives – This portion of the report provides an analysis of alternatives, including the ‘no project’ option.

Section D: Legal, Policy and Administrative Framework - This section presents an overview of the policy/legislative framework as well as the environmental assessment guidelines of GoG that apply to the proposed project. The overview is based on recent EIA reports prepared for the previous East West Highway Improvement Projects (EWHIPs).

Section E: Methodology – This portion of the report provides the methodology for completion of the EIA, including the procedures followed for monitoring, surveys, modeling, etc.

Section F: Description of the Environment – This section of the report discusses the regional and local environmental baseline conditions. This section is divided into subsections relating to:

- Physical: geology; topography; soils; climate; air quality; noise; surface water; groundwater; seismicity and natural hazards.
- Biological: flora and fauna; rare and/or endangered species (Red List species); critical habitats and ecosystems; protected areas. Particular attention shall be given to the presence of land plots registered as the State Forest Fund.
- Human: population; communities; demographics; employment and socio-economics; land use; infrastructure (including local access roads); transport; public health; cultural heritage; archaeology; waste management; tourism.

Surveys have been conducted to address important gaps in the existing data and to collect up-to-date information on topics and areas where significant negative impacts are expected, specifically, flora, fauna, noise, air quality and water quality.

Section G: Environmental Impacts and Mitigation Measures – Section F outlines the potential environmental impacts and proposes mitigation measures to manage the impacts. This has included numerical modeling of noise, vibration and air quality to assist in predicting impacts and planning mitigation in these fields.

Section H: Environmental Management Plan – This section comprises an Environmental Mitigation Plan and an Environmental Monitoring Plan.

The Environmental Mitigation Plan:

- Clearly identifies what specific potential impacts various types of works may have on the sensitive receptors;
- Provides concrete actions prescribed for managing these impacts, including location and timing of these actions;
- Provides cost estimates for the main discrete mitigation measures (those that are unlikely to be part of a construction company's corporate policy and will not necessarily be included into general pricing of the contract);
- Gives measurable criteria for identifying how adequately are the mitigation measures being applied and how effective they are; and
- Specifies responsibility for the implementation of each mitigation activity.

The Environmental Monitoring Plan:

- Lists all prescribed mitigation measures by types of construction activities;
- Provides selected criteria of monitoring implementation of mitigation measures;
- Specifies methods for measuring outcomes of applied mitigation measures (visual, instrumental, survey, etc.);
- Identifies location and timing/frequency of monitoring mitigation measures by the prescribed criteria;
- Gives cost estimates of monitoring mitigation measures by the prescribed criteria; and
- Specifies responsibility for tracking each monitoring criterion.

Section I: Public Consultation, Information Disclosure & Grievance Mechanism – Section H provides a summary of all of the stakeholder consultation activities undertaken. The section also describes the grievance redress mechanism, setting out the mechanisms for resolving complaints about environmental performance.

Section J: Conclusions and Recommendations – The final section of the report provides the report conclusions and recommendations, including a description of any residual impacts.

B. Project Description

B.1 Section Layout

This section of the EIA provides the Project description. More specifically it provides:

- Summary of the type and location of the Project, including detailed site location maps;
- Confirmation of the Project environmental category according to the ADB SPS (2009) and EIB Environmental and Social Principles and Standards (2009);
- A summary description of the need for the Project;
- The scope of work for the Project, including a description of the construction works required.

B.2 Type and Location of project

The Project is a road construction project located in Imereti Region of central Georgia. The Project road comprises Section F3 (Shorapani - Boriti) of the Khevi-Ubisa-Shorapani-Argveta Road (E-60). The length of Project road is:

- Right lane **(TA)**¹ – 13.053 km;
- Left lane **(AT)** – 13.070 km

Figure 3 indicates the location of the Project within the context of Georgia. Figure 4 to Figure 15 provide a set of twelve detailed maps of the site including locations of tunnels and bridges.

B.3 Environmental Setting

Figure 16 provides an overview of the F3 Section environmental setting.

¹ TA meaning Tbilisi – Argveta direction, AT meaning Argveta – Tbilisi direction.

Figure 3: Road Location Map



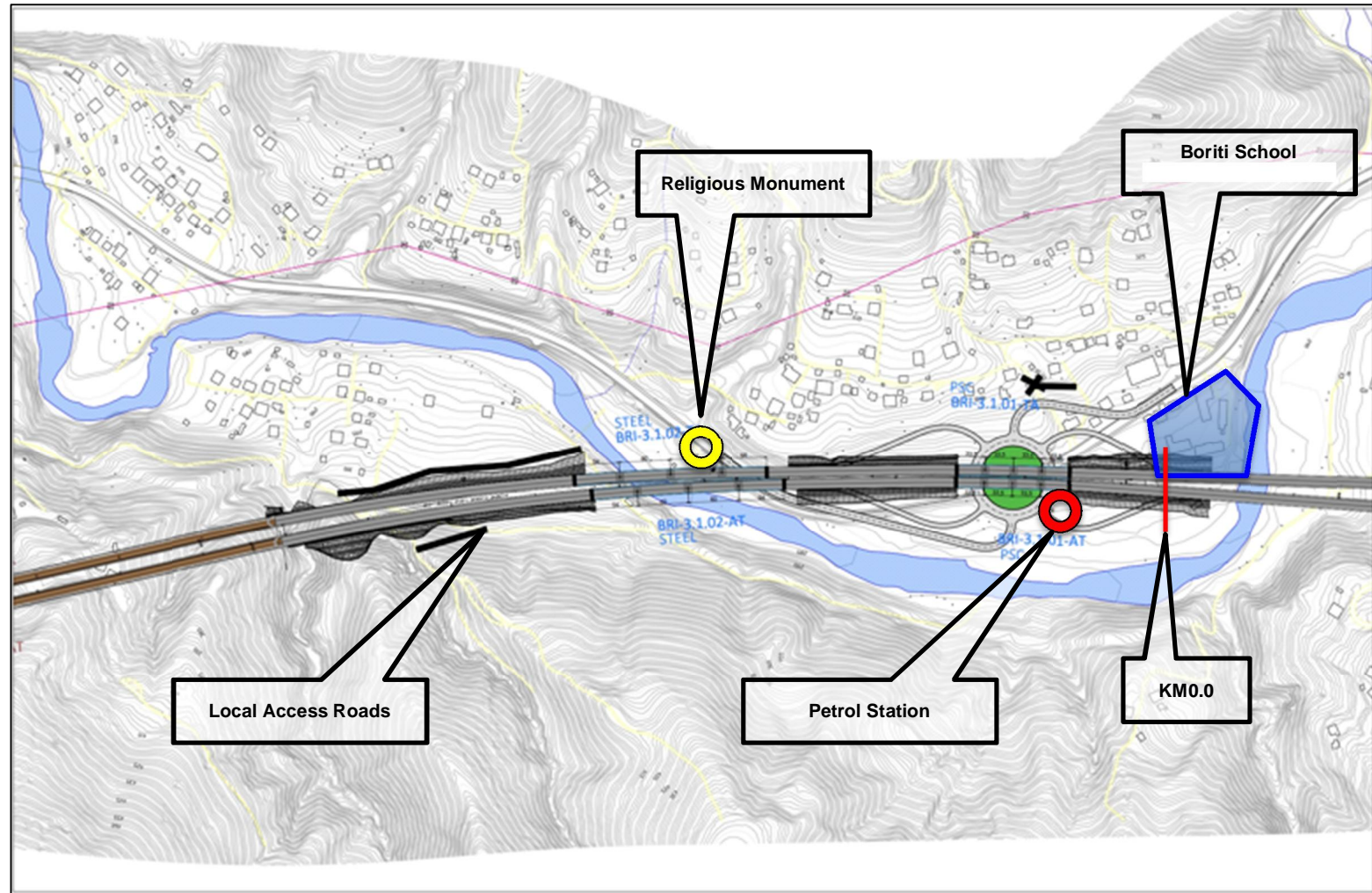


Figure 4: Project Road (KM0.0 – KM1.3)

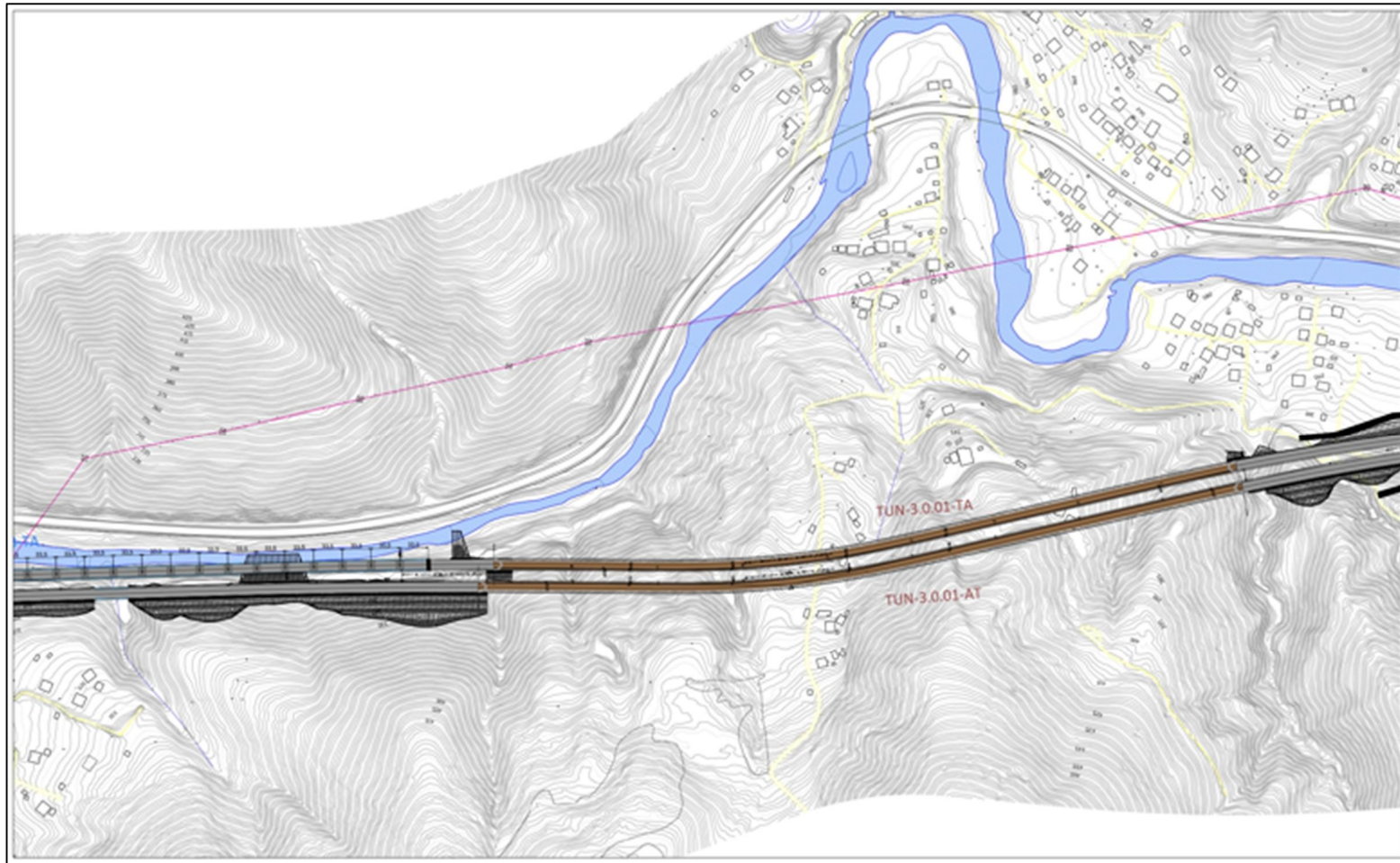


Figure 5: Project Road (KM1.3 – KM2.9)

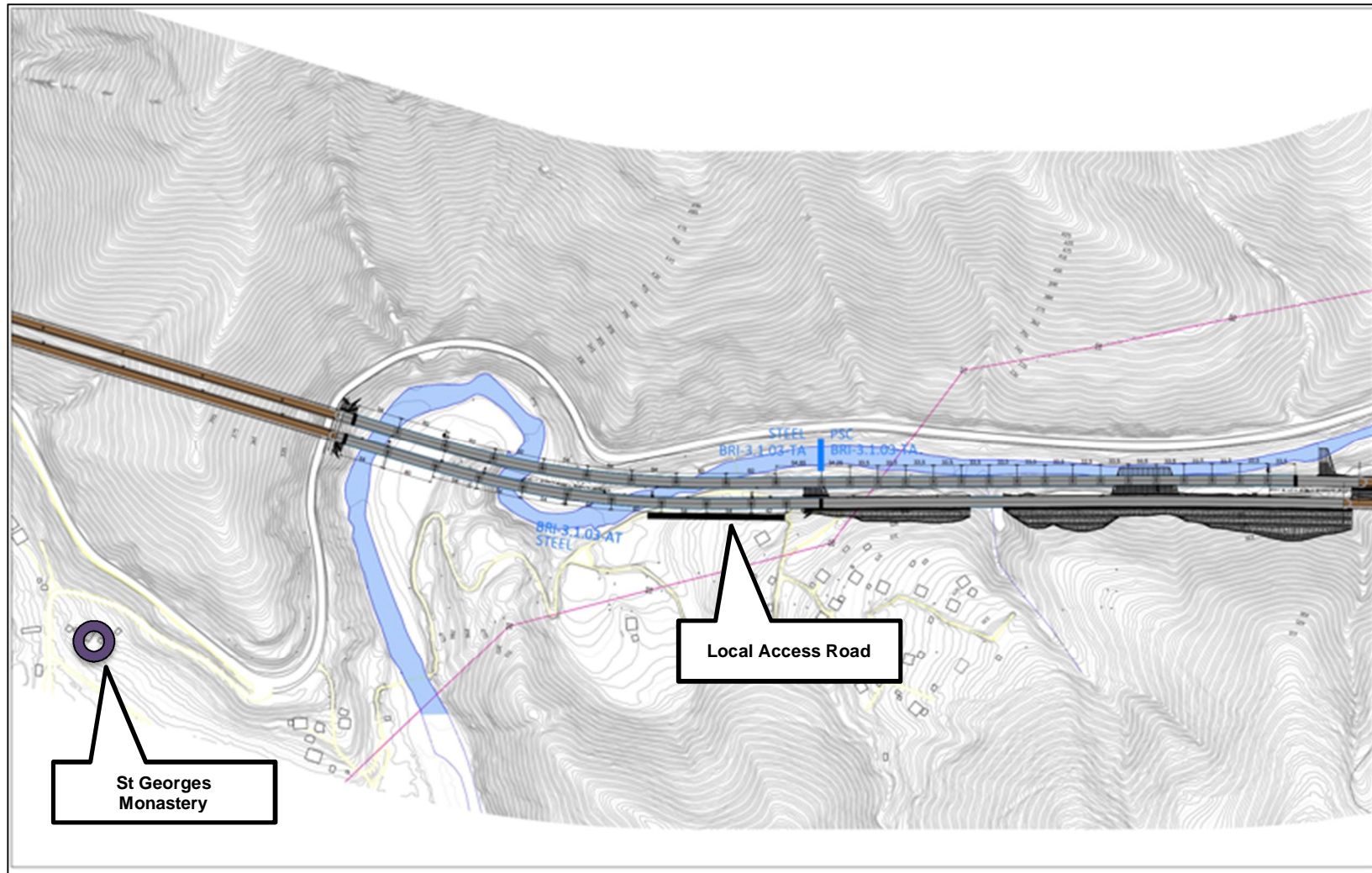


Figure 6: Project Road (KM2.9 – KM3.5)

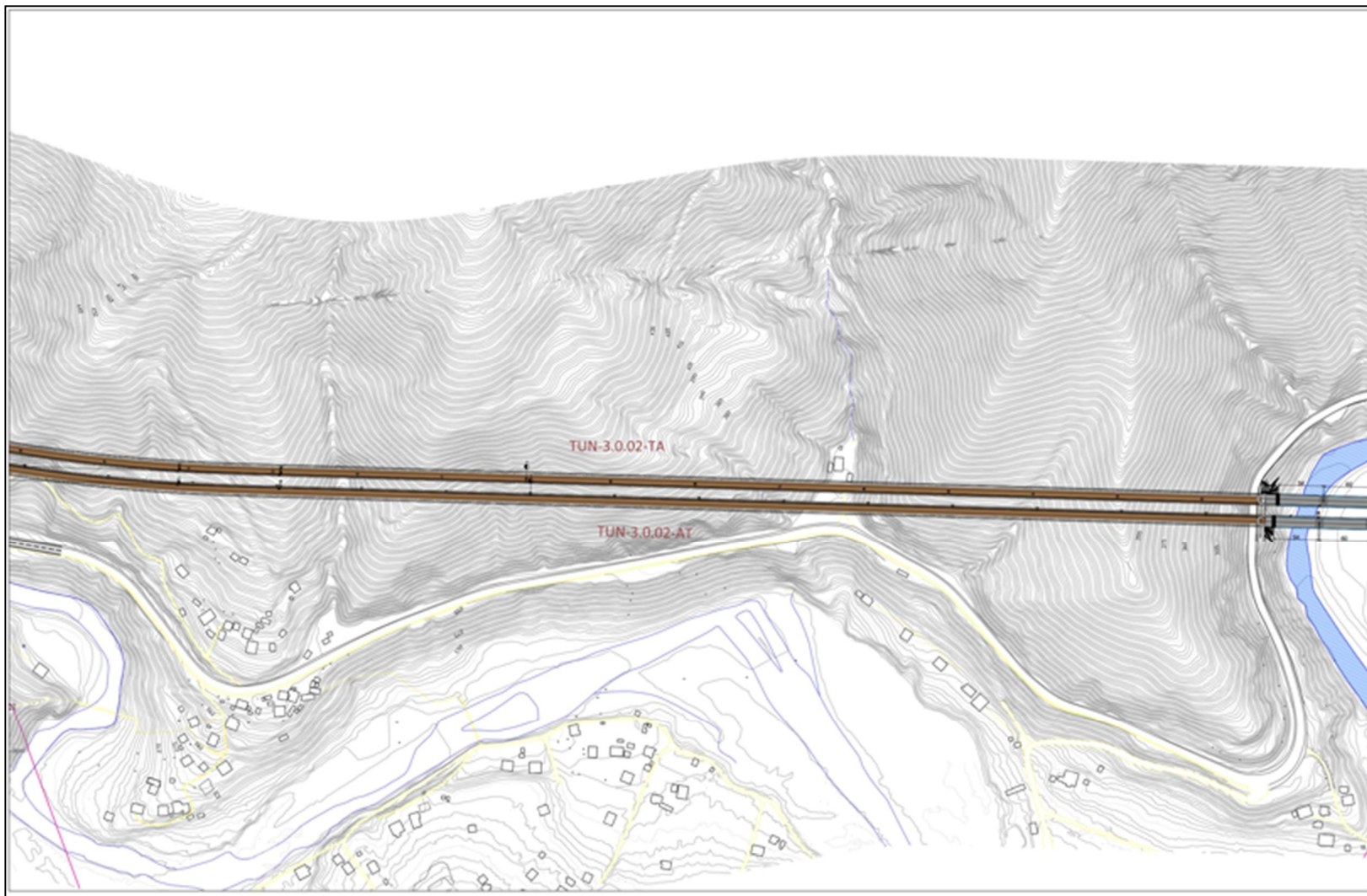


Figure 7: Project Road (KM3.5 – KM4.6)

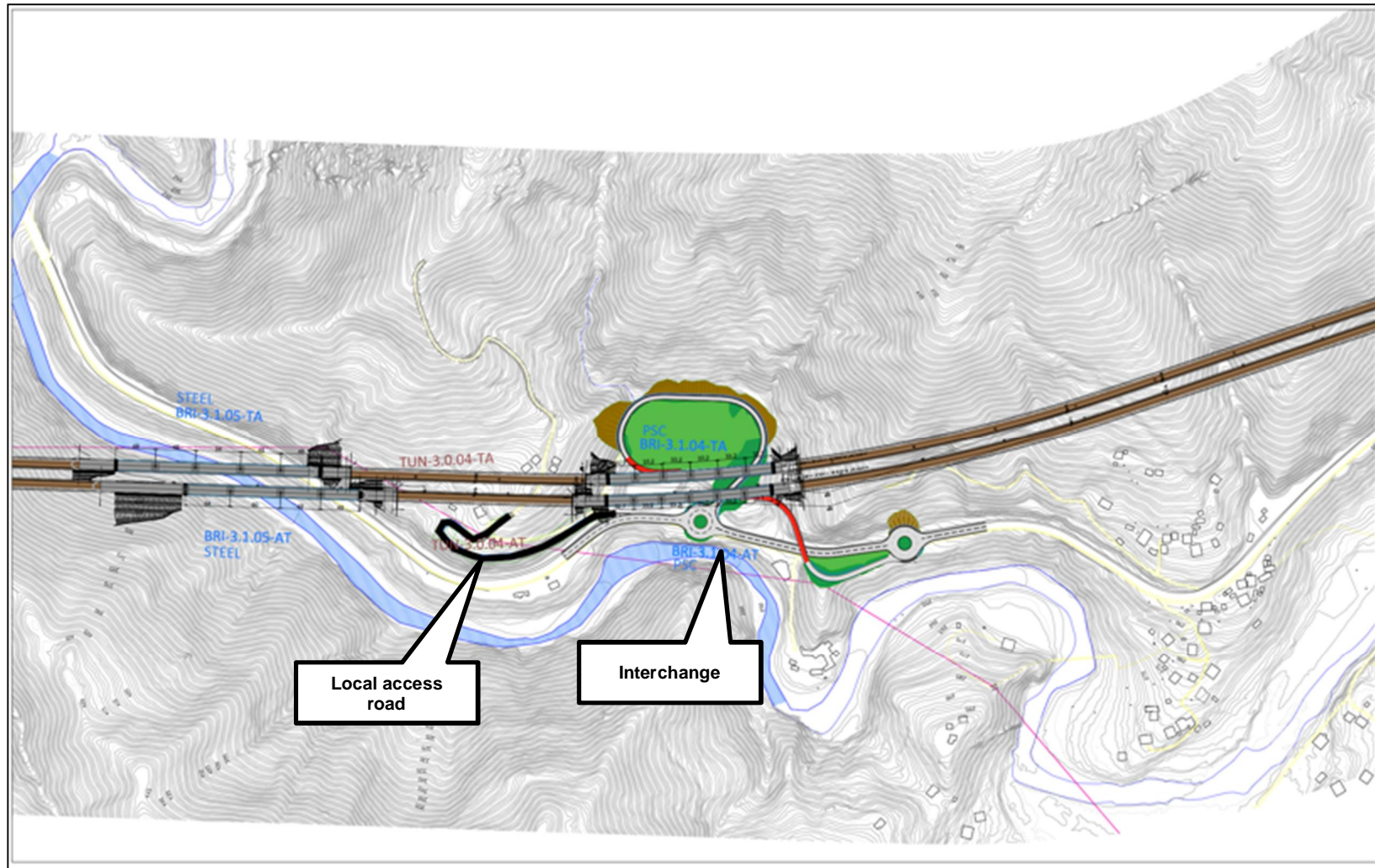


Figure 8: Project Road (KM4.6 – KM5.6)

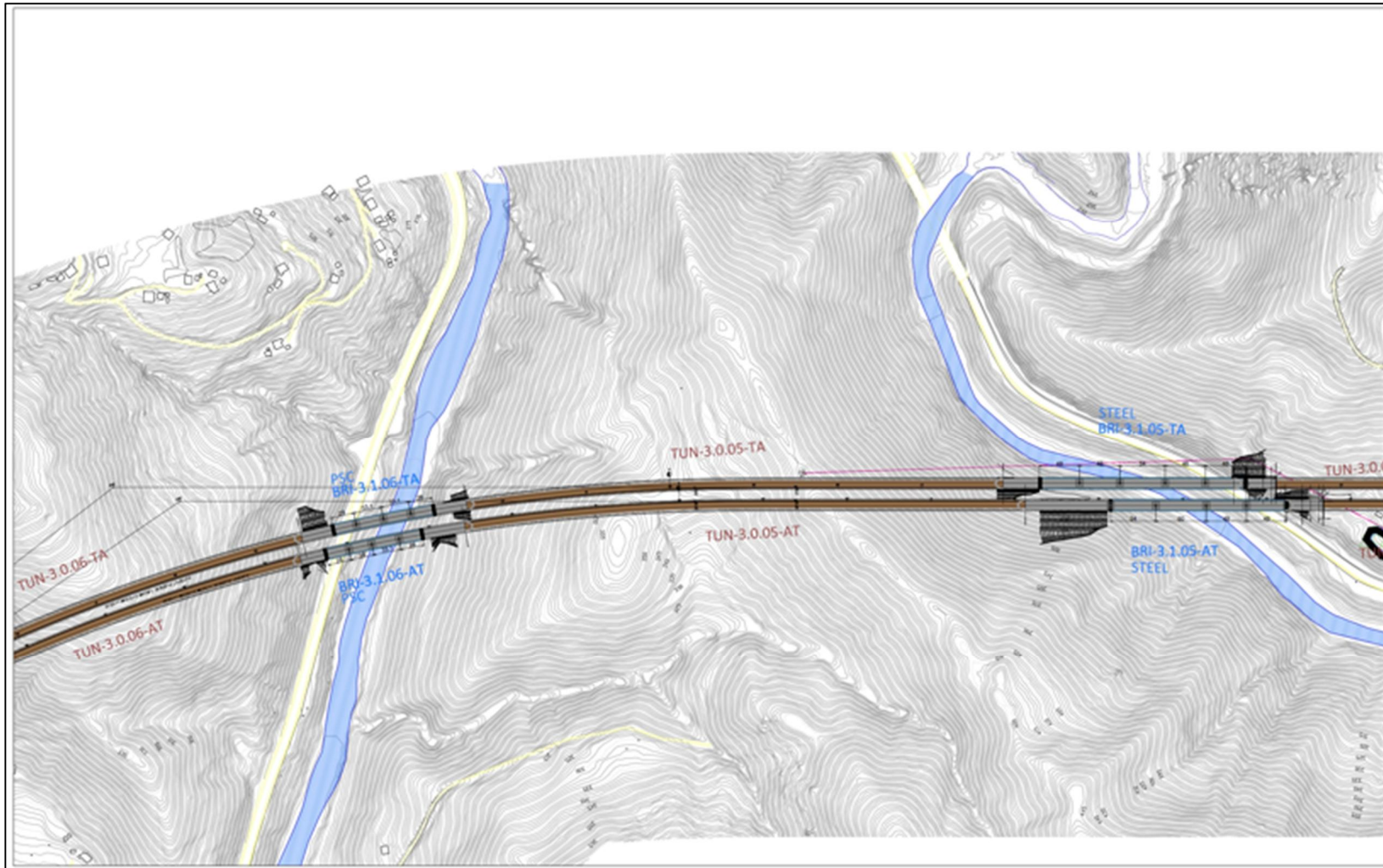


Figure 9: Project Road (KM5.6 – KM6.6)

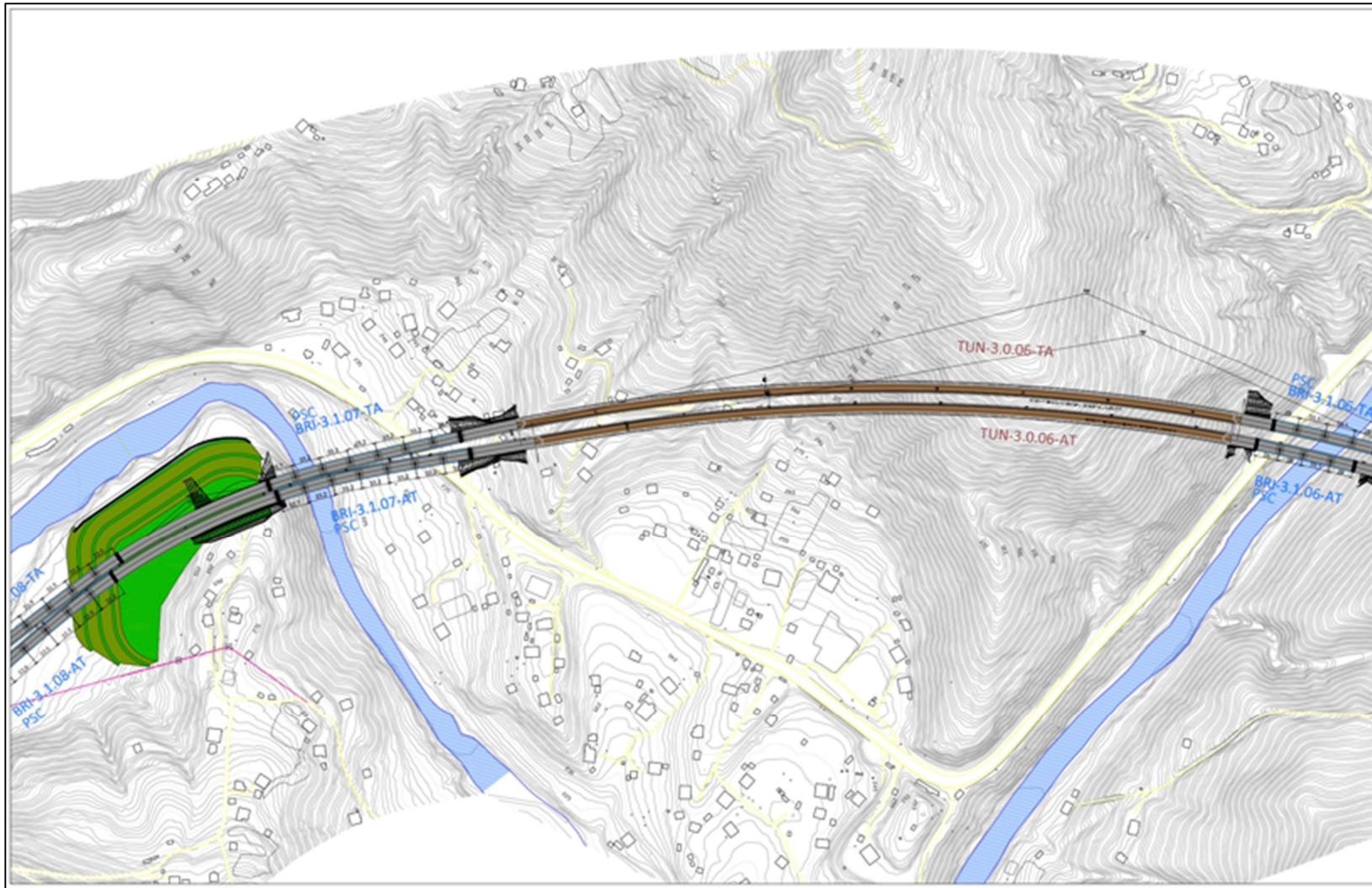


Figure 10: Project Road (KM6.6 – KM7.9)

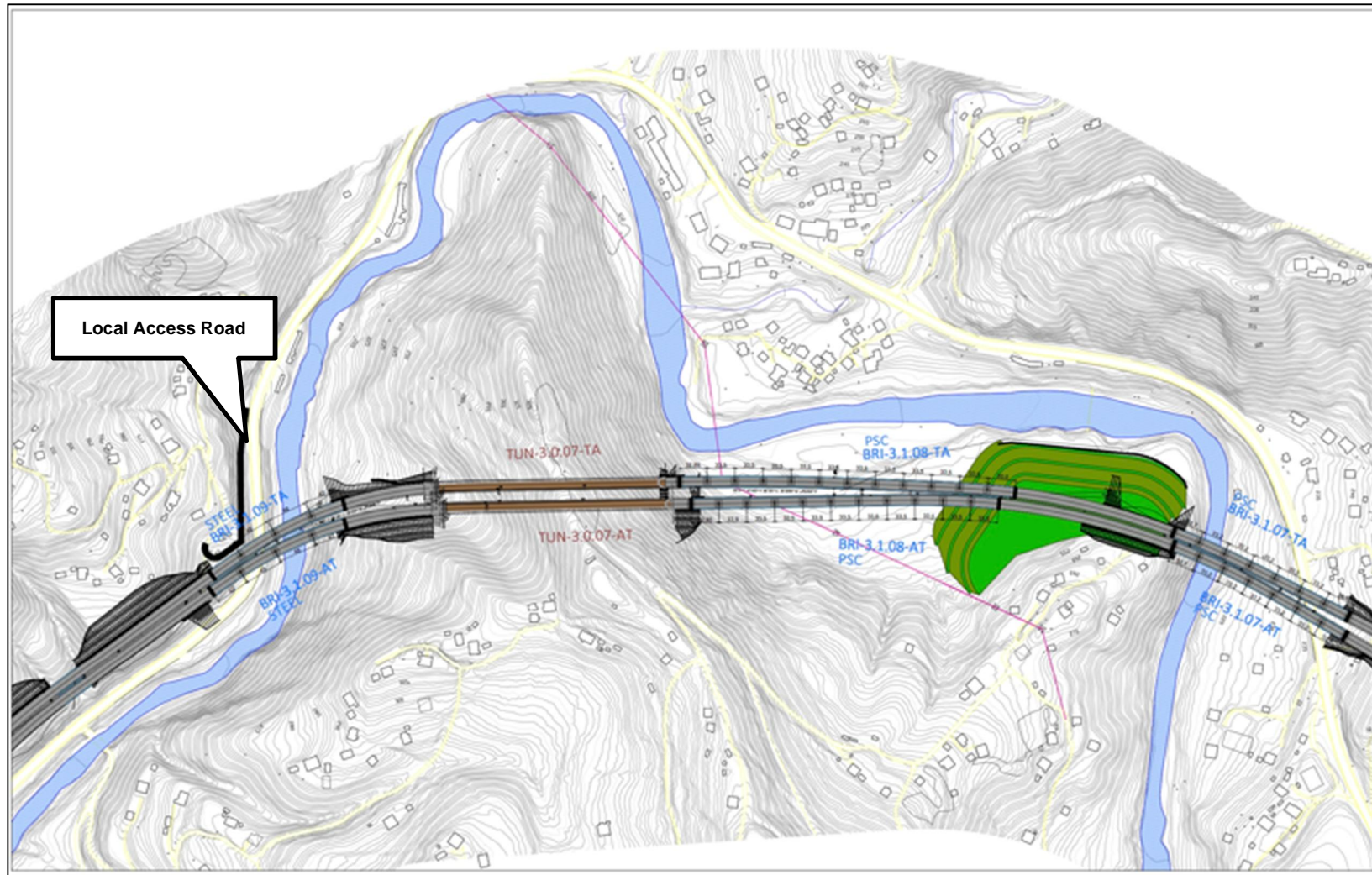


Figure 11: Project Road (KM7.9 – KM9.0)

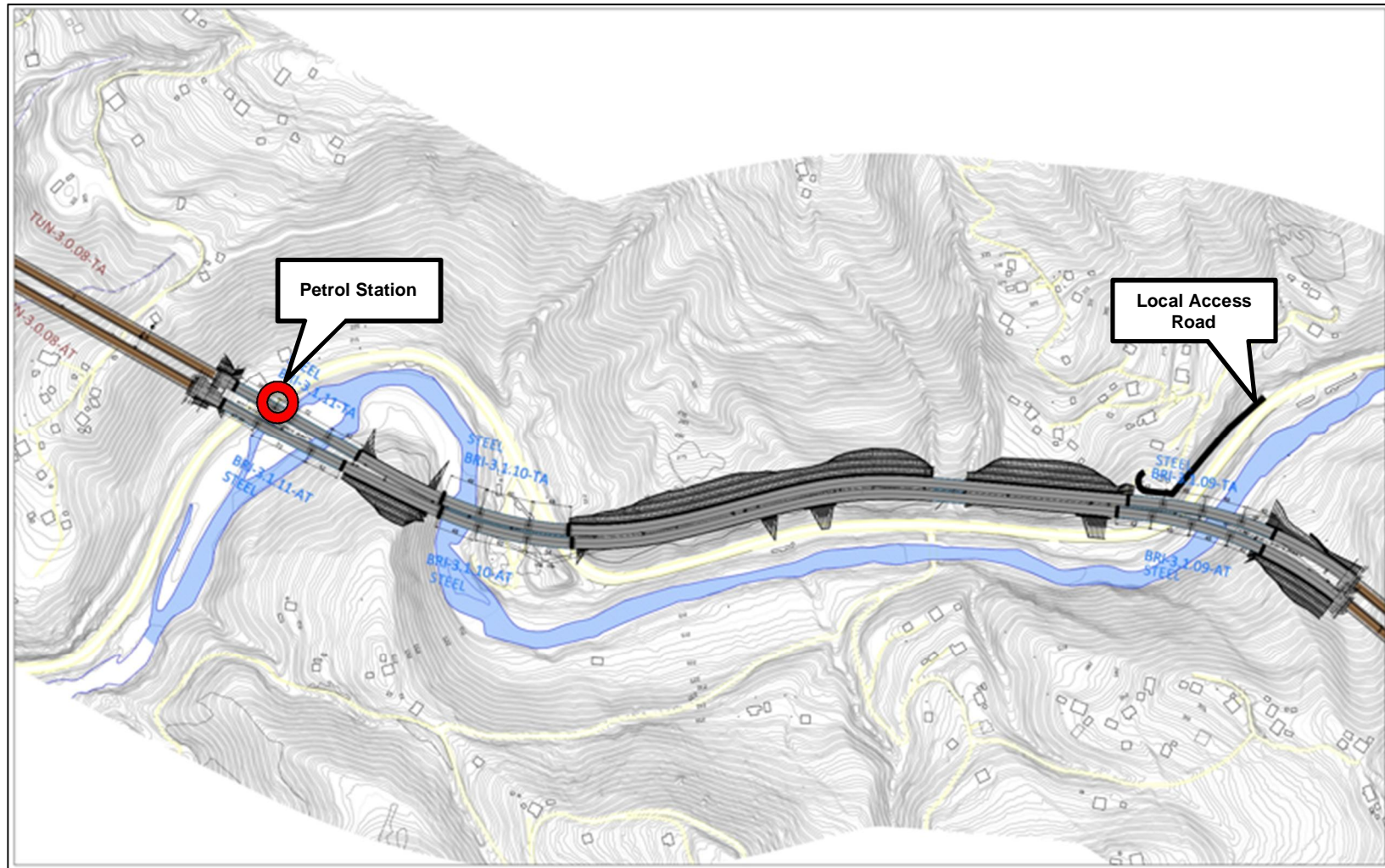


Figure 12: Project Road (KM9.0 – KM10.1)

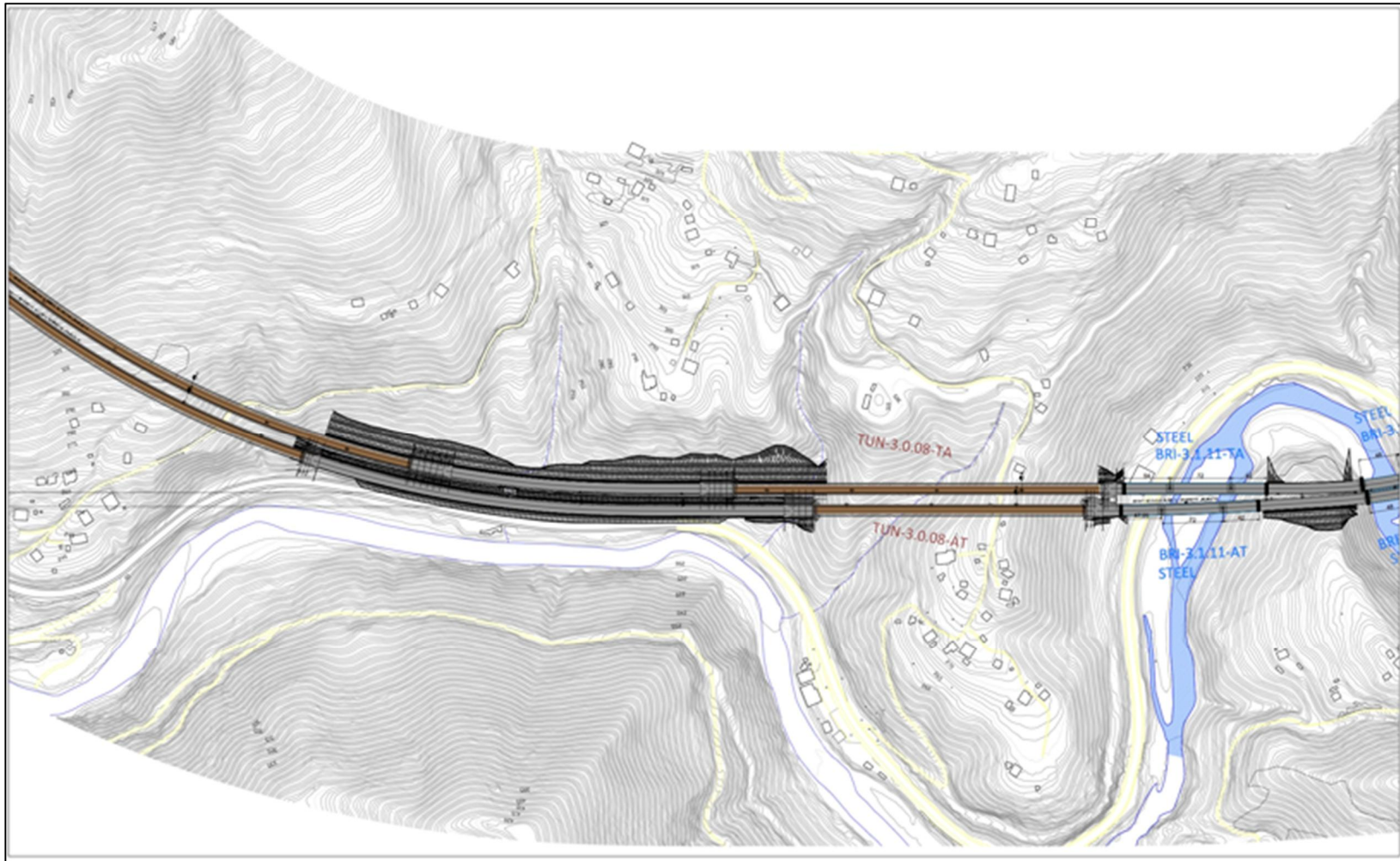


Figure 13: Project Road (KM10.1 – KM11.2)

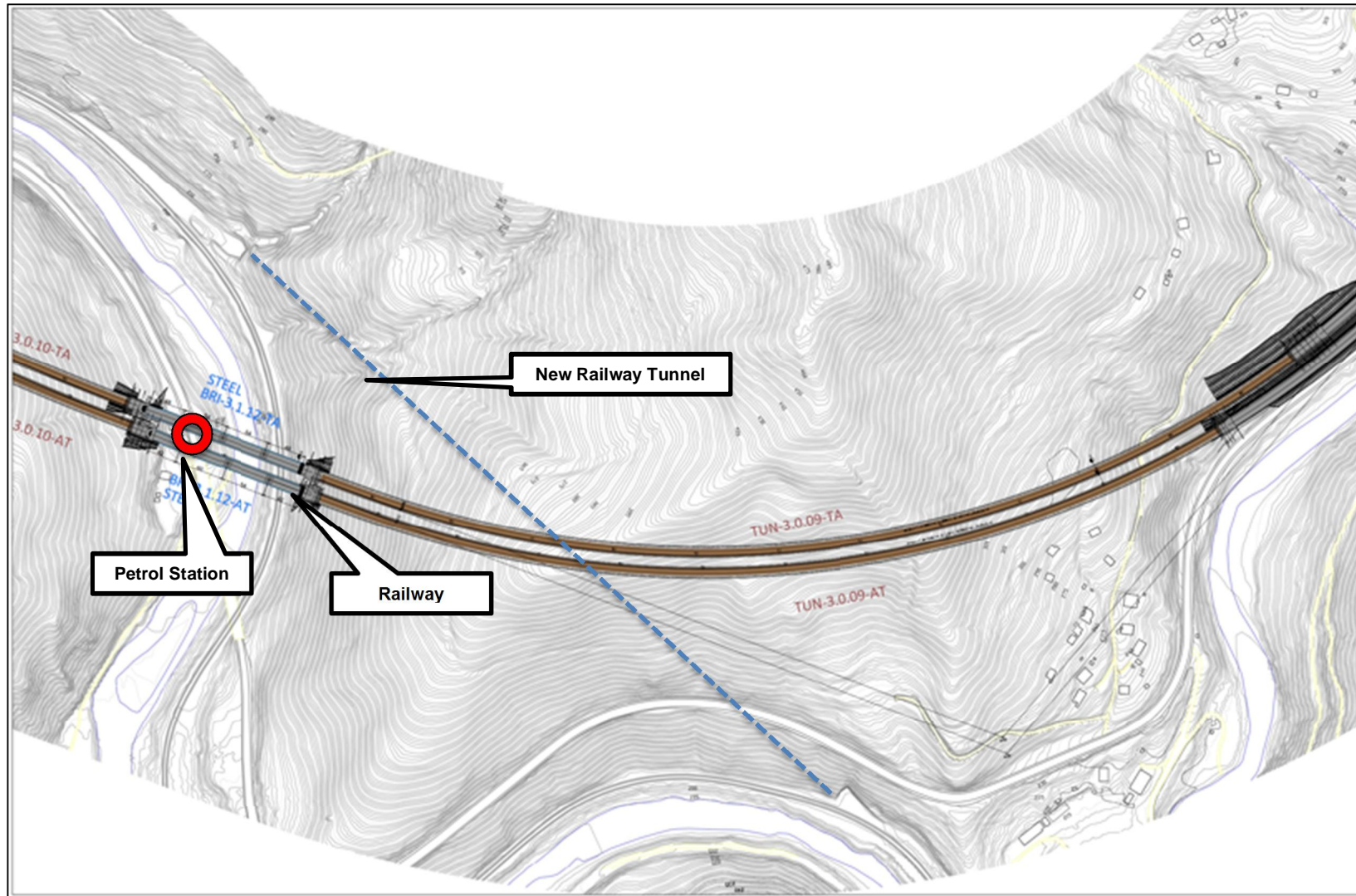


Figure 14: Project Road (KM11.2 – KM12.3)

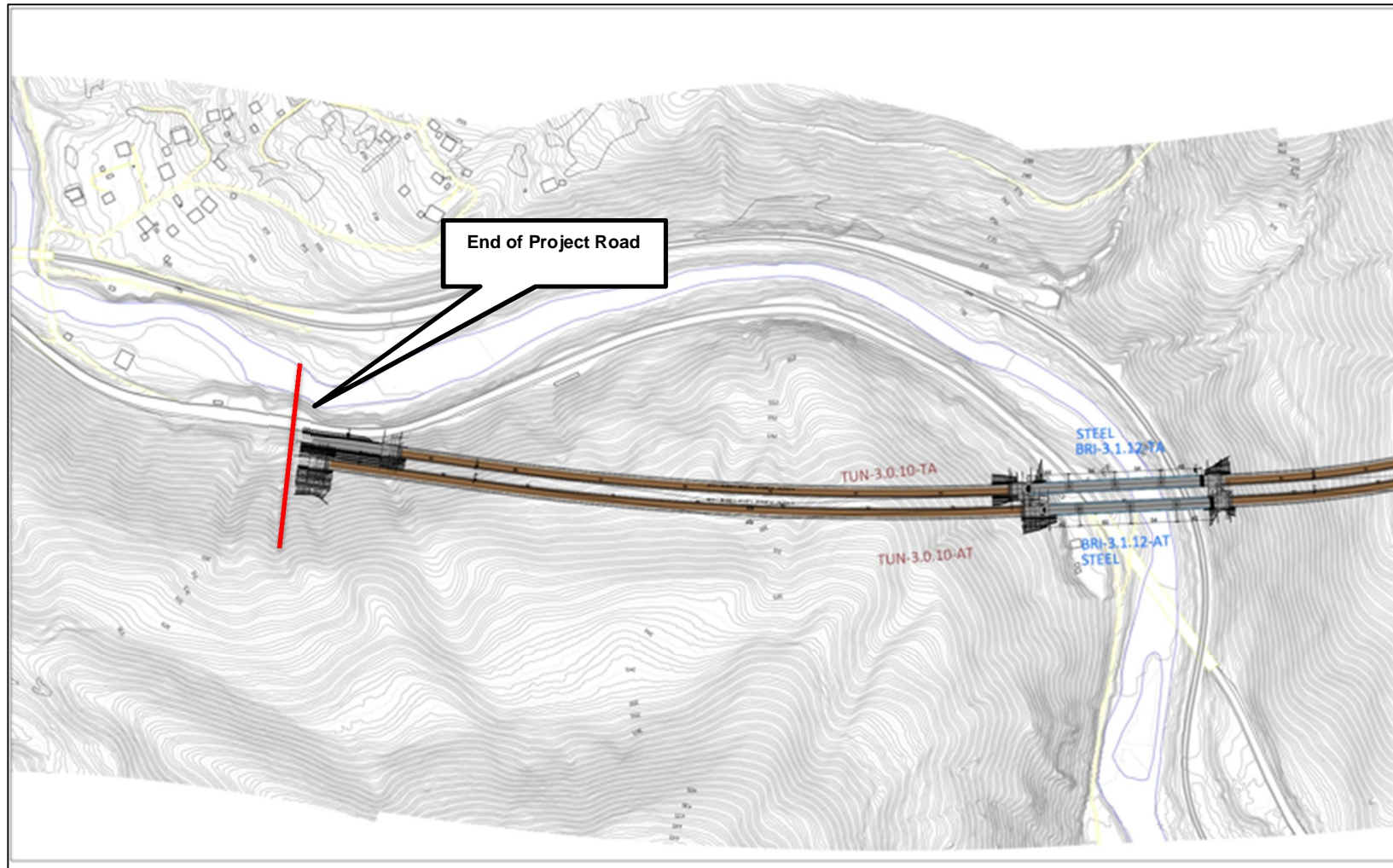
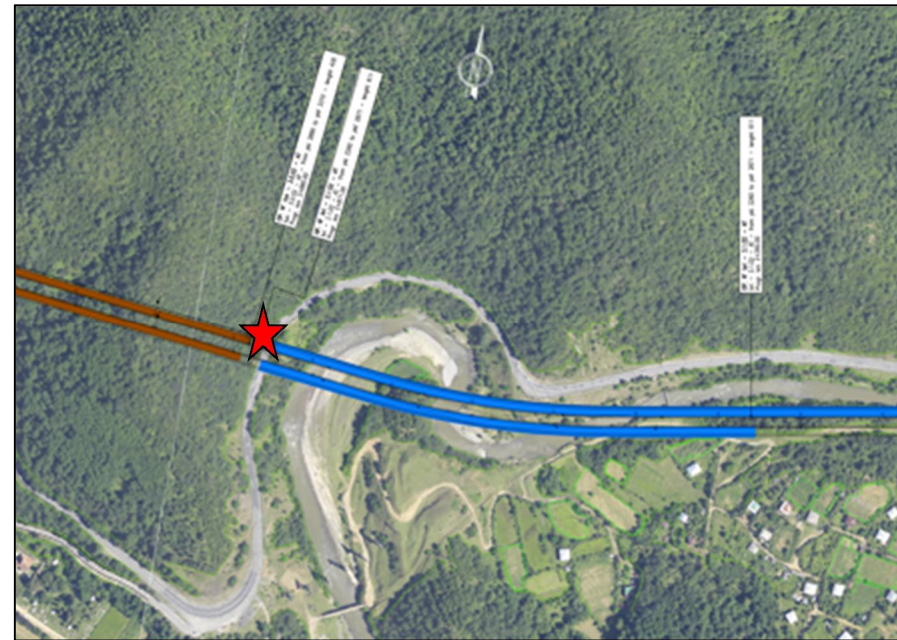


Figure 15: Project Road (KM12.3 – KM13.0)

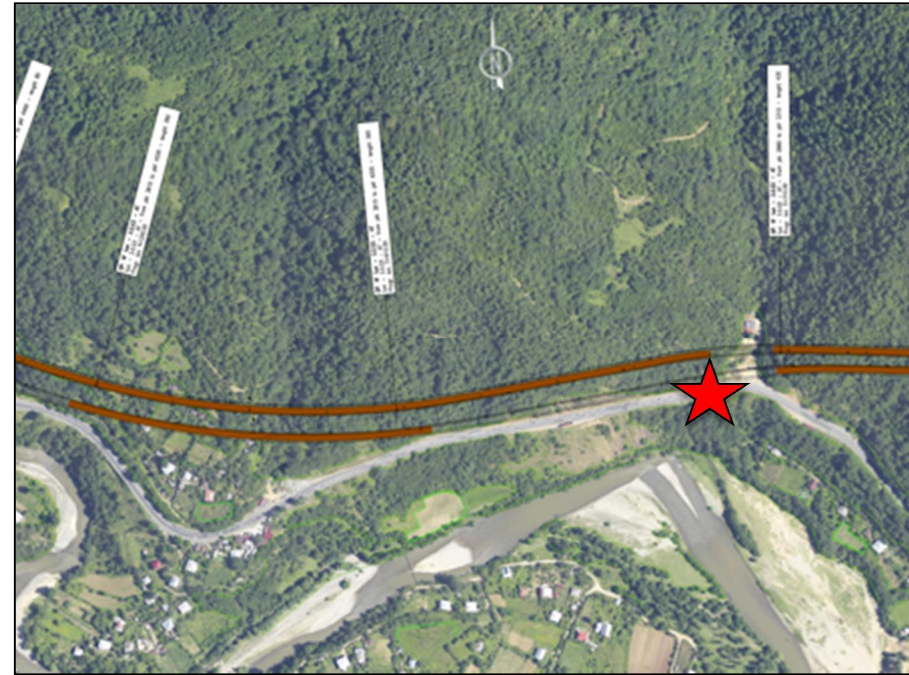
Figure 16: F4 Environmental Setting



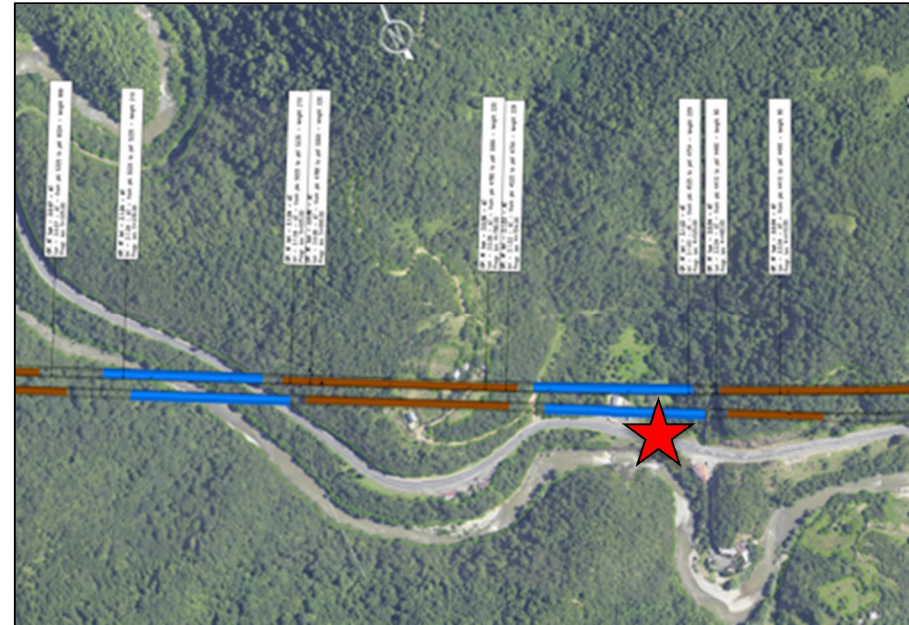
KM0 – The Project road commences in Boriti with an intersection and bridge. At this point the new alignment deviates from the existing E-60 pavement. Boriti is a small village, but several properties will be impacted by elevated noise levels from the new road before it passes into the first tunnel on the new alignment (3001 – TA/AT). Some tree cutting will be required around the tunnel portals and temporary access roads will need to be created to these areas. The photo above is looking west along the existing alignment from the red star.



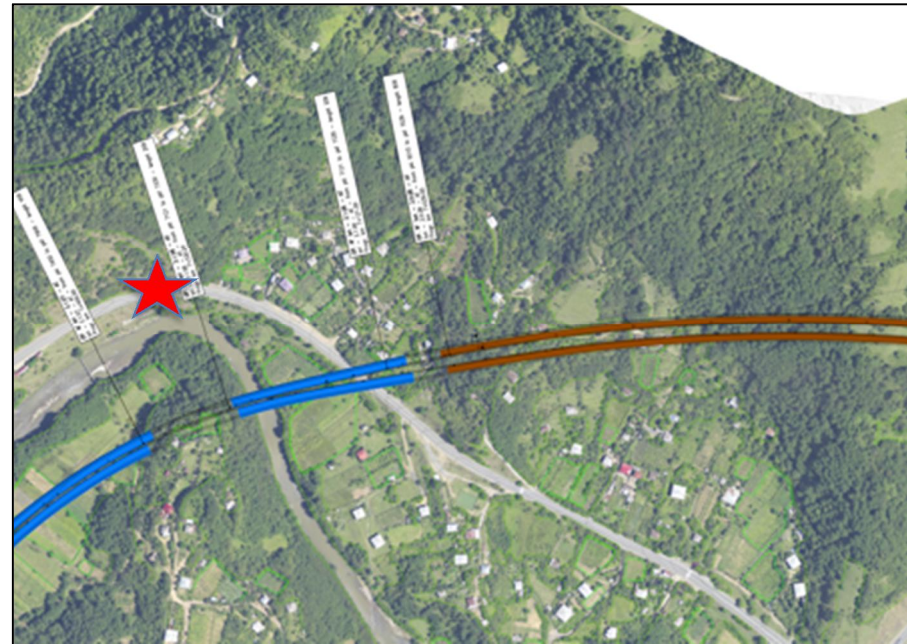
KM2.8 – The road leaves Boriti, traverses the afore mentioned tunnel before a long bridge section which follows the southern side of the valley bottom adjacent to the Dzirula river. The alignment then passes into a tunnel at the location of the red star. The photo is taken looking east from the red star back up the valley broadly parallel with the location of the proposed bridge.



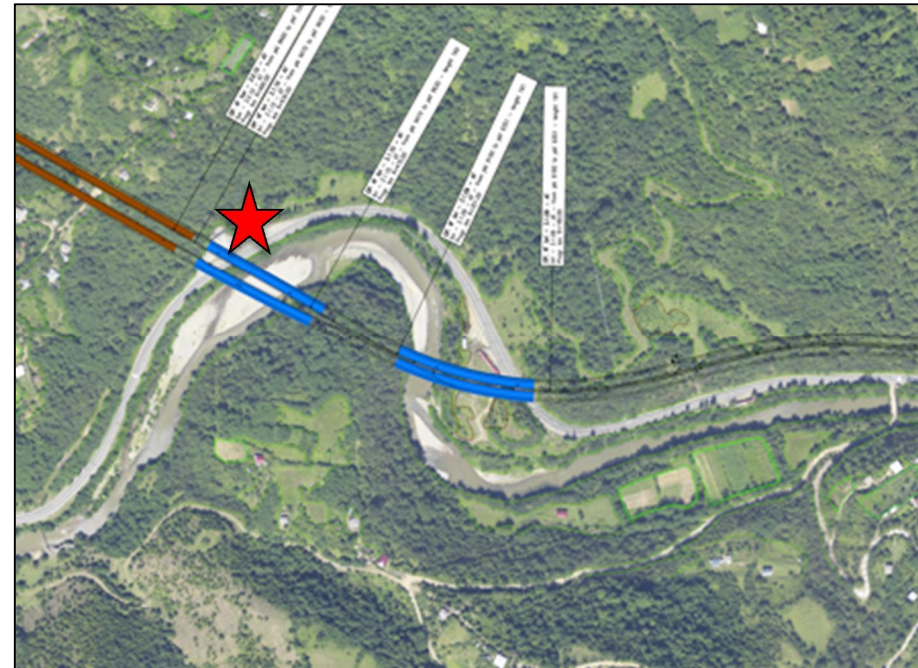
KM3.6 – The road continues to pass mainly through tunnels in this area of the new alignment. Access to tunnel portals will be from the existing alignment. Keeping the road within the tunnels will limit operation noise impacts and reduce the need for tree cutting and impacts to habitat. The photo above is taken looking west from the red star along the existing E-60. The embankment to the right will need to be cut back to accommodate the uncovered section of the new alignment.



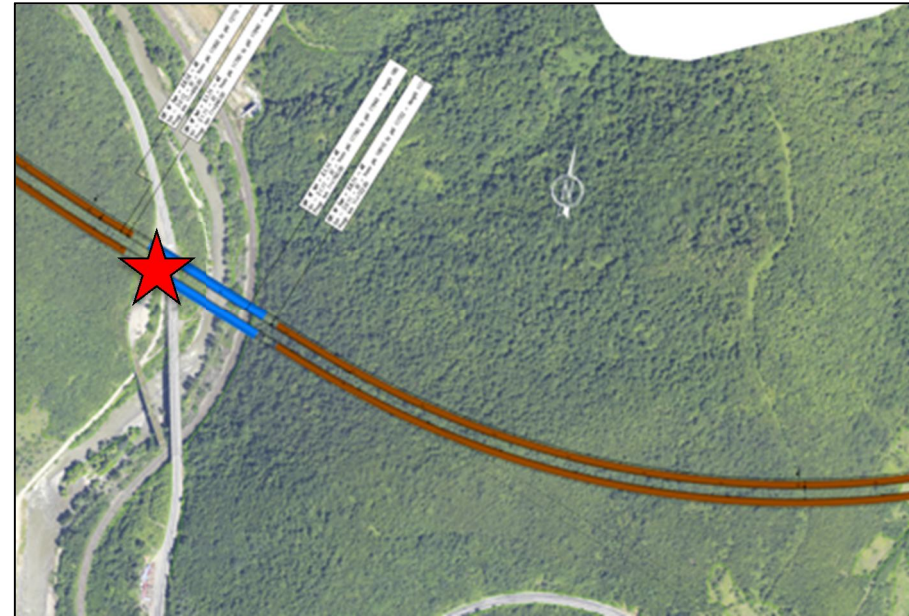
KM4.6 – The new alignment runs straight through a series of tunnels and bridges in this section. A number of trees will need to be cut in these areas. The new alignment will also cross directly above the property in the photo above. This property will be expropriated. No other significant noise, or air quality impacts are expected in these un-populated areas. Access to some of the riverside restaurants is maintained as the new alignment passes above or adjacent to the existing E-60.



KM7.6 – The new alignment finally comes out of a series of tunnels and then passes directly onto a series of bridges as it crosses the Dzirula and the bottom of the valley. Noise impacts during the construction and operational phases are likely to be above national and international standards and mitigation measures will be needed. The tunnel could also impact upon groundwater users to the south of the tunnel. The photo is taken from the red star looking south east along the existing E-60.



KM9.6 – The new alignment then passes more than 500 meters south of the small settlement of Shrosha and its pottery and ceramic market which will be unaffected by the new road. The existing alignment will not be affected by the new road in this area and access to Shrosha will be maintained by connecting the new road with the existing road at the new interchange. The new alignment will then cross the Dzirula at two points and a number of trees will need to be cut in this area. The photo is taken from the red star looking west to a petrol station which will need to be demolished to make way for the new bridge and tunnel portal.



KM12.7 – The road continues for the remainder of the alignment, mainly through long tunnels. Population density in these areas is low. Few impacts are anticipated in these areas apart from tree cutting and the need to remove large quantities of spoil material from the tunnels. The photo above is taken from the red star looking south along the existing E-60 bridge crossing the Dzirula. The new alignment will cross over this bridge and also the railway line on the opposite side of the river bank.

B.4 Road Standards and Profiles

Geometric design standards have been selected based on traffic flow, road category and relief to ensure safe and unimpeded traffic flow. The road design is based on the Georgian National Standard SST 72: 2009 “Standard on Geometrical and Structural Requirements for the Public Motor Roads of Georgia” and TEM (Trans-European North-South Motorway) Standards. The main technical parameters adopted in the detailed design are as follows:

- Design speed - 100 km/h;
- Number of traffic lanes – 4;
- Width of traffic lane - 3.75 m;
- Width of each carriageway - 7.5 m;
- Width of paved shoulder (emergency lane) - 2.5 m;
- Width of verge – 1.0 m;
- Width of central reserve- 5.0 m;
- Width of paved shoulder at the central reserve - 1.0 m;
- Total width of each paved platform – 11.0 m□
- Width of road bed - 27.0 m;
- Carriageway cross-fall on straight sections - 2.5%;
- Minimum radius of horizontal curve - 400 m;
- Maximum longitudinal gradient - 4%;
- Minimum convex curve - 15 000 m;
- Minimum concaved curve - 15 000 m.

A minimum radius of horizontal curve 400 m for the design speed 100 km/h is adopted based on Austrian standards and Russian standards (SNiP 2.05.02-85) for mountainous relief. The road axis has been designed separately for two independent right and left lanes. The axis is located on the outer edge of the paved section (1.0 m) of the central reserve: Tbilisi-Argveta direction **TA**, Argveta-Tbilisi direction **AT**.

B.4.1 Cross Sections

In all the section of the motorway, the cross section is arranged in two carriageways with two traffic lanes each (2+2 lanes); the carriageways may be divided and independent according to the terrain characteristics. Traffic lanes in this proposal are always 3.75m, to guarantee enhanced and homogeneous safety level across the road.

Cross Section on Embankment and Cuts – The cross section includes:

- 2.50m wide paved external shoulder (hard shoulder) on the outmost of each carriageway this element may be widened on the internal carriageways, where sight analysis requires widening;
- 1.00m verge on the outmost of the external shoulders, where external safety barrier may be located according to needs;
- 5.00m wide central reserve (median), composed by:
 - 3.00m space for the safety barrier (typically reinforced concrete, dual) and related workspace.
 - 2x1.00m paved internal shoulders (or wider on the external carriageway only, where sight analysis requires widening).

The verge may also be 5-10cm above the pavement level, to protect embankment from erosion (should be interrupted every 25m to permit water flow, in dedicated channels with lining on embankments).

Figure 17: Typical Cross Section of Road Pavement

Typical cross section of road pavement

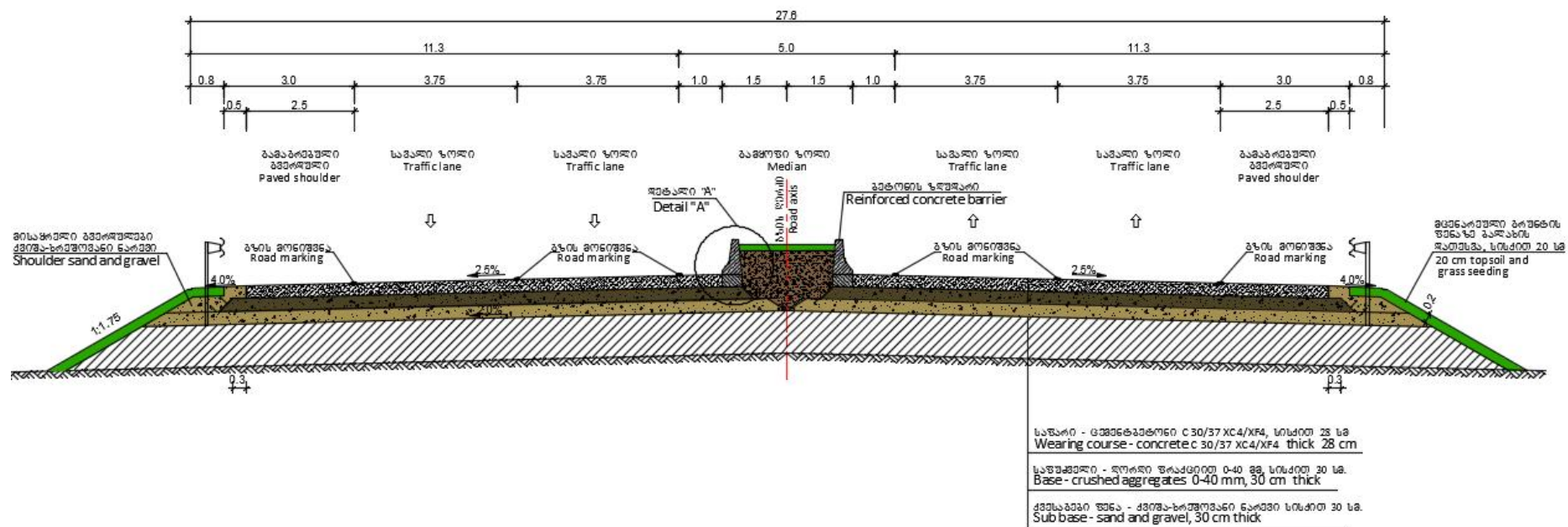


Figure 18: Other Types of Cross Section of Road Pavement

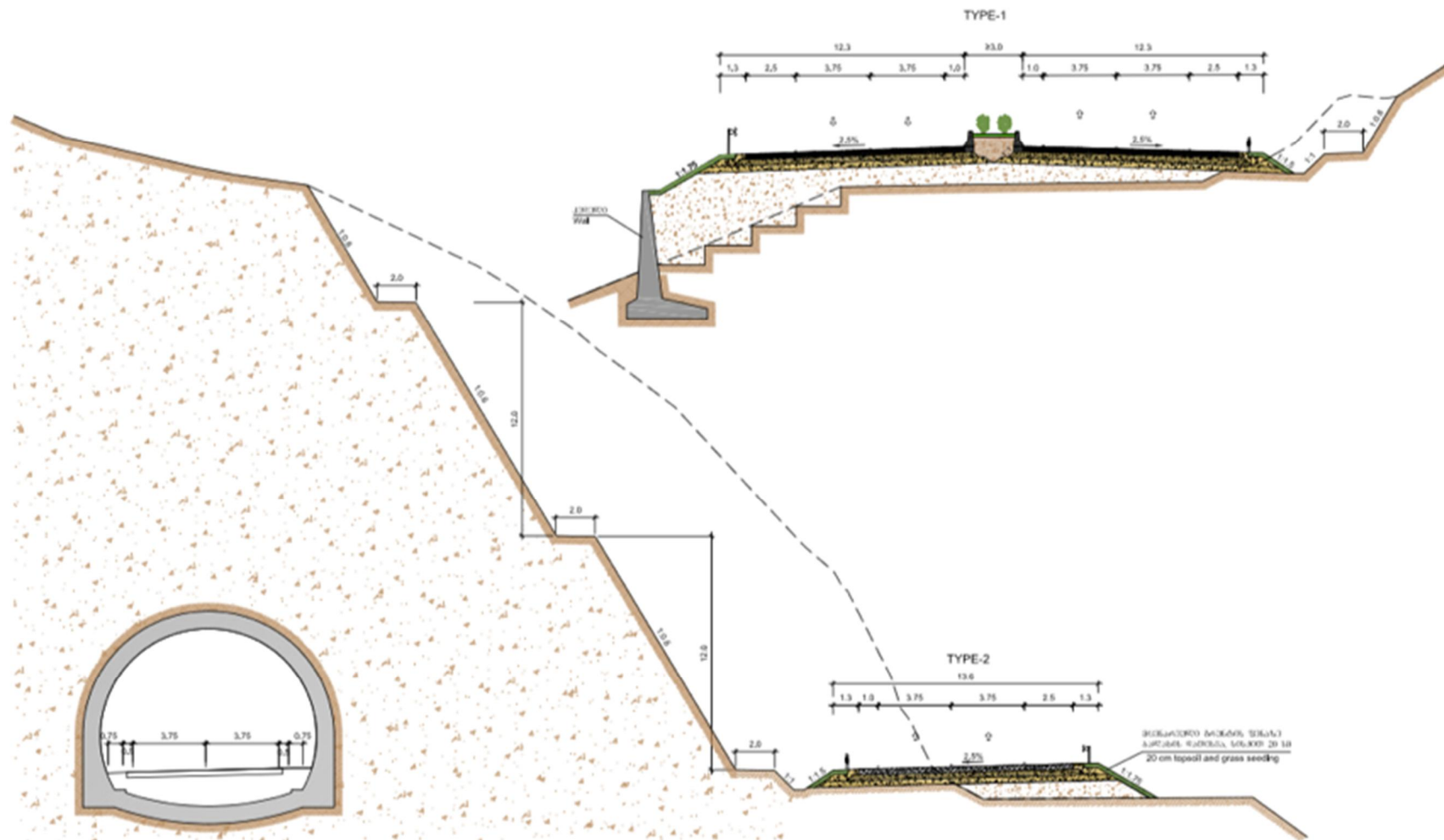


Figure 19: Other Types of Cross Section of Road Pavement

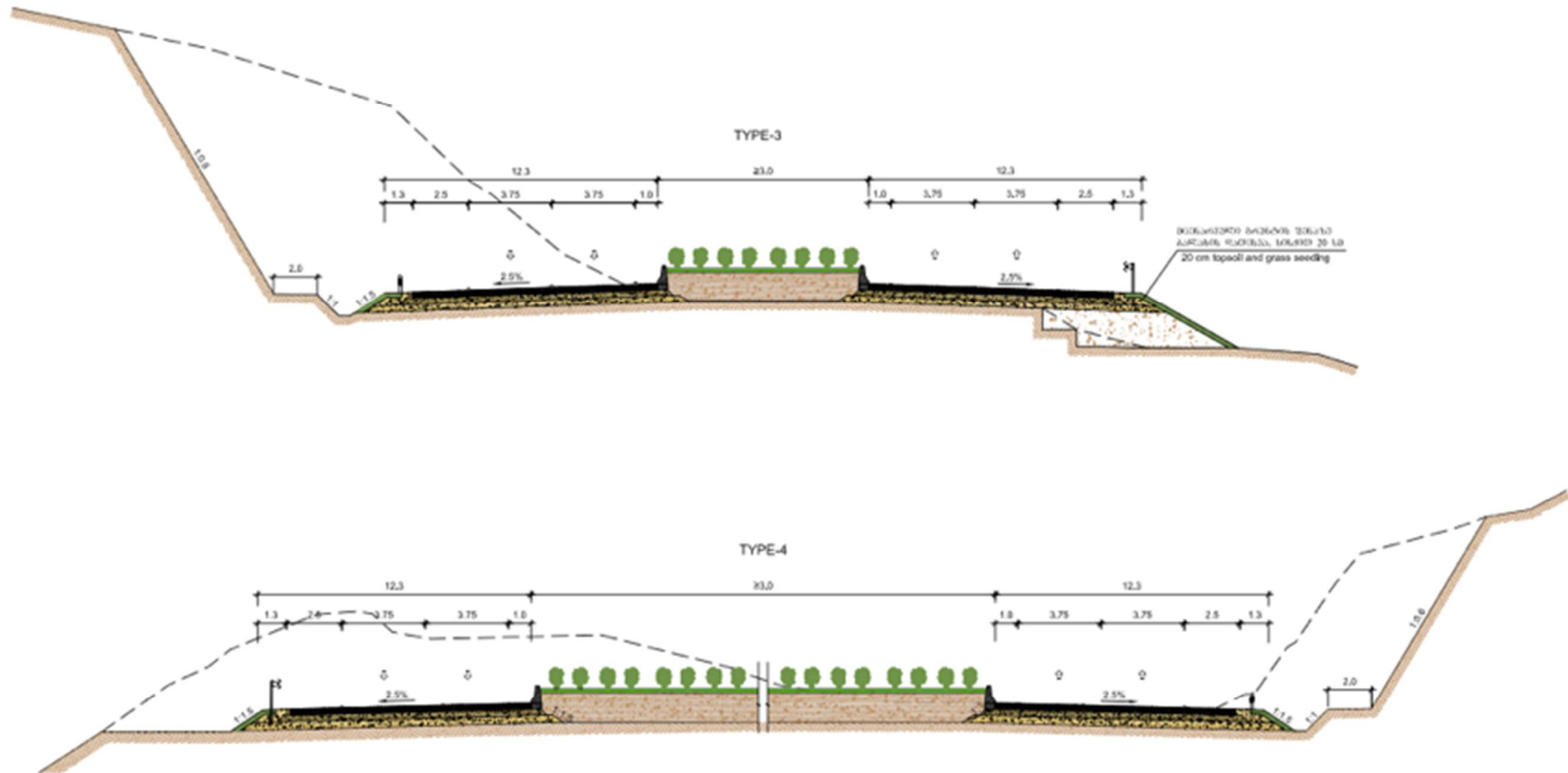


Figure 20: Cross Section on PSC Bridges

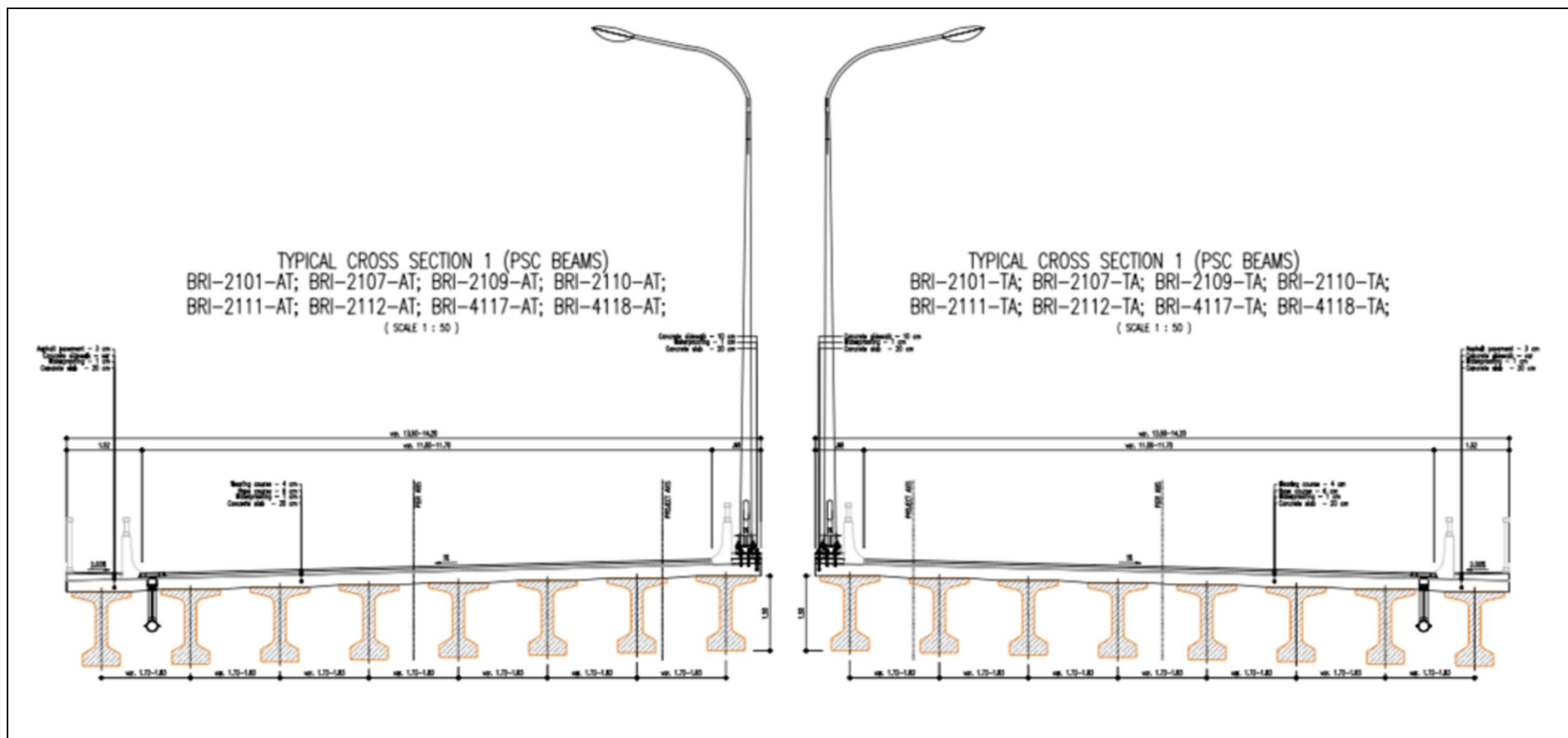


Figure 21: Cross Section on Steel-concrete Bridges

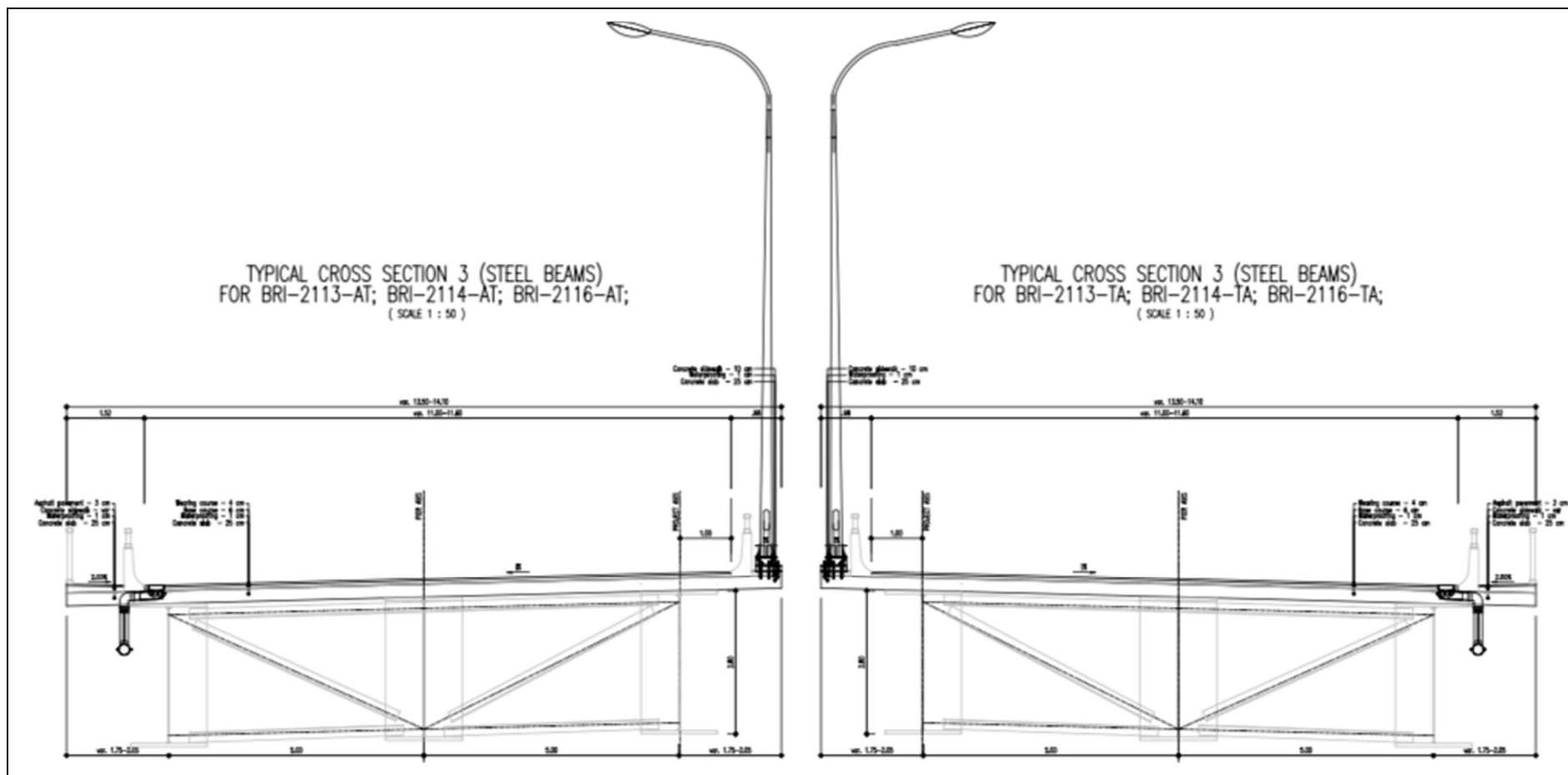
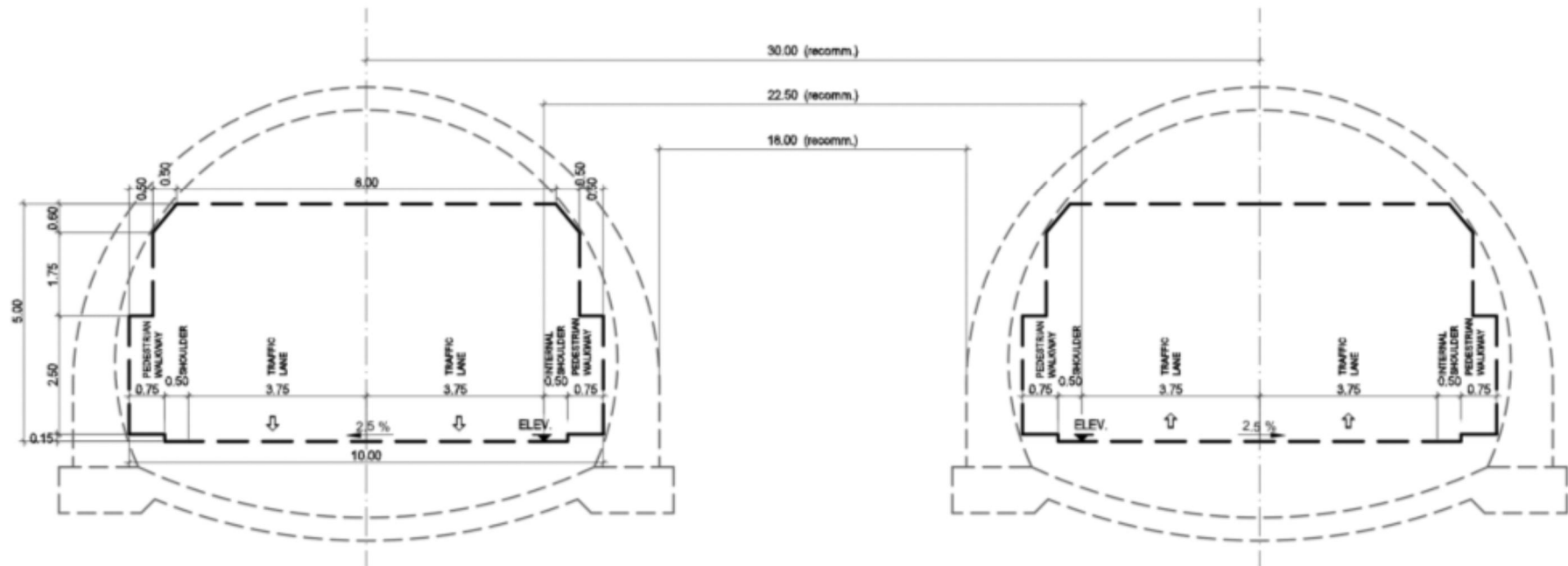


Figure 22: Cross Section in Tunnels



Cross Section on Bridges - This is a functional cross section, so the structural part is not shown. The minimum width for the paved area is 11.00m (2x3.75+2.50+1.00). Safety barriers (internal and external) shall always be included, positioned outside of the shoulders (no element shall invade the shoulder space) and may be installed according to the manufacturer's specification. Side walkways shall be added, with a minimum clear width of 0.6m. Walkway may be also built with a cantilever metal structure, with external pedestrian parapet.

Cross Section in Tunnels - This is a functional cross section including the clear area (gabarit), so the structural part is not shown but shall be organized out of the dashed boundary line; the minimum vertical clearance is 5.00m, which is 1m more than the height of the standard trucks. All the structural parts and additional system (lighting, fans, cable ducts, etc.) shall be positioned outside the dashed boundary line. Minimum width for the paved area is 8.50m (2x3.75+2x0.50), pedestrian walkways are 0.75m wide, on both sides. There is no need of widening in the curves, since when the radius is minimum (400 m) the maximum speed allowed is 80 km/h.

B.5 Bridges

Fourteen bridges will be constructed during the project works (throughout the report we will refer to fourteen bridges, although from a technical perspective there are twenty seven bridges as the AT lane and TA lane on each 'bridge' are not joined, but are standalone structures). Table 2 and Table 3 below provides summary details of the bridges and their locations.

Table 2: F3 Bridges TA Axis

BRIDGES AXIS TA			PK start	PK end	Length
BRI 3 1 01	TA	PSC	0+068,00	0+199,65	131,65
BRI 3 1 02	TA	STEEL	0+426,00	0+654,00	228,00
BRI 3 1 03	TA	STEEL	1+927,00	3+109,00	1,182,00
BRI 3 1 04	TA	PSC	4+766,52	4+969,87	203,35
BRI 3 1 05	TA	STEEL	5+313,62	5+559,62	246,00
BRI 3 1 06	TA	PSC	6+277,65	6+409,20	131,55
BRI 3 1 07	TA	PSC	7+365,62	7+586,82	221,20
BRI 3 1 08	TA	PSC	7+789,77	8+185,47	395,70
BRI 3 1 09	TA	STEEL	8+595,00	8+763,00	168,00
BRI 3 1 10	TA	STEEL	9+446,12	9+608,12	162,00
BRI 3 1 11	TA	STEEL	9+711,62	9+873,62	162,00
BRI 3 1 12	TA	STEEL	11+993,62	12+179,62	186,00
BRI 3 1 14	TA	PSC			99,00
Grand Total					3,516,45
Total PSC					1,182,45
Total Steel					2,334,00

Table 3: F3 Bridges AT Axis

BRIDGES AXIS AT			PK start	PK end	Length
BRI 3 1 01	AT	PSC	0+068,00	0+199,65	131,65
BRI 3 1 02	AT	STEEL	0+405,00	0+633,00	228,00
BRI 3 1 03	AT	STEEL	2+581,00	3+115,00	534,00
BRI 3 1 04	AT	PSC	4+784,94	4+982,64	197,70

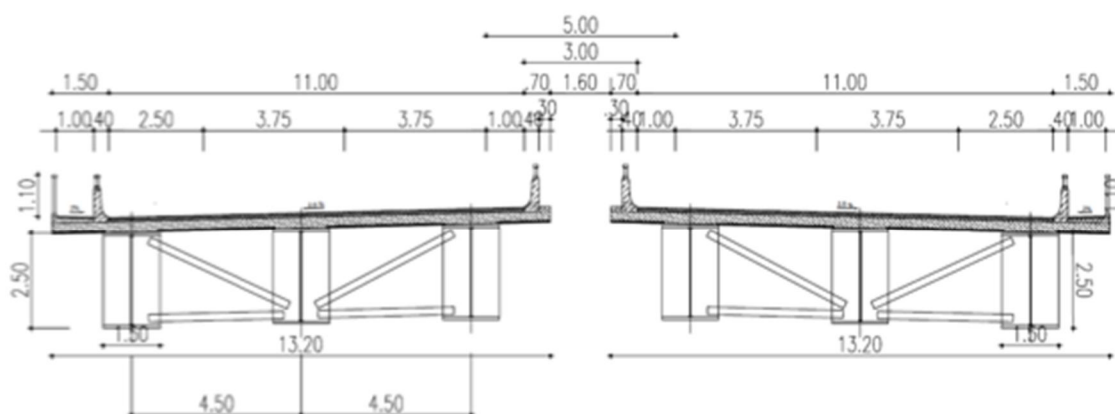
BRIDGES AXIS AT			PK start	PK end	Length
BRI 3 1 05	AT	STEEL	5+281,89	5+479,89	198,00
BRI 3 1 06	AT	PSC	6+304,37	6+426,52	122,15
BRI 3 1 07	AT	PSC	7+387,04	7+580,94	193,90
BRI 3 1 08	AT	PSC	7+793,89	8+157,59	363,70
BRI 3 1 09	AT	STEEL	8+595,00	8+763,00	168,00
BRI 3 1 10	AT	STEEL	9+425,89	9+593,89	168,00
BRI 3 1 11	AT	STEEL	9+720,89	9+876,89	156,00
BRI 3 1 12	AT	STEEL	11+996,89	12+182,89	186,00
BRI 3 1 13	AT	PSC			33,00
BRI 3 1 14	AT	PSC			99,00
Grand Total					2,779,10
Total PSC					1,141,10
Total Steel					1,638,00

The bridges will be either pre-stressed concrete (PSC) or steel / concrete composite (steel) structures. Both bridge types have their advantages and disadvantages as follows:

- PSC - In this method a crane moves the precast concrete girder up to the top of substructure. The weakness of this method is the requirement of installation of temporary plant for prefabrication of precast girder and difficulty of span arrangement over 40 m in a span length, but the strength is short construction period due to using crane method and economic efficiency.
- Steel bridges - will be constructed using staging construction method using temporary steel bent to place the cast-in place concrete of superstructure. The weakness is relatively difficult in construction due to long period of construction to place cast-in-situ concrete of superstructure and requirement of temporary steel bent to support the formwork of concrete.

173. The bridge decks will be two main beams connected by a trasversal beam and with the slab cast on a steel plate, more or less as is shown in Figure 23 below.

Figure 23: Bridge Cross Section



For foundation of substructures, installation of piles will be done through boring using cast-in-place bored pile with reinforced concrete was adopted due to local field condition, environment

effect, and supply of materials. This construction method has minor noise and vibration impacts compared to precast driving methods.

B.6 Tunnels

In Section F3 are foreseen nine tunnels with double tube with length from 249 m to 1,596 m. In this section, the ground thickness over the tunnel are generally limited and crossed clusters rock shown poor mechanical characteristics.

Table 4: Tunnels in Section F3

FINAL CODE		Carriageway	Chainages		Length
			Start	Finish	
TUN	3.0.01	TA	1+020.141	1+886.500	866.359
		AT	1+013.008	1+902.306	889.298
TUN	3.0.02	TA	3+153.544	4+749.953	1596.409
		AT	3+158.865	4+755.481	1596.616
TUN	3.0.03	TA	4+980.948	5+292.892	311.944
		AT	5+007.660	5+257.595	249.935
TUN	3.0.04	TA	5+626.441	6+223.824	597.383
		AT	5+540.000	6+257.989	717.989
TUN	3.0.05	TA	6+444.868	7+275.758	830.890
		AT	6+471.437	7+276.817	805.380
TUN	3.0.06	TA	8+242.000	8+500.000	258.000
		AT	8+225.000	8+505.897	280.897
TUN	3.0.07	TA	9+888.739	10+378.739	490.000
		AT	9+898.491	10+273.491	375.000
TUN	3.0.08	TA	10+721.662	11+974.000	1252.338
		AT	10+836.000	11+984.000	1148.000
TUN	3.0.09	TA	12+212.000	12+958.739	746.739
		AT	12+201.000	13+058.491	857.491

Table 5: Typical Tunnel Dimensions

Parameter	Value
Width of pavement	7.50 m
Width of sidewalk	0.75 m
Width of Shoulder	0.50 m
Total width of tunnel	10.00 m

Ventilation - The primary ventilation for the tunnels having length >1000m will be of the longitudinal type. Ventilations is guaranteed by the use of axial Jet-Fans, having rotor's diameter 1.250mm, stainless steel box, with reversible flow, fire resistant for 2h at 400°C. Moreover, Jet-Fans cables and switching for fan's wiring have the same fire resistance characteristics.

Escape Routes - Escape routes are provided for tunnels which length is >1000m, which in case of fire will allow users to reach the other tube of the tunnel, and from there they will go to the nearest portal. Escape routes are accessible only through specific filter areas with fire doors REI

120 in order to avoid the propagation of the fire or smoke inside bypass and pressurized by ventilation systems.

Fire Protection - Tunnels having length >500m are equipped with the fire protection system. Pump stations and the related tanks are installed next to the substations ES3, ES4 and ES5. The electrical plant supply are realized according to standard EN 12845. Fire protection network will supply the 120l/min hydrants located inside the niches of the tunnel next to the SOS every 150m along the slow lane. Next to the portals will be posed 300l/min hydrants above the ground. SOS stations and inside the substations are equipped with fire extinguishers. Fire detection inside the tubes is realized with the heat sensitive cable or double conductor cable with insulation sensitive to temperature, protected by a special outer sheath. This system is added to the smoke detection inlet system, to the opacimeters and to the ccTV plant (obscuration function).

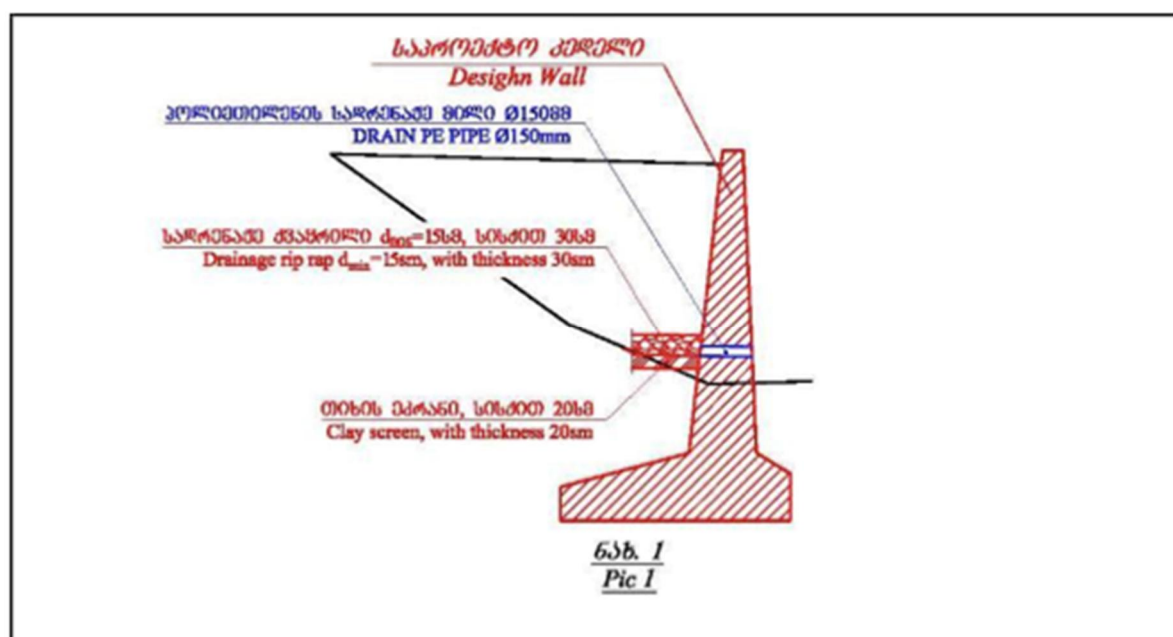
SOS Emergency Phone System - Tunnels longer than 300m SOS emergency phone at portals, inside the tunnels (every 150 m) and into pedestrian bypass allow service users to calls for roadside and emergency medical assistance.

B.7 Retaining Walls

To construct the roadbed in the project section concrete retaining walls and reinforced concrete support structures will be required on several sections due to the difficult relief conditions of the project section. Reinforced concrete retaining walls are required at the beginning of the project section from:

- Wall RWA-3501 on carriageway AT, at KM 2.105 - 90 meters long
- Wall RWA-3502 on carriageway AT, at KM 9.100 - 50 meters long
- Wall RWA-3503 on carriageway AT, at KM 9.180 - 20 meters long
- Wall RWA-3504 on carriageway AT, at KM 12.974 - 80 meters long
- Wall RWA-3507 on carriageway AT, at KM 10.340 - 440 meters long

Figure 24: Typical Retaining Wall



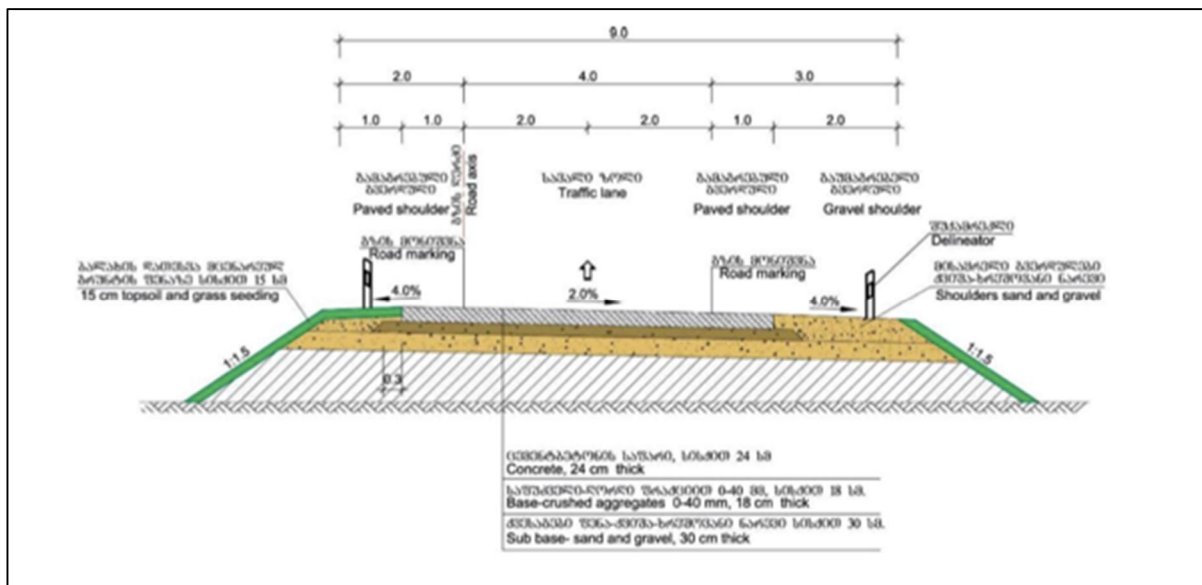
Note: Drain Pipe 150mm / Drainage Rip-rap thickness 30cm / Clay Screen thickness 20cm

B.8 Interchanges

There are two interchanges planned in F3 Section. Figure 4 and Figure 8 provide plans of the Project road including all interchanges. The pavement structure for interchanges includes:

- Pavement - cement-concrete, thickness 24 cm.
- Base course - crushed aggregates 0-40 mm, thickness 20 cm.
- Sub-base - sand and gravel mix, thickness 30 cm.

Figure 25: Road Pavement Structure for Interchanges



B.9 Culverts and Underpasses

Culverts, cattle passes and underpasses crossing the project motorway are designed in compliance with standard design practices for motorways using box type culverts. Culverts on the Project road ensure uninterrupted discharge of precipitations, water from ravines and water from drain channels. The Project road passes inhabited areas, arable lands, pastures and other rural territory. Thus box section underpasses shall be constructed to pass cattle, pedestrians and vehicles and ensure uninterrupted crossing of the Project road.

The following types of culverts will be constructed:

- Underpasses for rural roads, which are construction of cast in situ reinforced concrete structures of closed contours cross sections 6.0x4.5 m.
- Cattle passes, which ensure cattle cross the project road. Construction of cast in situ reinforced concrete structures of closed contours cross sections 4.0x2.5 m.
- Culverts, for which cast in situ reinforced concrete culverts cross section 2.0x2.5 m , 4.0x2.5m.

B.10 Construction Process

During the construction phase the following activities will be undertaken:

- **Land Acquisition** - Under the terms of the Loan of the ADB, before the commencement of the construction works at any part of the site, the Employer must prepare the LARP, obtain the approval of ADB and then implement the plan and acquire the land.

- **Specific Environmental Management Plan (SEMP)** - Ensure that the Specific EMP is submitted to the Engineer for review at least 10 days before taking possession of any work site. No access to the site will be allowed until the SEMP is reviewed by the Engineer and approved by the Project Management Consultant.
- **Site Clearing Works** - The Works include the following site clearing works within or adjacent to the RoW of the Project Road, in accordance with the Drawings or instructions of the Engineer:
 - Clearing and grubbing.
 - Removal and disposal of traffic signs, sign posts and their foundations.
 - Demolition, removal and disposal of existing bridges including foundations, abutments, piers, retaining walls, riverbank and waterway protection works.
 - Demolition, removal and disposal of existing culverts, inlet and outlet structures, headwalls, concrete drains, channel lining, and erosion protection works.
 - Removal of and any other natural or artificial objects within the RoW.
 - Removal and disposal of all vegetation and debris within the designated limits of the Right-of-Way.
- **Relocation of Existing Services** - The Works include the relocation of all services affecting the construction of the Project Road within the Right-of-Way (RoW). The services include the following
 - water mains
 - overhead electric supply lines
 - gas pipelines
 - underground telephone cables
 - sewer mains
- **Construction Activities**— The main construction phase aspects are described in detail below.

B.10.1 Bridges

The construction of the new bridges includes but is not limited to the following parts of the structures and associated works:

- Foundations.
- Substructure including bridge bearings.
- Superstructure, including construction of expansion and deformation joints and footpaths.
- Deck pavement including hydro isolation, drainage, hand railing, and conduits for services.
- Approach slabs.
- Slope treatments in front and around the abutments.
- Construction and maintenance of traffic detours.
- Scour and erosion protection of the waterway areas and river bank protection upstream and downstream of the bridge crossing, and removal of old foundations and substructure from the waterways.
- All necessary and incidental items required for a complete bridge.
- All new and widened bridges will be designed for the life expectancy of 100 years.
- Oil and grease interceptor tanks.

B.10.2 Tunnels

The actual development of the tunnel design follows the principles of ADECO RS² method and is summarized in the following table.

² ADECO is a method of calculation of the tunnels developed in Italy by prof. Lunardi and in the latest years widely spread in Italy and also in Europe. The main principles are described in the general report and the method consists in

Table 6: ADECO Tunneling Method

Phase	ADECO RS
Survey phase	Analysis means first of all researching the medium to be tunneled from a geological and geo-mechanical point of view, especially by taking into consideration its resistance and deformability.
Diagnosis phase	And later forecasting by means of analytical and numeric instruments, what sort of stress-strain behavior will take place (Expected Deformation Response) when excavating (Categories A, B, C), in the hypothetical lack of stability operations.
Therapy Phase	<p>The composition, in function of the foreseen behavior of the medium during excavation, of typical sections, defining the best type of stabilization operations for the expected operative context as well as phases, cadences, timing of implementation and any possible variability.</p> <p>Control of the Expected Deformation Response may come about by:</p> <ul style="list-style-type: none"> • Defining the type of pre-confinement actions or confinement actions that are necessary to manage and control the Expected Deformation Response of the medium to excavation; • Choosing the type of stabilization operations from those available with today's technology, on the base of pre- confinement and confinement actions that each one is capable of guaranteeing; • Sizing and verification, by means of mathematical models, of the operations chosen to reach the medium's desired behavior under excavation with the necessary safety coefficient; and • Forecast, again using mathematical models, of the medium's stress-strain behavior under excavation when so stabilized.

B.10.3 Culverts

Project works include the construction of culverts and underpasses, including inlet and outlet structures and associated works in accordance with the Specification. The scope of the cross drainage works includes:

- Complete replacement of existing culverts which are old, structurally deficient or undersized;
- Extension of existing culverts which are of adequate design and in good condition;
- Construction of new culverts at locations where no cross drainage structure existed before;
- Cleaning of existing culverts which are partially or completely silted;
- Miscellaneous repair of the existing culvert joints, headwalls, wing walls, and scour and erosion protection works; and
- Construction of new scour protection and channel lining works.

B.10.4 Other Drainage Structures

Surface runoff from the carriageway and all other pavements, and any cut and embankment slopes must be discharged through longitudinal drains designed for adequate cross section, bed slopes, invert levels and the outfalls. The Works include construction of the drainage system components in urban and rural areas according to the types, dimensions, classes and material requirements for this work.

B.10.5 Earthworks

letting the tunnel develop deformations and thus decrease the stress on the structures (DE.CO. means Deformations Controlled). There is a prevision of utilization of sections of intervention and a system of monitoring of the deformations (topographic, generally) which give information on the tunnel behavior. Then there is a report called Guide Lines which for each behavior gives instructions of which section to apply.

The Works include the following types of earthworks necessary for the construction of the Project Road and all associated works:

- Removal of topsoil.
- Construction of embankments.
- Construction of subgrade.
- Excavation and removal of the existing pavement materials and the existing road embankment.
- Removal and replacement of unsuitable materials.
- Structural excavation.
- Excavation for the construction of side drainage and cross-drainage works.
- Excavation for the removal and relocation of the existing utilities.
- All backfilling necessary for the construction of bridges, retaining walls or other earth retaining structures, cross drainage structures and associated works, side drains and erosion protection work.
- Preparation of beddings and filters for all structural, cross drainage, side drains or pavement works.
- Excavation, filling or backfilling necessary for the execution of any other incidental works.

Table 7 indicates the approximate earthworks and pavement quantities for the Project Road.

Table 7: Estimated Earthworks for Section F3

Description	Unit	Quantity
Stripping of topsoil	m ³	26,000
Road bed excavation and excavation in cut	m ³	1,247,000
Excavation in tunnel	m ³	1,510,000
Embankment Construction for roads and associated works up to bridge pay lines	m ³	516,000
Subgrade Preparation	m ³	57,000
Preparation of the underlying granular pavement layer	m ³	127,000
Dismantling of existing concrete structures	m ³	4,000
Removal and transportation of existing bituminous pavement	m ³	4,400
Asphalt pavement	m ³	12,000
Concrete pavement	m ³	118,000

B.10.6 Pavement

Two different pavement structures will be used:

- Concrete pavement structure for the motorway and interchanges; and
- Asphalt pavement structure for all Slip Roads and all Minor Roads and bridges.

The following shall apply to the motorway, concrete pavement structure, construction category I:

- 28 cm Concrete;□
- 30 cm Crushed Aggregate Course;
- 27 cm Granular Base Course;□
- 85 cm Total Pavement Construction.

The following shall apply to slip roads and minor roads, asphalt pavement structure, construction category III:

- 4cm Asphalt Wearing Course;
- 4cm Asphalt Binding Course;
- 14 cm Asphalt Bearing Course;
- 58 cm Granular Base Course;
- 80 cm Total Pavement Construction.

For bridges, following the best practices all around the world and for durability reasons (total waterproofing and protection of the concrete slab), asphalt pavement is envisaged, precisely 11 cm of thickness.

Concrete pavements are already constructed on preceding sections of the highway. The pavement designs for the constructed sections were carried out in accordance to the German pavement design standard RStO 01.

The proposed pavement structure was designed according to "AASHTO, Guide for Design of Pavement Structures" and according to "RStO 01 the German Guideline for determination of Pavement Structures". Traffic load and other design parameters were evaluated for a 20 year design life cycle. At this stage of the project the pavement design and determination of the layer thicknesses aims at a constant pavement structure along the full length of the road which is suitable for the varying traffic loads.

B.10.7 Construction Equipment

Table 8 provides indicative lists of the key equipment required in the construction phase (not including tunneling equipment).

Table 8: Key Equipment Section F4

No.	Equipment Type and Characteristics	Minimum Number required
1	Bulldozer (>245HP)	4
2	Excavator (>100HP)	12
3	Crushing and screening plant – mobile type at least 150 m ³ /h including rock material washing machinery	2
4	Concrete Paving Machinery width not less than 9.0 m for 2-layer concrete placing including film-forming machinery	2
5	Small Concrete Paving Machinery width not more than 5.0 m including film-forming machinery	1
6	Front Loader (>135HP)	15
7	Concrete batching plant (>150m ³ /hr)	2
8	Motor grader (>135HP)	10
9	Vibratory roller (> 13T)	8
10	Tipper truck (10T)	30
11	Tipper truck (16T)	30

No.	Equipment Type and Characteristics	Minimum Number required
12	Mobile concrete carriers (>25T)	25
13	Transit mixer (>6m3)	6
14	Crane (100 tons)	4
15	Crane (250 tons)	2
16	Rotary drilling Machine	8
17	Roadheader	2
18	Excavator Hammer	8
19	Jack Hammer	8
20	Pusher Leg	4
21	Truck mixer concrete pump	10

B.11 Source of Materials

B.11.1 Borrow Material

An assessment of the volumes of cut and fill are provided in **Section G.7.3** which discusses the management of spoil material. No additional quarries or borrow pits will be needed under this Project.

B.11.2 Concrete Batching and Asphalt

Bitumen and bituminous products are not produced locally in Georgia and is mainly imported from Iran, Azerbaijan and Romania. Bituminous products, which are necessary for the project (production and construction) must be imported and comply with European standards.

Cement is produced locally by companies such as Saqcementi and Kartuli Cementi in Kaspi (approximately 70 km east of the Project area), other sources of cement may also be found closer to the site.

The Contractor will be responsible for ensuring the concrete batching facilities and asphalt plant comply with the conditions outlined in **Section G.7.4** and that all necessary permits to operate are obtained from the MoEPA

In case Contractor decides to run asphalt production facility the issues must be agreed with MoEPA. Asphalt production belongs to activities listed in Annex II to Environmental Assessment Code. MoEPA will make a decision in the need of EIA for this activity based on the screening procedure (ref. Environmental Assessment Code (document code: 360160000.05.001.018492).

The Contractor will source concrete and asphalt from existing batching plants or from his own dedicated plant. **Section G.7.4** provides explicit conditions for operating batching plants and asphalt plants and the conditions for sourcing concrete and asphalt from existing plants.

B.11.3 Technical and Potable water

Approximately 200 m³ of technical water will be needed per day during the construction phase and around 15 m³ of potable water per day. Most technical water will be sourced from the rivers adjacent to the construction sites. Potable water will be sourced from existing water supply

pipelines, or will be provided to camps in reusable bottles – no single use bottles will be permitted. The final locations of the extraction points (for both technical and potable water) will require the approval of the Engineer and the RD prior to the start of extraction to ensure that over extraction of water resources does not happen. Potable water will also need to be tested regularly throughout the construction period to ensure it meets the drinking water standards of GoG.

B.12 Camps and Storage Areas

B.12.1 Construction Camps

Camp sites will be selected keeping in view the availability of an adequate area for establishing campsites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. The final locations of the camps will be selected by the Contractor after the approval from the RD and the Engineer.

The area requirement for construction camps will depend upon the workforce deployed and the type and quantity of machinery mobilized. For example, the camps may include rock crushing plant and concrete batching facilities. In view of the area required, it will not be possible to locate campsites within the RoW and the contractors will have to acquire land on lease from private landowners. The construction camp will also have facilities for site offices, workshop and storage yard, and other related facilities including fuel storage.

The Contractor will provide the following basic facilities in the construction camps:

- Safe and reliable water supply.
- Hygienic sanitary facilities and sewerage system.
- Treatment facilities for sewerage of toilet and domestic wastes
- Storm water drainage facilities.
- Sickbay and first aid facilities.

Detailed criteria for siting of construction camps and establishment of facilities are given in **Section G.7.4**.

B.12.2 Storage Areas

Temporary storage areas will be required for certain activities, such as the storage of sand and gravels and construction equipment. These storage areas may range in size from anything between 50 m² to more than a hectare. The precise locations of these temporary facilities is not known at this stage, as such mitigation measures shall be prepared to ensure that these areas are sited in approved locations.

B.13 Temporary Roads

The project included temporary road forecasts for access to construction sites, in particular to the main intervention sites, i.e. to tunnel portals and areas where bridges are envisaged. These temporary roads allow to access the construction sites from the existing roads. In general, such roads must be removed at the end of their use, unless otherwise notified by the Employer.

These forecast roads have been represented in the project for the sole purpose of indicating possible access routes and to evaluate the cost of construction within the Bill of Quantities (BoQ). These schemes of design are indicative and not mandatory, although suggested: the Contractors, according to their working methods, available machinery and experience, can

change them and must in any case submit to the Employer, or his Engineer, a detailed plan for such access roads and will also have to provide for the temporary acquisition of the relevant areas.

Such plan must be complete with detailed drawings of the elements that make up the road, the areas and the properties affected by possible occupation outside the areas owned by the administration, calculation reports if necessary. In addition, in this plan the existing traffic affected by the passage of construction vehicles must be shown and the Contractor will be responsible for requesting authorization from the Authority managing the use of the same infrastructure.

The Contractor shall install tanks for washing the truck wheels at the access points to the work site in order to guarantee the cleanness of the existing roads used for transport. The Contractor must also provide for the restoration of the existing roads if the Employer ascertains that the passage of construction vehicles has deteriorated the level of service. This assessment will be done in contradiction, to the presence of the Contractor, the Engineer and the Employer. Once ascertained, the costs for the restoration of such roads are totally on charge of the Contractor.

B.14 Road Safety

Besides a signage and markings plan in line with the best international motorway standards, the design has particularly focused on road restraint systems.

Safety barriers will be installed at the edges of the carriageways to prevent out-of-control vehicles from leaving the motorway or encroaching the opposite carriageway. In particular, as well as along the median, the barriers will be installed on the bridges and sections in embankments, where the expected consequences following a run-off are greater than a possible crash with the barrier. Both rigid and semi-rigid barriers will be implemented.

Rigid barriers - A rigid concrete barrier in line with current Georgian standards will be installed along the median. The barrier is anchored to the road infrastructure and has a profile that is similar to a New-Jersey type, so that vehicles can be redirected in the event of an impact. Similar barriers will be used on bridges.

Semi-rigid barriers - Guardrails have to comply with the European Standard EN-1317 "Road Restraint Systems" or comparable standards. In particular the roadside barriers shall be tested to properly retain heavy vehicles (13 tons) impacting at 70 km/h, i.e. containment level H2 according to EN-1317 standard. This containment class takes into account the high percentage of heavy vehicles expected on the highway (about 15%).

Moreover, in order to limit the width of the verge behind the barrier to 80 cm, the working width of the barrier shall be consistent with this distance, i.e. class W2 according to EN-1317 standard.

Finally, in order to assure an adequate anchoring of the posts to the ground and avoid a soil collapse in case of crash, the planting depth shall be at least of 115 cm, thus assuring a correct plastic bending of the steel post ("plastic hinge"). This measure has been assessed through soil modeling with FLAC3D software.

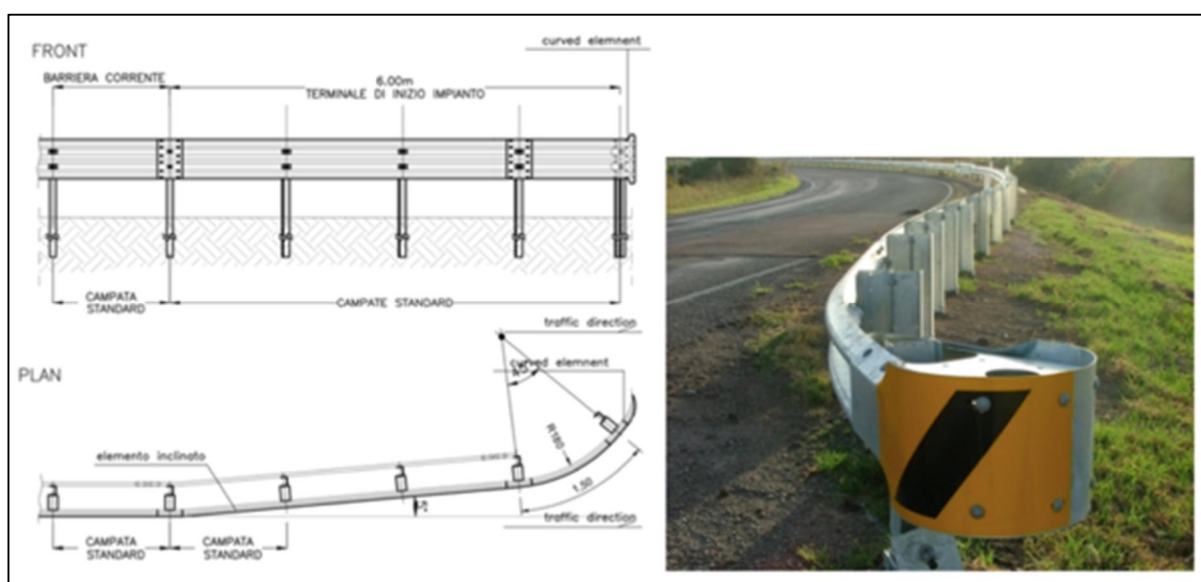
In order to assure a smooth transition between semi-rigid and rigid barriers (e.g. approaching to the bridges), the guardrail is gradually stiffened by doubling the number of posts in the ten spans preceding the rigid barrier.

Finally, special attention is given to the barrier terminals, which are curved outwards with respect to the mainline and terminated at full height. There is ample evidence, in fact, that this layout is safer than the ramped terminals that can cause vehicles to be launched and rolled. It is also recommended, if available on the local market, to install a Modified Eccentric Loader Terminal (MELT), which ensures even higher performance.

The main road safety benefits the project will deliver are the following:

- Reduced risk of vehicles leaving their lane to avoid potholes and surface deformations;
- Improved sight distances;
- Better separation between pedestrians and vehicles; and
- Better night driving conditions due to wider carriageway and improved pavement centerline markings.

Figure 26: Barrier terminal layout (left) and an example of MELT (right)



B.15 Traffic Projections

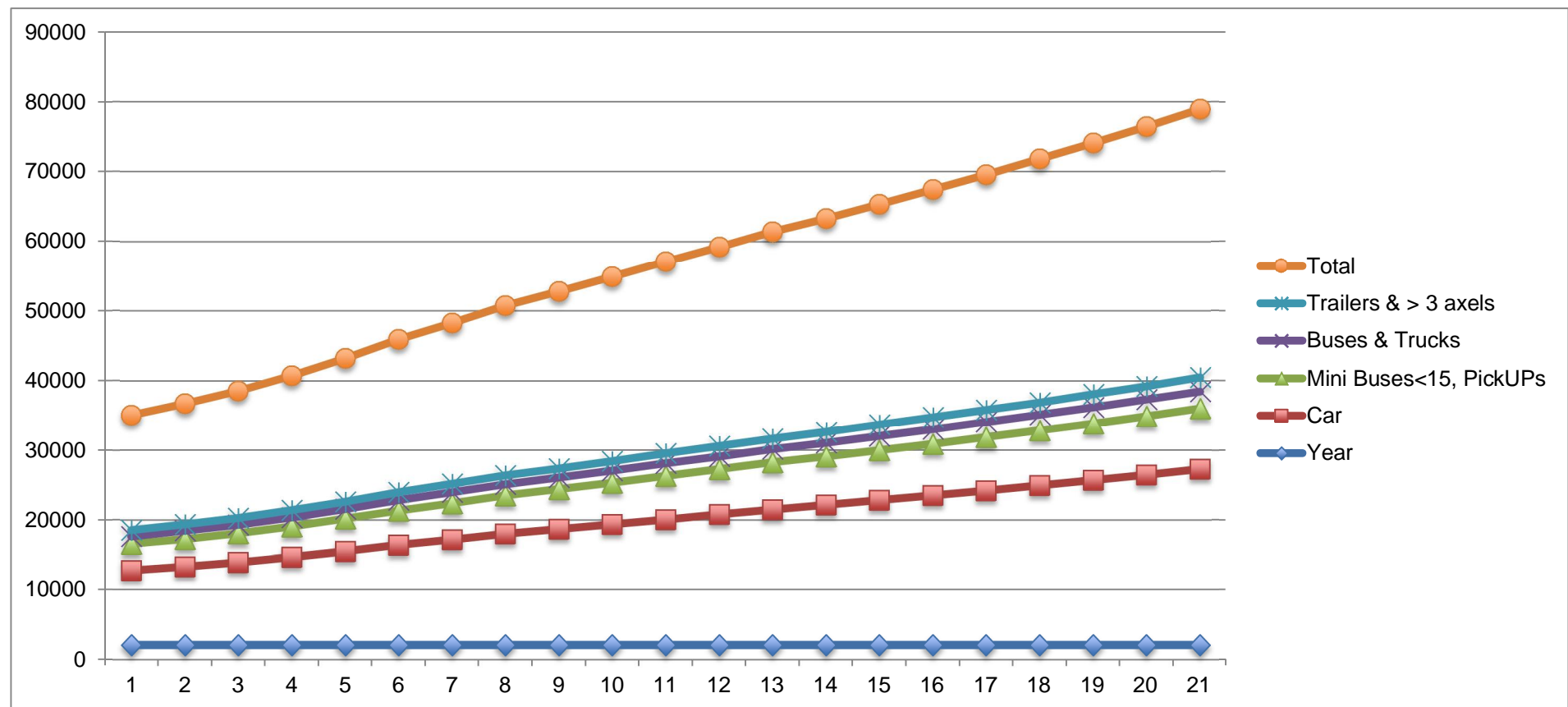
Traffic forecasts for Dzirula are presented below by Table 9 and Figure 27.

Table 9: Traffic Forecasts

Year	Car	Mini Buses<15, Pick-ups	Buses & Trucks	Trailers & > 3 axels	Total
2017	10791	3740	1117	889	16536
2018	11331	3927	1168	929	17355
2019	11942	4139	1225	975	18281
2020	12653	4385	1292	1029	19359
2021	13484	4673	1370	1090	20618

Year	Car	Mini Buses<15, Pick-ups	Buses & Trucks	Trailers & > 3 axels	Total
2022	14366	4979	1452	1156	21954
2023	15142	5248	1524	1213	23127
2024	15960	5531	1600	1273	24364
2025	16630	5764	1661	1322	25377
2026	17328	6006	1725	1373	26432
2027	18056	6258	1792	1426	27532
2028	18751	6499	1858	1478	28586
2029	19473	6749	1926	1533	29681
2030	20116	6972	1986	1581	30655
2031	20780	7202	2049	1631	31661
2032	21465	7440	2114	1682	32701
2033	22174	7685	2180	1735	33774
2034	22906	7939	2249	1790	34883
2035	23661	8201	2320	1846	36028
2036	24442	8471	2393	1904	37211
2037	25249	8751	2468	1964	38432

Figure 27: Forecasted Traffic, Dzirula, 2017 - 2037



C. Alternatives

C.1 General

One of the objectives of an EIA is to investigate alternatives to the Project. In relation to a proposed activity “alternatives” means different ways of meeting the general purposes and requirements of the proposed activity. The following section provides an assessment of alternative corridors, alignments, transport modes and technologies, as well as the ‘no action’ alternative.

C.2 The No Action Alternative

The “No Action” Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project Road. The “No Action” Alternative would result in the continued deterioration of the road, bridges and drainage structures along the RoW, thereby impeding the economic development of the Project Area and the Imereti region. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area. In light of these considerations, the “No Action” Alternative is deemed to be neither prudent nor in the best interest of Georgia or those with an interest in, and attempting to assist restoration of, Georgia’s well being.

C.3 Alternative Road Corridors

Given the complex topography of the region and Georgia in general, there are no other feasible alternative corridors that would be able to compete with the existing corridor in terms of travel times. In addition the Project forms part of the overarching program to upgrade the E-60 motorway which includes many sections that have recently been upgraded, or are in the process of upgrading (or detailed design), including the sections of road joining the start and end points of the Project road.

C.4 Alternative Alignments

Feasibility Study - As part of the Projects feasibility study a range of alternative alignments were studied. The F2, F3 and F4 sections were grouped together under the heading of Section 2BC. Five alternative alignments were proposed for this 2BC section. The key features for each candidate alternative alignment with bidirectional 4 lane road are summarized in Table 10.

Table 10: Key Features of Alternative Alignments with Bidirectional 4 Lanes

Parameter	Alternative Alignment				
	Alt. 2BC-1 (Opt. Blue)	Alt. 2BC-2 (Opt. Green)	Alt. 2BC-3 (Revised Yellow Line)	Alt. 2BC-4 (Red)	Alt. 2BC-5 (Navy)
Total Road Length	50.6 km	49.9 km	48.7 km	48.3km	46.5m
Minimum Horizontal Radius	250 m	250 m	450 m	800	1,200m

Parameter	Alternative Alignment				
	Alt. 2BC-1 (Opt. Blue)	Alt. 2BC-2 (Opt. Green)	Alt. 2BC-3 (Revised Yellow Line)	Alt. 2BC-4 (Red)	Alt. 2BC-5 (Navy)
Maximum gradient	6 % / 7%	6 %	5 %	5 %	4 %
Structure - Bridges	3,939 m	4,854 m	9,720 m	11,680m	8,140 m
Length - Tunnel	9,223 m	11,815 m	15,211 m	17,500m	28,680 m
Earthwork - Cut (m ³)	4,878,844	7,999,914	3,556,837	3,128,890	-
- Fill (m ³)	1,978,999	2,251,942	3,017,640	2,152,170	-
Demolishing of buildings	88 buildings	167 buildings	133 buildings	153 buildings	-
Affected forest area (tree cutting)	26.3 ha	43.9 ha	39.3 ha	20.8 ha	-
Length of river interference	2,980 m	1,741 m	n/a	n/a	-
Use of existing road	26,070 m	1,216 m	960m	650 m	-
Length through or nearby villages	12.0 km	16.1 km	9.7 km	9.5 km	-

* Detailed information of Alt. 2BC-5 is not available since Navy Line is conceptual alignment of high speed line. The Consultant has estimated the cost using the plan drawing only.

The alternatives were assessed based on a multi-criteria analysis approach (MCA). Alignments Blue, Green and Yellow were assessed from an environmental perspective, including impacts on landscape, air quality, noise, and biological diversity and ecological integrity. From an environmental view the yellow alignment scored the best, but including all aspects (financial, social, engineering, etc) the blue alignment gained the highest score. The Project road is based broadly on the blue alignment.

Detailed Design - The alignment has been updated based on the insights gained during the FS and previous phases of drafting the detailed design. Essentials of the update were as follows:

- Adaptation to the design standards proposed by the Consultant and approved by the RD;
- Review of the Feasibility Study issues; □
- Analysis and verification of the solutions provided in the previous design phase, mainly based on the observations during several site visits;
- Explore the interactions between the road in project and the existing road network to find the most appropriate solutions;
- Study of the best solutions to ensure the maintenance of traffic during the construction of the new road; and
- Reduction of impacts on environment and resettlement.

The analysis of the alignment shown in the Feasibility Study clearly indicates that the methodological approach was to try to update the existing road, maintaining as much as possible the old one.

This cost saving approach was the main drawback and compromised the geometry of the alignment: horizontal and vertical radii and slopes were often very close to the minimum and the overall geometry of the road needed smoothing in some sections.

In addition, the Feasibility Study showed some shortcomings in the definition (normal for that stage of Design) that may have led to a significant increase of costs in the Detailed Design. These are mainly found in:

- **Local roads/accessibility:** because of the difficult terrain and (in this Section) presence of numerous settlements, the connecting road network must be identified and reorganized, considering also that the highway belongs to a higher road category, therefore it is not possible to maintain direct access for private properties or roads with very low category. This necessity, in particular, carried to the acknowledgement that the existing road should be maintained in some section.
- **Construction phases:** the construction of a highway in this area, with constraints caused from terrain and settlements, has the additional difficulty coming from the necessity to maintain traffic over the entire road section during the full construction. This carries to conflicting needs that shall be considered and addressed during the detailed design, that may require the modification of the “optimal” design: in some cases, the best option may not be feasible either for the possibility to organize the construction phases and maintaining the traffic, or because this requirement would carry to too expensive temporary arrangements.

These considerations have been translated into a series of updates of the alignment provided by the Feasibility Study.

The updating of standards has led to an increase in the minimum planimetric radius from 240 to 450m and the keeping of the road width of 3.75m even in the design speeds of 80km/h. Both choices improve road safety for increased visibility and perceived road continuity for the driver.

Considering the above a realignment of the whole section was made as part of the detailed design.

C.5 Alternative Transport Modes

As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F3) is one of the last remaining sections of the road requiring upgrading. Accordingly, the Project is focusing on the upgrading of the E-60 and will not consider any other transport mode as an alternative.

C.6 Alternative Pavement Types

Only one pavement type was considered for the motorway and interchanges; rigid concrete.³ The rigid pavement structure is recommended for the following reasons:

- Concrete pavements are already constructed on preceding sections of the E60 Highway. The pavement designs for the already constructed sections were carried out in accordance to the German pavement design standard RStO.
- The high traffic load over the design life with heavy truck traffic requires a high strength to prevent rutting. The concrete pavement has a flexural strength and is less dependent on variations in subgrade strength. Deformation in the subgrade is not transferred to the subsequent layers.
- Along the alignment extreme varying surface temperatures of the pavement are expected from hot summer temperature to freezing in winter. Also contraction and expansion of the concrete slabs have to be considered by expansion joints, the integrity of the concrete is not reduced. Asphalt pavements may become soft in summer leading to rutting and hard and brittle in winter.

³ Asphalt pavement structure will however be used for all Slip Roads, bridges and all Minor Roads and bridges.

- The concrete surface is not damaged by the unavoidable oil and grease leaking from passing vehicles. The life span of a concrete pavement is general higher compared to a flexible pavement and maintenance cost might be also lower as the initial construction costs could be higher.
- For the actual situation in Georgia with no local bitumen production which requires all bituminous products to be imported, the concrete production from local available sources (gravel and cement) seem to be in more than one respect advantageous.

C.7 Alternative Spoil Disposal Locations

Initially the static balance of spoil material generated by the Project was estimated to be lower than the final calculated figures. spoil material from cut and tunnels was planned to be disposed of in the Kutaisi bypass. However, according to the RD this option would be too expensive given the huge volume of material to be moved there. Additionally, this option would have meant a large volume of daily truck movements (more than 200) travelling more than 50 kilometers along the E-60 through urban areas, including Zestaphoni.

After this, a further three sites were identified for spoil disposal as indicated in Table 11. Figure 28 to Figure 30 indicate the locations of the spoil disposal areas which are all located adjacent to the existing alignment thereby reducing the journey lengths of waste disposal trucks along the existing road.

Table 11: Spoil Disposal Areas

Reference ID	Area (m ²)	Height (m)	Volume (m ³)
DA1	47,000		370,000
DA3	38,000		300,000
DA4	16,000		150,000

Figure 28: Spoil Disposal Area DA1 (approx. KM3.5)

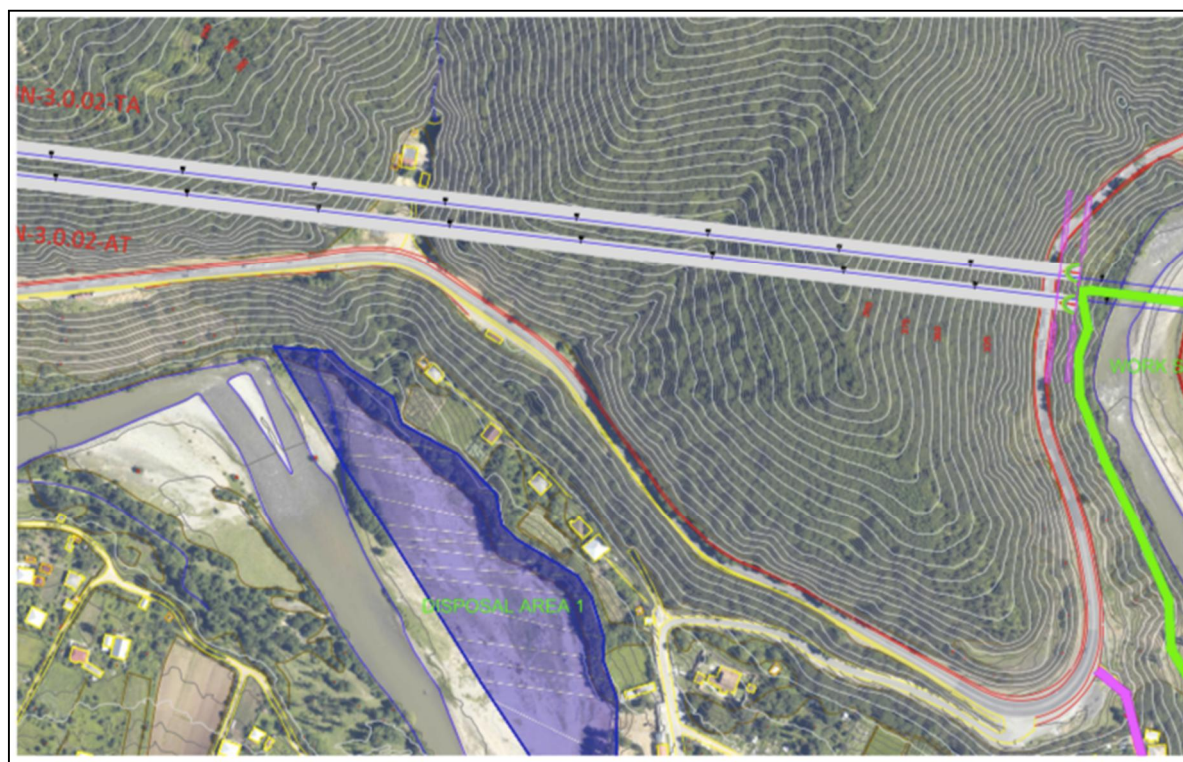


Figure 29: Spoil Disposal Area DA3 (approx. KM8.1)

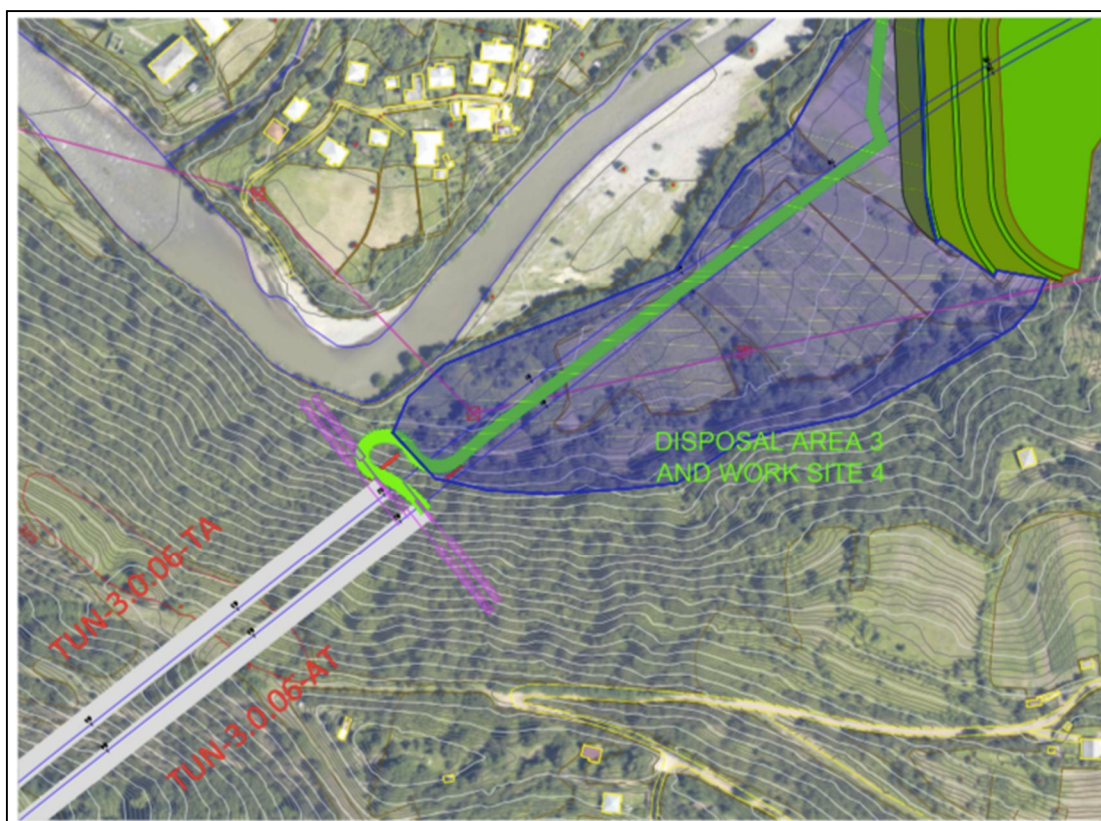
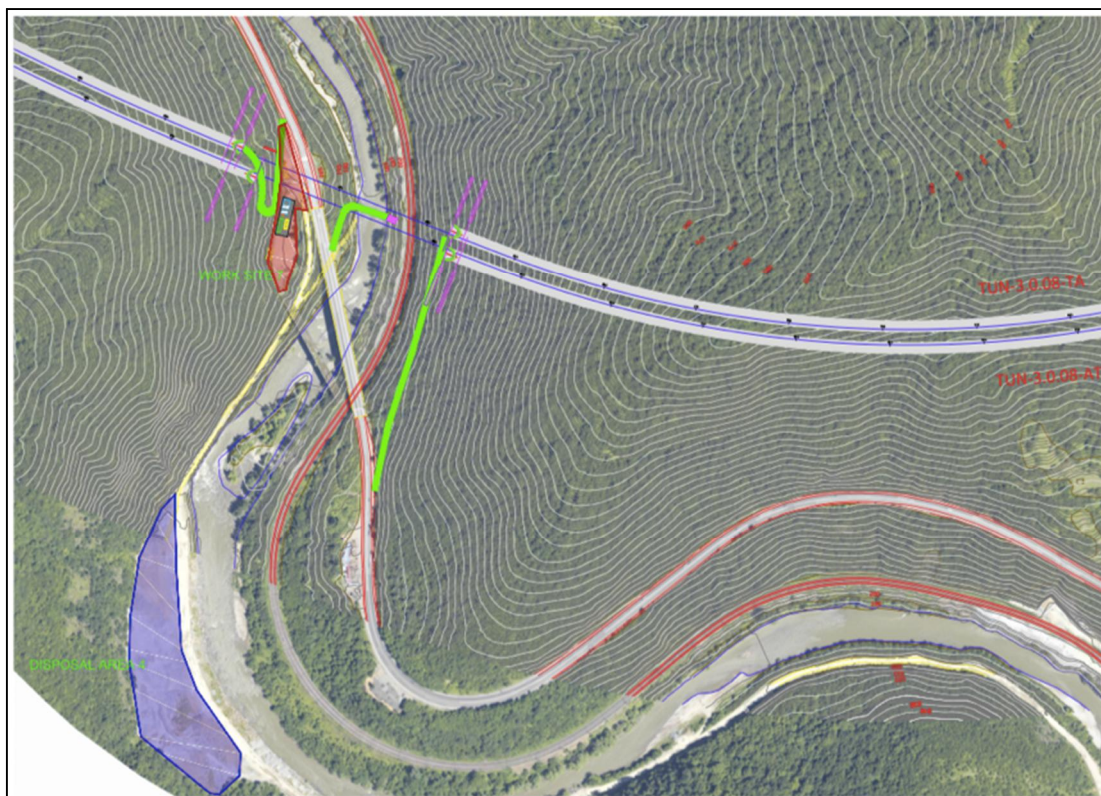


Figure 30: Spoil Disposal Area DA4 (approx. KM12)



However, options DA1 and DA4 were eliminated as they are located within the river floodplain. DA3 is however, considered a potential option as there are no significant impacts to habitat or the local community. The topsoil in this area would be stripped, stored and replaced on the spoil area as part of any works thereby allowing the area to be re-used for agricultural uses.

Three additional alternative spoil location sites were then identified by the Detailed Design Consultant close to Boriti, see Figure 31. Initial desk-top screening of the sites indicated that the two locations north of the existing road would require a large amount of tree felling in an area which could potentially be described as natural habitat. In addition, these sites were considered quite complex in terms of their topography and hydrological conditions. Accordingly, these sites were screened out of the assessment.

That left one remaining potential location for the placement of the spoil material, the large area to the south of Boriti. In terms of location, it suits both sections F2 and F3, being at the start and end points of both road sections. This means that long distance vehicle movements will be eliminated. However, the original identified access road from the E-60 is located opposite the medical facility in Boriti, and as such, if this spoil disposal location is to be used, it is recommended a new alternative river crossing is constructed away from this sensitive site (dust could be a significant issue in the summer months).

The site itself is located on a plateau area, meaning that hydrological issues would be minimized. It is also noted that this area comprises what appear to be open quarries, indicating that this site is already impacted quite heavily by human activity. Vegetation on this plateau is less dense than the other identified spoil areas meaning less tree cutting would be required. Also, the site is capable of containing all spoil material for both sections F2 and F3.

Figure 31: Locations of Potential Spoil Disposal Sites



Notwithstanding the above, the final selection of spoil locations rests with the Contractor, who may wish to choose alternative locations for cost reasons. There are a number of critical actions that the Contractor must complete before using this, or any other area as a spoil location, including the development of a EIA to meet national requirements. These measures are outlined in **Section G.7.3** below.

C.8 Alternative Construction Camps and Laydown Areas.

The locations of these facilities is not currently known. The Contractor will choose the sites which will need to follow the guidelines for siting and permitting as outlined in this EIA

D. Environmental Laws, Standards and Regulations

D.1 General

This section of the EIA provides a summary of:

- Environmental Legislation of Georgia;
- The Administrative Framework;
- Environmental Regulations and Standards of Georgia;
- National Technical Regulations Relevant to the Project;
- Environmental Permitting Procedure;
- Permit and Licenses Required for Off-site Works During Construction;
- International Conventions Relevant to the Project Ratified by Georgia;
- An overview of the ADB safeguard policies.

D.2 General

Georgian legislation comprises the Constitution, environmental laws, international agreements, subordinate legislation, normative acts, presidential orders and governmental decrees, ministerial orders, instructions and regulations. Along with the national regulations, Georgia is signatory to a number of international conventions, including those related to environmental protection.

MoEPA is responsible for regulating the activities that affect the natural environment.

D.3 Environmental Legislation of Georgia

A list of Georgia's environmental legislation as it pertains to the proposed project is given in Table 12.

Table 12: List of environmental laws and regulations relevant to the project

Year	Law / Regulation	Consolidated version -Last revision	Code
1994	Law on soil protection	07/12/2017	370.010.000.05.001.000.080
1995	Constitution of Georgia	13/10/2017	010.010.000.01.001.000.116
1996	Law on subsoil	07/12/2017	380.000.000.05.001.000.140
1996	Law on environmental protection	07/12/2017	360.000.000.05.001.000.184
1996	On the system of protected areas	07/12/2017	360.050.000.05.001.000.127
1997	Law on wildlife	07/12/2017	410.000.000.05.001.000.186
1997	Law on water	07/12/2017	400.000.000.05.001.000.253
1999	Law on protection of atmospheric air	07/12/2017	420.000.000.05.001.000.595
1999	Forestry code of Georgia	07/12/2017	390.000.000.05.001.000.599
1999	Law on compensation of damage from hazardous substances	07/12/2017	040.160.050.05.001.000.671
2000	Law on regulation and engineering protection of the sea and river banks	05/05/2011	400.010.010.05.001.000.830
2003	Law on Red List and Red Book	07/12/2017	360.060.000.05.001.001.297

Year	Law / Regulation	Consolidated version -Last revision	Code
	of Georgia		
2005	Law on licences and permits	23/12/2017	300.310.000.05.001.001.914
2003	Law of Georgia on conservation of soil and restoration-amelioration of soil fertility	07/12/2017	370.010.000.05.001.001.274
2014	Waste code	07/12/2017	360160000.05.001.017608
2017	Environmental Assessment Code	07/12/2017	360160000.05.001.018492

Brief summaries of the listed documents are given below:

Constitution of Georgia states the basic rights of people to live in a healthy environment and obligation to protect it. According to constitution everyone has the right to obtain complete, objective, and timely information about environmental conditions (Article 37 Part 3). It assures that the state shall protect environment and foster sustainable development (Article 37 Part 4). It establishes a legal framework that guarantees public access to information about the condition of the environment (Article 37 Part 5, Article 41 Part 1).

Environmental Assessment Code (EAC). The Code establishes a legal basis for regulating issues related to projects and strategic documents, which implementation may have significant impact on the environment, human life and health. It regulates the procedures related to environmental impact assessment, strategic environmental assessment, public participation in decision-making, trans boundary environmental impact assessment; defines rights and obligations of the developer, the planning authority, the public and the competent authorities in the course of decision-making envisaged by this Code; describes procedures of issuing Environmental Decision; exemption rules. The law includes two annexes. Annex I lists activities subject to EIA, Annex II - lists activities/projects that require screening procedure. Screening is responsibility of MoEPA. Under the EAC construction of international and interstate roads; construction and operation of tunnels and/or bridges on the international and interstate roads belongs to activities subject to EIA. According to the document, the main stages of environmental impact assessment include:

- Screening;
- Scoping procedure;
- Preparation of the EIA Report by the developer or the consultant;
- Ensuring public participation;
- Examination of the information presented in the EIA Report and any supplementary information provided by the developer to the Ministry as well as assessment of the information received through the public participation and consultation processes;
- Expertise procedure;
- Implementation of transboundary environmental impact assessment procedure (weather appropriate);
- Issuance of Environmental Decision or the decision on refusal to implement the project by the Minister.

Law on Licenses and Permits regulates legally organized activities posing certain threats to human life/health, and addresses specific state/public interests, including usage of resources, regulates activities requiring licenses/permits, determines types of licenses/permits required, and defines the procedures for issuing, revising and cancelling of licenses and permits. The law is generic and refers to the Environmental Assessment Code for details of environmental permitting (Environmental Decision) procedures.

Law on Environmental Protection regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities (without distinction-legal form) in the field of environmental protection and in the use of nature on all Georgia's territory including its territorial waters, airspace, continental shelf and special economic zone. The law defines the principles and norms of legal relations, rights and obligations and responsibilities, awareness raising, education and scientific research in the field of environment, key players and principles of environmental management; describes economical mechanisms and levers; ecological insurance; basics of environmental audit; environmental requirements during privatization; justifies needs of environmental standards and limits (air, water, soil, noise, vibration, fields, radiation) and ecological requirements for production, transportation and storage of goods and food products; ecological requirements applicable to waste; states necessity of environmental impact assessment and related issues (strategic environmental protection and transboundary environment assessment) referring to Environmental Assessment Code; defines general principles of environmental protection; considers different aspects on protection of ecosystems, protected areas, issues of global and regional management, protection of ozone layer, biodiversity, protection of Black Sea and international cooperation aspects. As stated in the law, in order to protect the climate against the global changes, the subject of the business activity is obliged to observe the limits to green-house gas emissions as well as to take measures for mitigating this emission. The emission of the green-house gases is regulated on the basis of integrated control of pollution of environment (Article 51). Besides, the subject of the business activity is obliged to reduce or stop production and use of such chemicals, which are likely to have effects on the ozone, layer of the earth and cause depletion of it (Article 52).

The status, of natural resources, study and usage of mineral resources is regulated by the **Law of Georgia on Subsoil**. The law describes rights and obligations of the users (Including re-cultivation after expiration of the license term), duration of the licenses (for energy resources – up to 45 years; for metal ores – up to 40 years; up to 30 years for construction materials and other non-ore mineral resources; ground water and gas (except for the natural gas) – up to 25 years); protection of natural resources and safety requirements; termination of license; state supervision and control over the use of mineral resources; general requirements during mining. With regards to the issues related to the licenses for use of the natural resources the law gives reference to the law on Licenses and Permits, Law on Oil and Gas and related regulations. The law states the need for protection of environment and OHS during operation (mining), including requirements for waste (including waste water) management. According to the law extraction and treatment of mineral resources from deposits both of natural and technogenic origin (soil disposal areas) are subject to state supervision and control.

The **Waste Management Code** (2015) provides the legal conditions for implementation of measures aiming at prevention of generation of waste and increased re-use, environmentally-sound treatment of waste (including recycling and extraction of secondary raw materials, energy recovery from waste, as well as safe disposal). The following summarizes the key points of the code.

Article 7 - General waste management requirements

- Waste, depending on its type, properties and composition, shall be collected, transported and treated in a manner not impeding its further recovery.
- Waste shall be collected, transported and treated in a manner which excludes, to the maximum extent possible, pollution of the environment and risks for human health.
- In case of waste pollution caused by waste transport activities, the waste transporter shall be responsible for taking clean up measures.
- The producer and holder of waste is obliged to treat their waste
- on their own or hand it over for collection, transport and treatment to persons entitled to

carry out such operations in accordance with this Law and legislation of Georgia.

- Where waste has been submitted for recovery or disposal, the original producer's and/or holder's responsibility shall remain until recovery or disposal is completed.
- Persons who collect and transport waste shall hand it over for treatment to appropriate facilities, holding the relevant permit or registration.
- The burning of waste outside permitted incinerators shall be prohibited.

Article 14 - Company waste management plan

- Legal and natural persons that produce more than 200 tonnes of non-hazardous waste or 1000 tonnes of inert waste or any amount of hazardous waste annually, shall prepare a company waste management plan.

Article 15 – Environmental Manager

- The persons under Article 14 of this Law shall nominate a suitable person as a company environmental manager.

Article 17 - General obligations for hazardous waste management

- The production, collection and transportation of hazardous waste, as well as its storage and treatment, shall be carried out in conditions providing protection for the environment and human health. It shall be prohibited to
 - a) discard hazardous waste outside waste collection containers;
 - b) discharge it into the sewerage systems or underground or surface waters, including the sea;
 - c) burn it outside waste incinerators permitted for that purpose;
 - d) treat it outside waste treatment facilities permitted to treat such type of waste

Article 18 - Special obligations for hazardous waste management

- Waste producers that produce more than 2 tons of hazardous waste per year shall
 - a) create and implement a suitable separation and collection system for such waste;
 - b) designate an environmental manager, pursuant to Article 15 of this Law, responsible to make arrangements for the safe management of said waste;
 - c) make arrangements for briefing and training for staff handling hazardous waste.
- Until the exact content of waste is unknown, the waste shall be regarded as hazardous.
- Hazardous waste for which no appropriate treatment techniques and/or technologies are available in accordance with the requirements of this Law within the territory of Georgia shall be exported for treatment. Until the export is carried out, the waste shall be safely stored at temporary storage facilities.
- The Ministry may exceptionally once allow for an extended storage period of up to one year if this is justified and does not harm human health or the environment.
- Hazardous waste may only be collected and transported by a natural or legal person after its registration pursuant to this Law.

Article 29 - Obligations for keeping records and reporting on waste

- Records on waste shall be kept and waste reports shall be submitted to the Ministry by natural and legal persons:
 - a) dealing professionally with collection, transport and/or treatment of waste;
 - b) which produced more than more than 2 tones non-hazardous (excluding municipal waste) waste or any amount of hazardous waste per year.

Law on Protection of Atmospheric Air. The law regulates protection of atmospheric air from man-caused impact. Pollution of atmospheric air is emission of hazardous substances originating from activities which are able to have negative impact on human health and environment. Four types of pollution are considered (Part II, Chapter IV, Article II.2): Pollution of environment with hazardous matter, Radiation pollution of atmospheric air.

Pollution with microorganisms and biologically active matter of microbial origin, Noise, vibration, electromagnetic fields and other physical impact. Maximum permitted limits for concentration of hazardous substances into the atmospheric air are defined for each contaminants and represent maximum concentration of hazardous pollutants, in averaged time span, recurring action of which has not have negative impact on human health and environment. Maximum permitted levels of emission of hazardous matters into the atmospheric air are defined with allowance of prospective of development of the enterprise, physical, geographical and climatic conditions, dispersion of emitted substances, background concentration of pollutants emitted from other neighboring enterprises, taking into account inter-location of existing or planned dwellings, sanatoria and recreation zones. In compliance with the law (Clause 28), in order to restrict pollution from the stationary sources⁴ of hazardous emissions the limits of emissions are to be set. The limit of pollution from the stationary source of emission is permitted quantity (mass) of emitted hazardous matters (Clause 29). Maximum annual emission level means the maximum permitted limit of discharge. This is annual permitted quantity of emission predetermined by technology in conditions of standard permitted capacity of discharge. Annual maximum capacity is defined for each hazardous substance and is calculated so that for each stationary source of emission cumulative emission from all registered sources of discharge does not exceed relevant maximum permitted value. Discharge of hazardous emissions from the stationary sources of emission without approved limits of discharge is forbidden. The standards of emissions (Clause 30) are to be worked out by the enterprise itself. According to the law (Clause 38) the enterprise is responsible for conducting self-monitoring which includes measurement of emission (evaluation), recording/registration and accounting. Emission which has not been recorded in self-monitoring record is considered illegal. As mentioned in the Clause 51 results of the monitoring and information on pollution of the air with hazardous substances is transparent and accessible for the public.

Law on Water regulates water use, defines rights and obligations of water users, sets out the types of licenses for the use of water, the rules and conditions of their issuance, considers conditions of suspension, withdrawal and deprivation of license, regulates water flows. The law states liability of all natural and legal persons to prevent pollution of catchment basins, water reservoirs, snow and ice covers, glaciers, permanent snow cover with industrial, household and other wastes and emissions which may cause deterioration of the underground water quality; prohibits piling of industrial and household wastes near the public water headwork's and in their sanitation zones, bans construction of facilities and implementation of any other activity which may cause water pollution; sets requirements for forest use within water protection zones. The state management of water protection and use is exercised through accounting, monitoring, licensing, control and supervision.

1. State monitoring of water is implemented by the Legal Entity under Public Law - the National Environmental Agency under MoEPA. By virtue of the law when locating/designing/constructing/commissioning of a new or reconstructed enterprise, or other facility, as well as in introducing of new technological process capable to affect the state of water, the rational water use is to be secured. At the same time, attention is to be paid to the measures ensuring due accounting of water abstracted from and returned to water bodies; protection of water from contamination, pollution-and depletion; avoidance of the unfavorable water impact; restriction of land flooding up to minimum necessary level, protection of land from silting, swamping or drying up; as well as environmental protection and landscape preservation.

⁴ Stationary source of pollution of the atmospheric air is stationary device or construction with a special emission unit. Any stationary device or construction which, proceeded from its technological peculiarities, is not fitted with sputtering device is also considered as a stationary source of emission.

2. Under the law required is purification, up to the fixed standard, of the waste water discharged in a water body. In order to protect the quality of water resources, the law requests creation of sanitary protection zone that consists of three belts, each having a special regime. The procedure fixing the water quality standards, the maximum permissible rates of emission of harmful substances (including microorganisms) into ambience, the water abstraction quotas and the temporary rates (limits) of emission of harmful substances (including microorganisms) into water is defined by the Law of Georgia on the Environmental Protection.
3. Georgian legislation may provide liability for other violations of law in the water protection and use sphere. Water users shall compensate for damages caused by violation of the law on Water in the amount and under procedure established by legislation of Georgia. Under the Article 17 (Protection of natural resources of the Black Sea) anadromous fish species (fish species seasonally migrating upstream of a river against the current) within the rivers of Georgia shall be protected by creation of conditions necessary for their reproduction, through conservation of the habitat, determination of procedures for regulating the fishing industry, determination of a total permissible amount of catching these species within the territorial waters, and within and outside special economic zones of Georgia, also through implementation of other measures defined by the legislation of Georgia. Article 20 (River water protection zone) defines protection zone of a river shall be its adjacent territory, where a special regime is established to protect water resources from pollution, littering, fouling, and depletion. This zone may include its dry bed, adjacent terraces, natural elevated and steep riversides, as well as gullies directly adjacent to riversides. 3. The width of a river water protection zone shall be measured in meters from the edge of a riverbed to both sides under the following procedure:
 - 10 meters - in the case of a river up to 25 kilometers long,
 - 20 meters - in the case of a river up to 50 kilometers long,
 - 30 meters - in the case of a river up to 75 kilometers long,
 - 50 meters - in the case of a river over 75 kilometers long.
4. Within this zone, prohibited is to: a) construct, expand or reconstruct functioning enterprises, except for cases directly determined by law; b) spray, by air atomisation, perennial plants, sown crops and forest lands with toxic chemicals; c) keep, collect or place toxic chemicals and mineral fertilizers, as well as any other wastes as defined in the legislation of Georgia. It is requested that hydraulic structures located within a water protection zone shall be normally equipped with appropriate technical facilities to completely exclude the possibility of river pollution and littering.

Law on Wildlife. The law regulates wildlife protection and use including hunting and fishing. The main goal of the law is to ensure protection and restoration of wildlife, its habitats, preservation and sustainability of species diversity and genetic resources, creation of conditions for sustainable development, taking into account the interests of present and future generation; legal ensuring of wildlife protection (including in-situ and ex-situ conservation, translocation and reproduction of wildlife) and state-based provision of use of wildlife objects. In addition to this law, Georgian legislation on the wildlife is based on the Constitution of Georgia, Georgia's international agreements and treaties, laws on Environmental Protection and on the System of Protected Areas, law of Georgia on Wildlife and law of Georgia on the "Red List" and "Red Book". It is one of the main goals of the Environmental Protection Law to support the preservation of biodiversity of the country, the preservation of rare, endemic and endangered species, the protection of the marine environment, and the maintenance of the ecological balance (Art. 3.1 (d)). The Law contains regulations on both wild animals and plants which are threatened by extinction and those which are not. Two main legal acts regulating the issues of species protection in Georgia.

Law on Red List and Red Book which gives the legal definitions of Red List and Red Book (relevant recommendations and methodological issues) of endangered species of Georgia. The Red List structure was also legally defined, as well as the relevant procedures for including species in the Red List, procedures for revising, and updating of it. The Law also regulates issues related to planning and financial matters connected with the protection, taking of, rehabilitation and conservation of endangered species. The Red List of Georgia was approved by Order of President of Georgia No. 303 (2006), later - by the Resolution of the Georgian Government No. 190, dated 20-Feb-14. The law defines special cases when removal of individuals of the Georgian Red List species from their habitats is allowed. Decisions are made by the Government of Georgia.

Forestry Code regulates relations and state policy in the area of forestry management, use and protection. The code specifies all activities, which may be carried out in Forestry Fund. It allows only those activities, which are related to forest resource protection or use such as timber logging, collection of non-timber resources, use of area for agriculture or recreation, establishment of hunting farms, etc. State forestry fund may be used for a special purpose in urgent cases. Decisions are made by the Government of Georgia.

Law on Soil Protection. The law provides the policy requirements and principles of the protection and preservation of fertility soil resources against negative impacts. Soil protection is the state problem since correct and rational use of all types of soil, including barren soil, saline soils, swamped soil, alkali soil and aqueous soil are the main reserve of dynamic development of agriculture and of the national economy as a whole. The purpose of the present Law is to establish the rights and the duties of landholders, landowners and the state in the field of soil protect. The law defines soil protection measures and methods and prohibits certain activities, e.g. use of fertile soil for non-agricultural purposes; implementation of non-agricultural activity without topsoil removal and conservation; any activity, which results in deterioration of soil properties, etc. In addition to this law soil protection issues are regulated by order #2-277 (25.11.2005) of the Minister of Agriculture on approving Recommendations for Complex Measures for Soil Protection from the Erosion.

Law of on Conservation of Soil and Restoration-Amelioration of Soil Fertility is to ensure conservation and improvement of soil in the territory of Georgia, define the legal principles, measures, limitations and prohibitions to that end; soil conservation and fertility restoration improvement measures. It prohibits unregulated grazing, removal of windbreaks, application of non-registered fertilizers or other substances, soil contamination and any activity, which results in deterioration of soil properties and facilitates desertification, swamping, salinization, etc. Businesses that use soil or conduct activities upon soil that have the potential to negatively impact soil conservation are required to follow the Law and related normative documents and regulations, including Order #113 (27.05.2005) of the Minister of Environment and Natural Resources' Protection on affirming regulation on "Removal, Storage, Use and Re-cultivation of the Fertile Soil Layer" and 2) Resolution of the GoG #424 (31.12.2013) on affirming technical regulations on "Removal, Storage, Use and Re-cultivation of the Fertile Soil Layer". These documents consider issues of land resources protection and rational use and issues related to removal, storage, use and re-cultivation of the fertile soil layer during different activates. According to the regulation, restoration of degraded soil fertility must be implemented using re-cultivation (technical and biological) methods.

Law on System of Protected Areas. Forms a legal basis for planning, establishment and maintenance and assignment of categories of protected areas, described funding issues for each category. It specifies ownership forms of land and other natural resources in protected areas, allowed and prohibited activities.

Law on Regulation and Engineering Protection of Seacoast and Riverbanks of Georgia provides general principles and requirements for protection of coastal areas and riverbanks from negative environmental impacts.

Law on Compensation for Damage Caused By Hazardous Substances Includes principles and procedures for compensating the negative impacts caused by discharge of hazardous substances into environment.

Laws and regulations related to social aspects and land ownership applicable to the project are presented in Table 13.

Table 13: List of social and land ownership related laws relevant to the project

Year	Law / Regulation	Last revision	Code
1996	Law on agricultural land ownership	16/06/2017	370.030.000.05.001.000.132
1997	Civil code of Georgia	23/12/2017	040.000.000.05.001.000.223
1997	Law on compensation of land substitute costs and damages due to allocating agricultural land for non-agricultural purposes	25/12/2014	370.020.000.05.001.000.244
1999	Law on rules for expropriation of property for public needs	06/09/2013	020.060.040.05.001.000.670
2007	Law on cultural heritage	07/12/2017	450.030.000.05.001.002.815
2007	Law on public health	07/12/2017	470.000.000.05.001.002.920
2010	Law on state property	07/12/2017	040.110.030.05.01.004.174
2010	Labour Code	04/05/2017	270000000.04.001.016012

Brief summaries of the listed documents are given below:

Civil Code regulates contractual relations, describes the rights and responsibilities of natural and legal persons, defines the penalties in the case of violations of the requirements set out in the document. The Civil Code differentiates between movable and immovable property and provides rules for acquiring title over property, as well as any proprietary or obligatory rights thereto. This piece of legislation must be taken into account when entering into contracts in Georgia.

Labour Code regulates employment relations, unless such relations are otherwise regulated by international treaties that have been implemented in Georgia. Employers are obliged to comply with requirements and clauses of the document for the purpose of ensuring that the rights of employees are protected.

Law on Public Health regulates legal relations for ensuring a safe environment for human health. It indicates quality norms of for air, soil and water pollution and restrictions related to ionized radiation, noise and vibration. The limits must be complied with. Section 7 of the law is dedicated to safety of technological processes.

Law on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-agricultural Purposes defines compensation amounts, required at the time of allocation, use or disposal of agricultural land parcel for non-agricultural purpose; the payment procedure and the procedure for changing the agricultural land category, including payment of losses to landowners or land users, as a result of restricting their rights or reducing the quality of their land.

Law on agricultural land ownership. Objective of the law is to ensure improvement of the structure of agricultural land based on rational use of resources, avoidance of splitting and

unsustainable use of the land plots. The law defined the rules for acquisition and selling the land, participation of the state in agricultural land related relations. The law deals with land ownership issues, restrictions of land alienation in case of co-ownership, sets priority of the state in buying out the agricultural land plots.

Law on rules for expropriation of property for public needs outlines respective procedures and conditions for expropriation of private property as well as procedures for compensation payment for expropriated property or the transfer of other property with the same market value.

Law on State Property regulates relationships on state property management and transfer for use by others, defines special requirements and procedures for transfers. The Ministry of Economy and Sustainable Development is the state authority in charge of the property.

Law on cultural heritage sets out procedures for protection of cultural heritage and permitting arrangements for archaeological investigations.

D.4 Administrative Framework

Ministry of Environment Protection and Agriculture (MoEPA) - In December 2017, MoEPA had its responsibilities split between the ministries of agriculture and economy, with the latter also taking over the Ministry of Energy.

MoEPA is responsible for all environmental protection issues and agriculture in Georgia. The responsibilities of the Ministry as the competent authority are: a) to intermit, limit, or stop any activity having or likely to have adverse impact on the environment, b) to carry out screening of planned development, c) to implement scoping, d) to issue environmental decision for project subject to EIA procedure (ref. Environmental Assessment Code), c) to control the execution of mitigation measures by the developer, d) to organize public meetings and discussion of an estimation of influence on environment and prepares the documentation (the project of the order of the minister) to let out the permission to influence to environment.

Ministry of Economy and Sustainable Development (MoESD) - MoESD is responsible for carrying out the review of technical documentation (including conclusion of independent experts) and issuing Permits on Construction for projects, as well as for supervision over constructing activities and for arranging Acceptance Commission after completion of construction. State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the Ministry of Economy and Sustainable Development of Georgia. Following to reorganization of MoEPA and the Ministry of Energy the MoESD took over the functions of the latter, as well as part of the main functions of MoEPA (viz. licencing activity).

The Roads Department - The Roads Department of the Ministry of Regional Development and Infrastructure (RD) is responsible for elaboration of policy and strategic plans related to developing motor roads, management of road and traffic related issues and construction, rehabilitation, reconstruction and maintenance of the roads of public use of international and national significance, utilizing funds from the state budget, loans, grants and other financial sources. Thus, the RD is responsible for the procurement of design and EIA studies, as well as works on construction and rehabilitation of roads and is responsible for ensuring compliance with the Georgian legislation and environmental and social requirements of the relevant donor organizations. Control of implementation of the Environmental Management Plan (EMP) is direct responsibility of the Roads Department. Within the RD there is Environmental Division dealing with the environmental issues. This division is supposed to review the EIAs and EMPs related to the Roads Department projects and perform monitoring of compliance of the contractor's performance with the approved EMPs, EIAs, environmental

standards and other environmental commitments of the contractor.

The Ministry of Culture, Monument Protection and Sports - responsible on supervision of the construction activities in order to protect archaeological heritage. In case if construction is to be carried out in a historic sites or zones of cultural heritage, consent of the Ministry of Culture, Monument Protection and Sport is also required for issuing construction permit.

The “National Service for the Foodstuffs Safety, Veterinary and Plant Protection” of the Ministry of Environmental Protection and Agriculture - responsible for implementation of complex sanitary protection measures in case of identification burial sites during earthworks. Information about suspicious burial sites should be delivered to the “National Service for the Foodstuffs Safety, Veterinary and Plant Protection” of MoEPA by the Construction Contactor (field environmental officer) and RD field officer.

D.5 Environmental Regulations and Standards

Georgia has a large set of specific standards that refer to emission, effluent, and noise standards, as well as standard to handle and dispose specific wastes ranging from sewage to hazardous wastes. The following summarizes these laws and standards along with IFC and EU standards.

D.5.1 Ambient Air Quality Standards

Maximum permissible concentrations (MPC) for **air** born pollutants are set by the hygienic standards on Maximum Permissible Concentrations of Air Born Pollutants for Settlements (HN 2.1.6. 002-01), see Table 14. This project will also ensure compliance with IFC guideline values (not interim targets) as these values are, in some instances, more stringent than the national standards, the most stringent standards are highlighted in green.

Table 14: Ambient Air Quality Standards

Parameter	Averaging Period	Limit (µg/m ³)		
		Maximum Permissible Concentration (MAC) for Air Quality	IFC Guideline Value	EU Ambient Air Quality Guidelines
Nitrogen Dioxide (NO ₂)	30 minutes	200	-	-
	1 Hour	-	200	200
	24 Hours	40	-	-
	1 Year	-	40	40
Sulphur Dioxide (SO ₂)	10 minutes	-	500	-
	30 minutes	500	-	-
	1 Hour	-	-	350
	24 Hours	50	20	125
Carbon Monoxide (CO)	30 minutes	5000	-	-
	24 Hours	3000	-	-
Total Suspended Particulates (TSP) / Dust	24 Hours	150	-	-
	30 minutes	500	-	-
PM10	1 year		20	40
	24 hour		50	50
PM2.5	1 year		10	25
	24 hour		25	-
Ozone	8-hour daily maximum		100	120

D.5.2. Surface Water Quality Standards

The values of Maximum Admissible Concentrations of the harmful substances in surface are provided in the Environmental Quality Norms approved by the Order #297N (16.08.2001) of the Ministry of Labour, Health and Social Protection (as amended by the Order No 38/n of the same Ministry of 24.02.2003). The admissible level of pollutants in surface water is given in Table 15. All effluents shall comply with the Georgian National Standards. However certain parameters are not specified in the national standards for these IFC Guidelines are being used as shown in the Table.

Table 15: Applicable Standards for Surface Water Quality

Parameter	Maximum Permissible concentration	Source
pH	6.5-8.5	National
Diluted Oxygen, mg/l	4-6	National
BOD5, mg/l	30	IFC
COD, mg/l	125	IFC
Total Nitrogen, N, mg/l	10	IFC
Total Phosphate, mg/l	2	IFC
Chlorides, mg/l	350	National
Oil Products, mg/l	0.3	National
Zinc (Zn ²⁺)	1g/kg	National
Lead (Pb total)	23.0	National
Chrome (Cr ⁶⁺)	32.0	National
Cadmium (Cd, total)	6.0	National
Total Suspended Solids, mg/l	50	IFC

Quality requirements depend on category of water body (ref. Technical regulations of protection of surface water from pollution, approved by decree #425 of the government of Georgia, 31/12/2013). The categories are: a) household water use, b) domestic water use and c) fisheries. The latter, in its turn, splits in highest, first and second categories.

Table 16: Water quality requirements by water use category

	Water use category			
	Household water use	Domestic water use	Fisheries	
			Highest first	and Second
	Increase not higher than listed below is allowed			
Suspended solids	0.25mg/l	0.75 mg/l	0.25mg/l	0.75 mg/l
	For rivers with natural content of suspended solids 30mg/l, around 5% increase is allowed			
	If waste water contains suspended particles with deposition rate above 0.2mm/sec discharge in water reservoirs is not allowed. Discharge of effluents containing suspended particles with deposition rate above 0.4mm/sec is prohibited.			
Floating matter	Patches and films of oil, petroleum products, fats must not be detectable			
Colour	Must not be visible in water column		Water must not have unusual colour	
	20cm	10cm	-	
Odour, taste	Water must not have odour and taste of higher than 1 unit intensity		Water must not result in unusual odour and taste in fish	
	After chlorination of other treatment	Without treatment	-	

Temperature	After discharge of waste water, temperature in water reservoir must not exceed by more than 5% compared to the natural value		For water bodies where cold water lowing fish is found (<i>Acipenseridae</i> , <i>Coregonidae</i>) maximum allowable temperatures in summer and winter are 20C and 5C respectively, for other water bodies 28C (in summer), 8C (in winter)	
pH	Must be in 6.5-8.5 interval			
Water mineralisation	<1000mg/l, Incl. chlorides – 350mg/l; sulphates - 500mg/l	To comply with requirement given in section related to taste (see above)	In accordance with taxation	
Dissolved oxygen	Must not be lower than			
	4mg/l	4mg/l	6mg/l	6mg/l
Biological oxygen demand	At 20C must not exceed			
	3mg/l	6mg/l	3mg/l	6mg/l
Chemical oxygen demand	Must not exceed			
	15 mg/l	30 mg/l	-	-
Chemical substances	Must not exceed maximum permissible limits			
Pathogens	Must be free for pathogens, including viable helmint eggs, tenia oncosperes and viable cysts of pathogen organisms			
Toxicity	-	-	At the point of discharge and control section of the river toxic impact must not be observed.	

D.5.3 Groundwater Quality Standards

250. Groundwater quality standards are not set under Georgian law. Drinking water quality standards are commonly used instead as assessment criteria for groundwater. Quality of drinking water is determined by the Technical Regulations for Drinking Water (approved by order №58 of the government of Georgia, (15.01.2014).

Table 17: Drinking water quality criteria

Parameter	Units	Value
Odour	Unit	2
Taste	Unit	2
Colour	Grad	15
Turbidity	Turbidity units (formazine) or mg/l (kaolin)	3.5 or 2
Metals and Miscellaneous		
Boron, B	mg/kg	0.5
Arsenic, As	mg/kg	0.01
Cadmium, Cd	mg/kg	0.003
Copper, Cu	mg/kg	2
Mercury, Hg	mg/kg	0.006
Nickel, Ni	mg/kg	0.07
Lead, Pb	mg/kg	0.01
Selenium, Se	mg/kg	0.01
Zinc, Zn	mg/kg	3
Total Petroleum Hydrocarbons, TPH	mg/kg	0.1
Cyanide	mg/kg	0.07

Parameter	Units	Value
Sulphate	mg/kg	250
Chloride	mg/kg	250
pH	pH value	6-9
Sodium, Na	mg/kg	200
Microbiological characteristics		
Thermotolerant coliforms	Bacteria in 100cm ³	not allowed
Tota; coliforms	Bacteria in 100cm ³	not allowed
Mesophylic aerobes and facultative anaerobes	Colony forming units in 1cm ³	< 50
Colifagues	Negative colonies in 100m ³	not allowed
Sulphitereducing clostridia	Spores in 20cm ³	not allowed
Lamblias and cysts	Cysts in 50dm	not allowed

D.5.4 Noise Standards

Admissible noise standards of the IFC and Georgian national standards for residential areas are similar. The national standards for noise are set according to the Technical regulation – Acoustic noise limits for rooms/premises in residential houses and public establishments (Document #300160070.10.003.020107, Date 15/08/2017) see Table 18.

For IFC noise impacts should not exceed the levels presented in Table 19 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site. This project will comply with both IFC Guidelines and Georgian Standards. Note that Georgian standards refer to the allowable limits indoors, not at the building façade.

Table 18: Georgian Standards for Noise Levels

Purpose/use of area and premises	Allowable limits (dBA)		
	L _{day}		23:00 – 08:00
	08:00 - 19:00, Day	Evening 19:00-23:00	L _{night} , Night
Educational facilities and library halls	35	35	35
Medical facilities/chambers of medical institutions	40	40	40
Living quarters and dormitories	35	30	30
Hospital chambers	35	30	30
Hotel/motel rooms	40	35	35
Trading halls and reception facilities	55	55	55
Restaurant, bar, cafe halls	50	50	50
Theatre/concert halls and sacred premises	30	30	30
Sport halls and pools	55	55	55
Small offices (≤100m ³) – working rooms and premises without office equipment	40	40	40
Small offices (≤100m ³) – working rooms and premises without office equipment	40	40	40
Conference halls /meeting rooms	35	35	35
Areas bordering with houses residential, medical establishments, social service and children facilities (<6 storey buildings)	50	45	40
Areas bordering with houses residential, medical establishments, social service and children facilities (>6 storey buildings)	55	50	45
The areas bordering with hotels, trade, service, sport and public organizations	60	55	50

Note:

1. in case noise generated by indoor or outdoor sources is impulse or tonal, the limit must be 5dBA less than indicated in the table.
2. Acoustic noise limits given above are set for routine operation conditions of the 'space', i.e. windows and door are closed (exception – built-in ventilation canals), ventilation, air conditioning, lighting (in case available) are on; functional (baseline) noise (such as music, speech) not considered.

Table 19: IFC Noise Level Guidelines

Receptor	One hour L_{aeq} (dBA)	
	Daytime 07.00-22.00	Night-time 22.00 – 07.00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

For workplace noise the following IFC standards are applicable.

Table 20: IFC Work Environment Noise limits

Type of Work, workplace	IFC General EHS Guidelines
Heavy Industry (no demand for oral communication)	85 Equivalent level L_{aeq} , 8h
Light industry (decreasing demand for oral communication)	50-65 Equivalent level L_{aeq} , 8h

D.5.5 Vibration Standards

The Georgian Standards for vibration are designed for human comfort. These are shown in Table 21. Note that no standards for building damage exist.

Table 21: Georgian General Admissible Vibration Values in Residential Houses, Hospitals and Rest Houses, Sanitary Norms 2001

Average Geometric Frequencies of Octave Zones (Hz)	Allowable Values X_0, Y_0, Z_0			
	Vibro-acceleration		Vibro-speed	
	m/sec ²	dB	m/sec 10 ⁻⁴	dB
2	4.0	72	3.2	76
4	4.5	73	1.8	71
8	5.6	75	1.1	67
16	11.0	81	1.1	67
31.5	22.0	87	1.1	67
63	45.0	93	1.1	67
Corrected and equivalent corrected values and their levels	4.0	72	1.1	67

Note: It is allowable to exceed vibration normative values during daytime by 5 dB during daytime. In this table of inconstant vibrations, a correction for the allowable level values is 10dB, while the absolute values are multiplied by 0.32. The allowable levels of vibration for hospitals and rest houses have to be reduced by 3dB.

The American Association of State Highway and Transportation Officials (AASHTO) (1990) identifies maximum vibration levels for preventing damage to structures. Table 22 summarizes the maximum levels.

Table 22: AASHTO Maximum Vibration Levels for Preventing Damage

Type of Situation	Limiting Velocity (in/sec)
Historic sites or other critical locations	0.1
Residential buildings, plastered walls	0.2-0.3
Residential buildings in good repair with gypsum board walls	0.4-0.5
Engineered structures, without plaster	1.0-1.5

D.5.6 Soil Quality

Soil quality is currently assessed by Methodological Guides on Assessment of Level of Chemical Pollution of Soil (MG 2.1.7.004-02). However, these limits will soon be replaced as Georgia harmonizes its regulations with the EU and moves away from the outdated standards prepared while part of the Soviet Union. The national standards for soil quality are given in Table 23 along with the limits proposed by MoEPA and the Ministry of Labour, Health and Social Affairs.

Table 23: Soil screening values

Compound	Units	Current Limit	Proposed Limit
Metals and Miscellaneous			
Arsenic, As	mg/kg	2	30
Cadmium, Cd	mg/kg	2*	0.5** – 1.0***
Copper, Cu	mg/kg	3-132*	60**-100***
Mercury, Hg	mg/kg	2.1	
Nickel, Ni	mg/kg	4-80*	60**- 80***
Lead, Pb	mg/kg	32-130*	100** - 140***
Zinc, Zn	mg/kg	23-220*	130** - 200***
Total Petroleum Hydrocarbons	mg/kg	1000	-
Cyanide	mg/kg	0,2	-
Volatile Organic Compounds			
Benzene	mg/kg	0.3	0.05
Toluene	mg/kg	0.3	-
Total xylenes	mg/kg	0.3	0.05
Semi Volatile Compounds			
Benzo(a)pyrene	mg/kg	0.02-0.2	0.1
Isopropylbenzene	mg/kg	0.5	-
Pesticides			
Atrazine	mg/kg	0.01-0.5	-
Lindane	mg/kg	0.1	-
DDT (and its metabolite)	mg/kg	0.1	0.075

* Note: Sodium and neutral (clay and clayey) pH >5.5 - No screening value available, ** Light Soils, ***Other Soils

D.6 National Technical Regulations Relevant to the Project

Technical (national) regulations applicable to the road project in Georgia include:

- Law on Roads (310.090.000.05.001.000.089, last amended in 2013);
- Construction norms and regulations 2.05.03-84 - Design of bridges, viaducts, overpasses and pipes;

- Construction norms and regulations 2.05.02-85 - Motor roads (regulate traffic safety, environmental issues, set forth main technical and traffic operation norms, crossings and intersections, paving aspects, etc.)

According to these documents:

- International and national importance roads should be built bypassing the settlements. Access roads to the settlements should be provided. To allow modernisation, the distance between the residential area (settlement) and the edge of the carriageway must be not less than 200m, distance to agricultural land - 50m. If because of technical or economical purposes the road is to cross the settlement, minimum distance to the residential area must be 50m, in case noise barriers are provided – 25m. For local roads minimum distance to residential area must be 50m, distance from agricultural land – 25m.
- To protect residential area from noise and emission impact, 10m wide green barrier must be arranged;
- Along with technical and economic aspects environmental impacts must be taken into account during design and construction;
- Prior to arrangement of temporary infrastructure and preparation of road embankment, topsoil must be removed and stockpiled until subsequent use for re-cultivation after completion of construction and removal of all temporary facilities;
- Roads along the rivers, lakes and reservoirs must be built with consideration of protection zone boundaries for the surface water bodies.

D.7 Environmental Permitting Procedures

Since the draft of the EIA report for the planned development was disclosed before the entry into force of the new Environmental Assessment Code, permit application/issuance procedure follows the steps defined in the law on Environmental Impact Permit described below:

Table 24: Environmental impact permit issuance procedure (valid for the projects disclosed before January 1, 2018)

Step	Action	Comment	Timeframe
1	Publication of information on the project in central and regional newspapers.	The advertisement has to include the project title, location, place and the date, time and venue of public disclosure meeting(s). It will also identify locations where the EIA can be reviewed and where comments may be submitted.	Day 0
2	• Submission of the draft ESIA report to the Ministry of Environment Protection and Agriculture (MoEPA))	Hard copy and electronic version of the report delivered to MoEPA	within 3 days after announcement in the newspapers
	• Feedback	Receiving public comments on the disclosed EIA	45 days from announcement in the newspapers
	• Meetings with stakeholders including local community, NGOs, local authorities, etc.	All comments and questions must be documented and answers, minutes of the meeting(s) written up.	Between 50 and 60 days after publication of the advert
3	Development of final version of the	Comments received from	After arranging a

Step	Action	Comment	Timeframe
	ESIA and submission to MoEPA (together with Non-technical Summary, Technical Summary, reports on emissions and allowable limits) for the state ecological examination.	the stakeholders considered in the report. Minutes of meeting(s) enclosed to the document as attachment. .	public review of the EIA report and development of final version of the EIA, the developers is authorised to submit, within one year, an application to the permit issuing administrative body for a permit
4	Consideration of the documents by MoEPA and issuance of conclusion		20 days after registration of an application for a permit and submission of the EIA package to the MoEPA.

Note: According to the national regulations (Law on Licenses and Permits and in compliance with Resolution of the GoG on rules and conditions for issuance of construction permit (N57, 24 March 2009, with amendments) construction/ modernization of highways requires Construction Permit.

After January 1, 2018, the procedure including screening, scoping and EIA stages is has been introduced. According to the Code, 'construction of international and interstate roads' and 'construction and operation of tunnels and/or bridges on the international and interstate roads' belong to the Annex 1 projects that require EIA. This does not differ from the statement given in the law on Environmental Impact permit replaced by the new Code. The differences between the old and the new procedures are in scoping stage, which was not required before and increase role of the MoEPA is the public consultations process.

The procedure described below will be applicable to all international/interstate road and construction and operation of tunnels and/or bridges on the international and interstate roads disclosed after January 2018 (Note, this project was started prior to January 2018 so is not subject to the new rules).

Table 25: Environmental Decision (formerly environmental impact permit) issuance procedure (after January 1, 2018)

Step	Action	Comment	Timeframe
1	Written application to the Ministry submitted by developer.	The application submitted by the developer shall be accompanied with the following documents and/or data: a. EIA report; b. Projects on estimation of the limits for emission of harmful substances into the atmospheric air and for the injection of polluting substances into the surface waters together with the waste waters. c. Notification about a confidential part of a submitted application, if applicable; d. Copy of the document evidencing payment of the fee (500 GEL) in accordance with the existing legislation. e. Electronic copy of above mentioned documents.	Day 0
2	Ministry ensures publication of submitted application and attached	The Developer is entitled to request the Environmental Decision on several activities through a single application, if the activities	within 3 days after submission of

Step	Action	Comment	Timeframe
	documents on its official website as well as on the notice board of the relevant local authorities and/or representative bodies and upon request, provides paper copies of abovementioned documentation.	are significantly interconnected.	the application
3	Minister sets up the Expert Commission		within 5 days after registration of the application
4	Expert commission prepares and submits the expertise conclusion on the EIA report to the Ministry		within 40 days
5	Ministry takes decision on the finding of a deficiency in application		within 15 days after registration of the application
6	Feedback from stakeholders		within 40 days after the publication of the application
7	Publication of the announcement on the public hearing	The announcement on public hearing shall include the information on: a. The content and brief description of the issue to be discussed, format of the discussion; b. The time, place and rules of the public hearing; c. The web address where the respective application, the EIA report and any other information relevant to decision-making will be available as well as indication about the opportunity of accessing the paper copies of these documents during the public hearing.	no less than 20 days prior to organizing the public hearing
8	Public hearing	The Ministry is responsible for organizing and conducting the public hearing. It is chaired and protocolled by a representative of the Ministry. The public hearing is organized in the closest appropriate administrative building to the site of the planned project or within its vicinity. If the project is planned to be implemented within the administrative borders of a self-governing community, the public hearing is organized in the closest appropriate administrative building to the site of the project or within its vicinity and if the project is planned to be implemented within the administrative borders of a self-governing city, the public hearing is organized in the appropriate administrative building	no earlier than 25th day and no later than 30th day after the publication of the application

Step	Action	Comment	Timeframe
		determined by the Ministry, or within its vicinity. The public hearing is open to the public and any person has a right to participate in it.	
9	Prior to issuance of the Environmental Decision or the decision on the refusal to implement the project, the Ministry ensures involvement of the Ministry of Culture and Monument Protection of Georgia, within its competence, in the administrative procedures as other public authority, under the rule envisaged by Article 84 of General Administrative Code of Georgia.		
10	The Minister issues individual administrative legal act on issuance of the Environmental Decision or the decision on the refusal to implement the project		no less than 51 and no more than 55 days after registration of the application
11	Ministry ensures publication of the EIA report, the Expertise Conclusion, the Environmental Decision or the legal act on the refusal to implement the project and the results of public participation on its official website as well as on the notice board of the relevant local authorities and/or representative bodies and upon request, provides paper copies of abovementioned documentation		within 5 days after issuing the Environmental Decision or the legal act on the refusal to implement the project

Note: The table does not include description of the scoping stage procedures.

D.8 Licenses, Permits, and Approvals

The Project will also be required to obtain a number of permits and consents, of which the main permits and the implementing national legislation are described in Table 26. The Law on Licences and Permits governs the issue of all permits and consents. Subject to satisfaction of application requirements, all the permits are issued within 30 days from application submission.

Table 26: Permits Register

Permit Required Activity	Permit Title	Issuing Authority	Implementing Law	Responsible Party for Obtaining License
Pre-construction				
Construction activities	Construction Permit	Ministry of Economy and Sustainable Development	Law No.1775 on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Environmental Decision	MoEPA	Law No.519 on Environmental Protection Law No 890-II	RD

			Environmental Assessment Code	
Construction activities	Cultural Heritage Clearance	National Agency of Cultural Heritage	Law No 4708 "On Cultural Heritage" Law No.1775 on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Visual geological-engineering conclusion	National Environmental Agency	Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"; Order N7 of the Minister of Environment Protection	RD
Construction Phase				
Tree felling in state forest lands for ROW and permanent facilities	Forest use agreement	MoEPA	Law No.2124 on Forestry Code of Georgia; Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use Resolution No.132 of Government of Georgia on Approval of Regulations on Rules and Conditions of Issuance of Forest Usage License	Contractor
Tree felling in state forest lands for Temporary Facilities	Forest Use Agreement	MoEPA	Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use; Order N10/61 of the Chairman of State Department of Forestry	Contractor
Underground water abstraction	Mineral extraction licence	Ministry of Economy and Sustainable Development	Decree of the Government of Georgia N136 of August 11, 2005; Law N 946 "On Fees for Use of Natural Resources"	Contractor
Construction or upgrade of access roads	Approval of construction or upgrade activities	Ministry of Infrastructure and Regional Development; local municipalities	Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	Contractor
Transportation	Transportation	Ministry of	Joint Order N956/1-	Contractor

of oversized and overweight cargo	permit	Internal Affairs	1/746 of the Minister of Internal Affairs and Minister of Economic Development; Law N 700 "On Road Transport"; Law "On Road Traffic"	
Spoil disposal	Spoil disposal approval	MoEPA	Law "On Subsoils", May 8, 2012	Contractor
Import of explosives	Permit to import explosives	Ministry of Internal Affairs	Tax Code of Georgia; Decree of the Government of Georgia N420; Law N2911 "On Control of Technical Hazard"; Order N 1-1/2502 of the Minister of Economy and Sustainable Development	Contractor
Use of explosives	Permit to use explosives	Ministry of Economy and Sustainable Development	Tax Code of Georgia; Decree of the Government of Georgia N420; Law N2911 "On Control of Technical Hazard"; Order N 1-1/2502 of the Minister of Economy and Sustainable Development	Contractor

D.9 Construction Permits

The Law on Licences and Permits defines protocols for the issue, amendment and withdrawal of permits. For projects such as this, a construction permit is needed.

Construction permit – a different hierarchical permit which, proceeding from the economic interests of permit seekers, is divided into three mutually-dependent but in terms of administrative procedure independent stages: I stage – establishment of urban planning conditions; II stage - endorsement of architectural-construction design; III stage – issuance of construction permit. The rules and principles defined by this law for permit issuance shall apply to these stages.

The responsible authority (the RD) must obtain the following approvals before it gets approval from the MoESD:

- Geological conclusions to be issued by National Environmental Agency;
- Cultural heritage clearance to be issued by National Agency of Cultural Heritage;
- Environmental Decision issued by MoEPA;
- Project design approval to be issued by MoESD; and
- Project's registered rights to land.

D.10 State Forest Fund

According to The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use, Article 27¹ State forest land (or State Forest Fund (SFF)) may be used for the purposes of construction of motorways, as well as for other activities which are deemed as special use of forest lands. Article 27 states that if the activity that is deemed as special use of forest land and is subject to Ecological Expertise then the Client (in this case the RD) is obliged to apply to remove all trees identified in the affected SFF area from the SFF register or “de-list” them before they can be cut. The decision to de-list trees and plants from the State Forest Fund of Georgia is issued by the National Forest Agency excepting the vegetation species protected by the Red List of Georgia. A decision to de-list trees and plants from the Red List of Georgia is made by MoEPA. The client must apply to the MoEPA in writing regarding the presence of the Red-Listed species in the project area.

D.11 International Conventions and Agreements

Important international environmental treaties that have been signed by Georgia and may have relevance to the Project are listed in Table 27.

Table 27: International Agreements and Treaties

Date	Title	Status in Georgia	Date
Natural environment			
1961	International Convention for The Protection of New Varieties of Plants	Entry into force	2008
1971	Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat	Entry into force	1997
1973	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Entry into force	1996
1991	Agreement on The Conservation of Populations of European Bats	Entry into force	2002
1995	Agreement on The Conservation of African-Eurasian Migratory Waterbirds	Entry into force	2001
1997	International Plant Protection Convention (1997 Revised Text)	Entry into force	2007
1983	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (CMS)	Entry into force	2000
1992	Rio Convention on Biological Diversity	Entry into force	1994
2000	Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Entry into force	2009
2000	European Landscape Convention	Entry into force	2011
2008	Convention on the Conservation of European Wildlife and Natural Habitats (Bern)	Entry into force	2010
2010	European Landscape Convention	Entry into force	2011
Environmental pollution, waste			
1997	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	Entry into force	2009
1998	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Entry into force	2007
1989	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Entry into force	1995
2001	Stockholm Convention on Persistent Organic Pollutants	Entry into force	2007
Climate			
1994	UN Framework Convention on Climate Change (UNFCCC)	Entry into force	1994

Date	Title	Status in Georgia	Date
		force	
1985	Vienna Convention for the Protection of the Ozone Layer	Entry into force	1996
1987	Montreal Protocol on Substances that Deplete the Ozone Layer, (and its London, Copenhagen, Montreal and Beijing Amendments 2000 and 2011)	Entry into force	1996
1997	Kyoto Protocol to UNFCCC	Entry into force	2005
1999	Geneva Convention on Long Range Transboundary Air Pollution	Entry into force	1999
Cultural heritage			
1954	European Cultural Convention	Entry into force	1997
1972	Paris Convention Concerning the Protection of the World Cultural and Natural Heritage	Entry into force	1992
1982	European Convention on the Protection of the Archaeological Heritage	Entry into force	2000
1985	Convention for the Protection of the Architectural Heritage of Europe	Entry into force	2000
2005	Council of Europe Framework Convention on the Value of Cultural Heritage for Society (Faro convention)	Entry into force	2011
Public participation and information accessibility			
1998	Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters	Ratified	2000
Labour issues			
1930	Forced Labour Convention	Entry into force	1993
1936	Holidays with Pay Convention	Entry into force	1993
1949	Freedom of Association and Protection of the Right to Organise Convention	Entry into force	1999
1948	Right to Organise and Collective Bargaining Convention	Entry into force	1993
1950	European Convention for the Protection of Human Rights and Fundamental Freedoms	Entry into force	1999
1951	Equal Remuneration Convention	Entry into force	1993
1957	Abolition of Forced Labour Convention	Entry into force	1996
1958	Discrimination (Employment and Occupation) Convention	Entry into force	1993
1962	ILO Social Policy (Basic Aims and Standards) Convention	Entry into force	1997
1964	Employment Policy Convention (Geneva)	Entry into force	1993
1973	Geneva Convention concerning Minimum Age for Admission to Employment	Entry into force	1996
1975	Human Resources Development Convention	Entry into force	1993
1978	Labour Relations (Public Service) Convention	Entry into force	2003
1997	Employment Service Convention	Entry into force	2002
1997	Private Employment Agencies Convention	Entry into force	2002

Date	Title	Status in Georgia	Date
1999	Worst Forms of Child Labour Convention	Entry into force	2002

D.12 Asian Development Bank Safeguard Policies 2009

The ADB has three safeguard policies that seek to avoid, minimize or mitigate adverse environmental impacts and social costs to third parties, or vulnerable groups as a result of development projects⁵.

Safeguard Requirements 1: Environment – The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. Eleven ‘Policy Principles’ have been adopted as part of the Safeguard Policy Statement (SPS), including:

1. Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks. (The Project was initially screened by the ADB and classified as a Category A project).
2. Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project’s area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate. (The EIA herewith provides the environmental assessment for the Project, including an assessment of climate change. Transboundary impacts are not applicable).
3. Examine alternatives to the project’s location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative. (Alternatives have been considered, including the ‘no project’ alternative in **Section C – Alternatives**).
4. Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle. (An EMP has been prepared for the Project and is outlined in detail in **Section G – Environmental Management Plans and Institutional Requirements**).

⁵ ADB. 2009. Safeguard Policy Statement, Manila

5. Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance. (Consultations were held to discuss environmental issues, the findings of the consultations (and a description of the Project grievance redress mechanism) are presented in **Section H – Public Consultation, Information Disclosure & Grievance Mechanism**).
6. Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders. (This EIA and its EMP will be disclosed on the EIB and RD web-sites).
7. Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports. (The EIA and its EMP outline a plan to monitor the implementation of the EMP and the institutional responsibilities for monitoring and reporting throughout the Project lifecycle: **Section G – EMP Institutional Responsibilities**).
8. Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources. (No critical habitats have been identified that would be significantly impacted by the Project).
9. Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides. (The EIA and its EMP outline specific mitigation and management measures to prevent and control pollution: **Section G – Environmental Management Plans and Institutional Requirements**. No pesticides will be used during the lifecycle of the Project).

10. Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. (The EIA and its EMP outline the requirement for specific health and safety plans and emergency response plans: **Section G – Environmental Management Plans and Institutional Requirements**).
11. Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of “chance find” procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation. (No physical and cultural resources have been identified that would be significantly impacted by the Project. Chance finds are discussed in **Section G – Physical and Cultural Resources**) and a sample chance finds procedure is provided in **Appendix E**.

Safeguard Requirements 2: Involuntary Resettlement.

The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The safeguard requirements underscores the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

The involuntary resettlement requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) resulting from (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. Resettlement is considered involuntary when displaced individuals or communities do not have the right to refuse land acquisition that results in displacement. A land acquisition and resettlement plan (LARP) has been prepared for the Project to ensure compliance with the safeguard on Involuntary Resettlement.

Safeguard Requirements 3: Indigenous Peoples.

The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples’ identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

The Project does not involve impacts to Indigenous Peoples and therefore no further actions relating to this safeguard are required.

D.13 EIB Statement of Environmental and Social Principles and Standards (2009)

D.13.1 General

The EIB requires that all the projects it is financing are acceptable in environmental and social terms by applying appropriate safeguards to all its operations.

The EIB applies a set of environmental and social requirements throughout the project cycle to help ensure the sustainability of all the projects that it finances. Promoters are responsible for preparing, implementing and operating projects financed by the Bank; they are also responsible for the fulfilment of Bank requirements, especially for legal compliance. The Bank will assist the promoter to fulfil these responsibilities.

The EIB will not finance projects that do not meet its environmental and social requirements as described in the Statement. This includes projects that do not comply with appropriate national and EU environmental and social legislation in force at the time. The requirements of the Bank may go beyond what is legally required.

For projects approved for EIB financing, the obligations of the promoter that derive from the environmental and social requirements of the Bank are described in the Finance Contract signed between the EIB and the borrower.

The EIB monitors the environmental and social performance of the projects it is financing, especially the fulfilment of any specific obligations described in the Finance Contract. The extent of monitoring is a function of the characteristics of the project, the capacity of the promoter and the country context. Monitoring by the Bank is based on reports from the promoter. It may be supplemented by site visits by the Bank and other sources of information, including that provided by affected communities. A breach of contract and/or poor project performance in other respects requires corrective action by the promoter, in agreement with the Bank.

D.13.2 Principles

The EIB refers to EU environmental law as the primary source of its environmental principles. The EIB aims, in accordance with EU policy on the environment, at a high level of protection based on the application of the precautionary principle, and on the principles that preventative action should be taken, that environmental damage should be rectified at source, and that the polluter should pay. □

The EIB considers the need for applying the precautionary principle when there is a risk that a project may cause significant and irreversible damage to the environment. In such cases, measures should be taken by the promoter to avoid in the first place and if a feasible alternative is not available to reduce that risk to an acceptable degree. This applies even where there may not be conclusive evidence of a causal link between the project and its potential negative consequences. The Bank aim is to minimize any negative environmental impacts of the projects it finances. Where such impacts are demonstrably unavoidable, the Bank requires the promoter to apply mitigation measures, and for impacts that cannot be fully mitigated, compensation and/or offsets should be implemented.

The application of the prevention principle means that the promoter should demonstrate that appropriate action to protect the environment has been taken at an early stage. The objective is to prevent any damage from occurring in the first place, through an alternative

project, design or process, rather than to attempt to repair the damage after it has occurred. □

The principle that environmental damage should be rectified at source is enshrined in a number of EU laws, notably those concerning water and air pollution.

It is an objective of the EIB to increase social benefits and decrease social costs in all of the projects it finances, thereby to maximize social well-being; the Bank will not finance a project with significant residual social costs. To achieve this, the Bank follows a rights based approach when considering the social aspects of a project. □

D.13.3 Standards

General Environmental Standards - The EIB requires that all promoters apply good international practices in these respects, where EU law is the benchmark for Bank purposes. The standards, though derived from EU environmental law, where necessary are supplemented by other good international practices, and the Bank reserves the right to require standards that are more stringent than or fall outside EU legal requirements.

For projects in all other regions of EIB activity (Georgia has signed an Association Agreement with the EU, but is not a candidate or potential candidate country), the Bank requires that all projects comply with national legislation, including international conventions ratified by the host country, as well as EU standards. Where EU standards are more stringent than national standards the higher EU standards are required, if practical and feasible. □

The EIB recognizes that for a variety of reasons, including institutional capacity, technological capability, availability of investment funds and consumer ability and willingness to pay, for a particular project the immediate achievement of EU requirements may not be practical and in some cases may not be desirable. When the case arises, it is incumbent on the promoter to provide an acceptable justification to the Bank for a deviation from EU standards, within the framework of the environmental and social principles and standards set out in the Statement. In such cases, provision should be made for a phased approach to higher standards.

In the case of ambient standards, outside the EU, EU standards applied to a specific project may not be the most cost-effective solution in socio-economic terms in order to protect the natural environment and/or to promote social well-being. □

In projects for which the EIB requires a formal EIA, the EIA process and content must be consistent with the requirements of the EU Directive. □

Involuntary Resettlement □- People whose livelihoods are negatively affected by a project should have their livelihoods improved or at minimum restored and/or adequately compensated for any losses incurred. As such, where physical or economic displacement is unavoidable, the Bank requires the promoter to develop an acceptable Resettlement Action Plan. The plan should incorporate and follow the right to due process, and to meaningful and culturally appropriate consultation and participation, including that of host communities. □

Indigenous People and Other Vulnerable Groups □- Where the customary rights to land and resources of indigenous peoples are affected by a project, the Bank requires the promoter to prepare an acceptable Indigenous Peoples Development Plan. The plan must reflect the principles of the UN Declaration on the Rights of Indigenous Peoples, including free, prior and informed consent to any relocation. □

ILO Core Labour Standards □- In the case where there are gaps in implementing the core labor standards of the ILO, the promoter shall develop and implement verifiable programs and procedures to ensure that the core labor principles and standards are adhered to or would be reached during project □implementation. The objective is to prevent unacceptable forms of labor and employment practices and promote the development of the sound management of worker relations.

Occupational and Community Health and Safety - Where there are risks to worker and/or community health, promoters should develop and implement verifiable programs and procedures to ensure community and occupational health and safety standards are aligned with good international practices. The purpose is to avoid or minimize risks and impacts to the health and safety of workers and communities, ensure that employees and company property are safeguarded in a legitimate manner, support the promotion of programs for community health, and reduce the spread of major communicable diseases.

Cultural Heritage - The EIB generally does not finance a project which threatens the integrity of sites that have a high level of protection for reasons of cultural heritage, including UNESCO World Heritage Sites.

Consultation, Participation and Public Disclosure - As an EU body, the EIB complies with the Aarhus Regulation on the application of the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters to Community institutions and bodies. □

Stakeholder concerns should be considered as early as possible in the project assessment process in order to reduce risks and provide for timely resolution of conflicts. For all projects for which the EIB requires a formal EIA, the promoter should conduct a meaningful, transparent, and culturally appropriate public consultation of affected communities and provide for a timely disclosure of appropriate information in a suitable form; there should be evidence that the views expressed have been considered.

Biodiversity - For all projects financed by the EIB, the promoter must demonstrate that a range of alternatives and their impacts on biodiversity has been analyzed. The promoter is also required to apply the mitigation hierarchy, i.e. to take appropriate measures to avoid, minimize or rehabilitate/mitigate impacts that may damage biological diversity. Where residual adverse impacts on biodiversity remain, the promoter may propose biodiversity offsets, where appropriate. The Bank supports the ongoing work to make operational the selective application of biodiversity offsets, while recognizing that certain impacts - such as loss of critical habitat - cannot be offset. □

Critical habitats are areas of particular ecological value and sensitivity, which are defined according to six criteria. The EIB does not finance projects in critical habitats if there are negative impacts in terms of one or a number of the defining criteria, or within the EU unless they fully comply with Community legislation on environmental protection, in particular the Habitats Directive. □The EIB does not finance projects located in protected sites unless they are consistent with the relevant legal requirements and site management plans. Protected sites include Natura 2000 sites designated under EU legislation, sites recognized under the Ramsar, Bern and Bonn Conventions and areas designated or identified for designation as protected areas by national Governments. □

D.14 Gap Analysis of Legislation / Safeguard Policies

D.14.1 EIA Procedures

On January 1, 2018, a new “Environment Assessment Code” was enforced in Georgia. The requirements of this Code are based on the requirements of the EU Environment legislative base and consequently, most of the gaps existing between the environmental requirements of the international financial institutions (IFIs) and Georgian legislation have been filled. It should also be noted that the Environmental and Social Handbook of the European Investment Bank, as well as the Georgian legislation is entirely based on EU Directives.

However, one of the major problematic differences between the international and national legislations having taking many years in vain to eliminate was impossible to solve even this time, after adopting the new legislation. The stage of the Environmental Impact Assessment (EIA) is at issue. Under the requirements of the Georgian legislation, the EIA is developed after the project detailed design is complete, while as per the requirements of the international financial institutions (IFIs), the EIA is prepared at the stage of preliminary design. Under the requirements of a number of international financial institutions, an EIA document may also be developed based on the project concept.

The above-mentioned requirement, in addition to the confusion, results in higher project costs and prolonged project duration, as in fact, it implies drafting two different documents with two public consultations held at each requested location.

As per the law enforced on January 1, 2018, the public review of the EIA developed within the scope of a project financed by ADB or EIB will be done by a consultant (in line with the requirements of ADB or EIB), while after some time, the same public consultations will be done by the representatives of the Ministry of Environment Protection and Agriculture of Georgia at the same time and with the same subject.

This approach is also problematic in case if implementing the projects financed by the international financial institutions. In line with the procedures to finance a project by the IFIs, for project appraisal by the EIB, together with information on environmental impact assessment, the bank must be submitted an Environmental Permit issued by the Ministry of Environment Protection and Agriculture of Georgia. It is at this stage, we have an endless circle, as:

1. The funds needed to develop a detailed design are assigned by the international financial institutions only after the project approval.
2. The international financial institutions require Environmental Permit issued by the local authority as one of the necessary documents for the project approval.
3. On the other hand, as per the requirement of the Ministry of Environmental Protection and Agriculture of Georgia, the Environmental Impact Assessment (EIA) must be developed following the detailed design is in place.

D.14.2 Compensation Planting

The Georgian Government Resolution No. 242 of August 20, 2010 “On the Rules of Forest Use” regarding the forest fund:

In order to accomplish public infrastructural projects, in case of necessity to cut down the timber plants to use the state forest fund with a special designation, a forest user is obliged to pay a single compensation fee under Table 1, Annex 7 of Resolution No. 242 of August 20, 2010 “On the Rules of Forest Use. The compensation fee is used to realize the forest growing and restoration measures by the managing authority. Consequently, the project owner is exempted from accomplishing the compensation planting procedures.

Within the scope of the project, the project implementing agency is obliged to accomplish compensation planting, in case of project requirement to plant the trees as a mitigation measure.

As per the guidelines of the EIB, the project owner is obliged to accomplish relevant compensation planting on his own in agreement with the bank in question and the government of Georgia. There are no specific guidelines from ADB regarding compensation for planting, this will be determined on a project by project basis. However, it has been determined by this EIA that the Contractor will be responsible for the planting of additional trees in addition to compensation payments.

Table 28: Gap analysis between EIB, ADB and Georgian legislation

#	EIB Requirements	ADB Requirements	Requirements of the Georgian legislation	Note
Screening				
1.	<p>Para 37: "Before the EIB proceeds with full due diligence, an E&S screening shall be carried out for all projects" and para 39: ".the following screening checklist should be filled out by the Project Team" (Environmental and Social Handbook B.1.3 Environmental and Social Screening and Project Identification Note (PIN))).</p> <p>The EIB accomplishes screening not only for the activities listed in Annexes 1 and 2, but also in regard of the following directives:</p> <p>1. Compliance with the EU Habitats Directive 92/43/EEC, in particular Articles 6(3) and (4) of the Directives has been met, and appropriate assessment has been carried out for Natura 2000 areas as well as bird areas and the Competent Authority for Nature Conservation has recorded its assessment and conclusions;</p> <p>2. Compliance with the Water Framework Directive, in particular the criteria for derogation laid down in Art. 4 (7) has been met and the studies assessing the impact of the</p>	<p>"ADB is responsible for screening projects to specify ADB's safeguard requirements. ADB will carry out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose. Screening and categorization is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements." (Para. 49 ADB SPS 2009)</p>	<p>The screening can be omitted if the project owner is sure that an EIA report is necessary to develop within the scope of the project (Environmental Assessment Code, Article 7, Part 13).</p> <p>The Georgian legislation assesses the need for the EIA preparation following the project type only. If the type of a specific project does not belong to the type of actions specified by Annex I or II, under the Law, the project owner is authorized not to apply to the Ministry of Environmental Protection and Agriculture without any regard to the degree of sensitivity of the area, in which he/she intends to implement the project.</p>	<p>The actions envisaged by the legislation of Georgia specified under Annex 1 to the Environmental Assessment Code are almost identical to Annex 1 to Directive 2014/52/EU used by EIB.</p> <p>As for Annex 2 to the said laws, both, for the EU Directives and Georgian Law, it specifies the list of activities needing additional exploration in order to decide whether an EIA is needed to develop for the activities in question. In addition, Annex 2 specifies the minimal areas used by the project.</p> <p>Under the Georgian legislation, if territory used for the activities specified by Annex 2 is less than it is indicated area, the project owner does not apply to the Ministry of Environmental Protection and Agriculture notwithstanding if he/she intends to realize the project in urban area, bogged area or</p>

	modification/new activity on the status of water body verified.			<p>resort area.</p> <p>Annex 3 to the EU Directive 2014/52/EU specifies the list of territories, where the project activities are planned to realize. Consequently, unlike the Georgian legislation, EIB, when determining the need for developing EIA for the project, considers the location of the project area.</p> <p>ADB does not have a list of projects requiring EIA similar to Annexes of the EU, rather screening of a project is done on a case by case basis.</p> <p>In any case, this Project has been classified as a Category A project by the ADB requiring full EIA.</p>
Legislative base				
1	<p>"For projects outside the EU, the ESIA must be consistent with the principles contained in the EU EIS Directive and best international practice, taking into account national laws and regulations and any obligations and standards of multilateral agreements to which the host country is a party to. Specific attention should be given to integrating the impacts on human rights, biodiversity, climate change, cultural heritage and disaster risks</p>	<p>"ADB will not finance projects that do not comply with its safeguard policy statement, nor will it finance projects that do not comply with the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law. " (Para. 47 ADB SPS 2009)</p> <p>"When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or</p>	<p>The Georgian legislation envisages only the national base for developing an EIA report. If there is a difference between the donor's requirements and those of the Georgian Law, the Law does not take the Donor's requirements into account and at the stage of developing the EIA document, requires only meeting the requirements of the national legislative base.</p>	<p>Despite the fact that the Constitution of Georgia clearly defines the obligation of the country (chapter 6, point 2): "The legislation of Georgia shall correspond to universally recognised principles and rules of international law. An international treaty or agreement of Georgia unless it contradicts the Constitution of Georgia, the Constitutional Agreement, shall take</p>

	into the overall ESIA.” (EIB), ESH, ESS 1, para. 11).	measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document.” (Para. 33 ADB SPS 2009).		precedence over domestic normative acts” ⁶ , at the stage of developing the Georgian version of the EIA document, the requirements of the International Financial Institutions is not considered. The EIA document is developed entirely in line with the requirements of the Georgian legislation. Accordingly, for this Project two environmental assessments are prepared, one to comply with all donor requirements and one to comply with Georgian Standards. However, both documents will include broadly the same information and will have the same conclusions and recommendations.
Stakeholders engagement				
1	“Standard 10 outlines a <i>systematic approach to stakeholder engagement</i> ., Stakeholder engagement is an inclusive and <i>iterative process</i> that involves, in varying degrees, <i>stakeholder analysis and engagement planning</i> , and stakeholder participation, and a mechanism ensuring access to grievance and remedy.” (EIB, ESH, ESS 10, para. 2)	ADB does not discuss directly ‘stakeholder engagement in the SPS, rather it discusses the issue under the heading of ‘disclosure and consultation’ “(the project shall) Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women’s participation in consultation. Involve stakeholders, including affected people and concerned	Aiming at ensuring the stakeholder engagement in the stage of the EIA document development, the obligations of the Ministry of Environment Protection and Agriculture are as follows: 1. Within 3 days of the registration of the scoping proposal, the Ministry of Environment Protection and Agriculture is obliged to ensure the disclosure of the scoping report on its official web-site and	As the requirements evidence, the Georgian legislation does not oblige the project owner to accomplish any activities in respect of stakeholder awareness or engagement. Rather, the Ministry accomplishes these activities meaning disclosing the relevant information on the web-site and information board of the

⁶ change is added by the Constitutional Law of Georgia of 30 March 2001

<p>“Stakeholder engagement, including disclosure and dissemination of information, will be planned for and carried out in line with the principles of prior, informed and free <i>engagement and informed participation</i>,..... <i>In the event that broad community support is not attained, the promoter is expected to dedicate all necessary resources and time to additional community engagement and public consultation initiatives, as required.</i>” (EIB, ESH, ESS 10, para. 17) (<i>emphasis added</i>)</p> <p>“Factors such as, <i>unequal gender relations</i> ...to be carefully considered by the promoter when pursuing an effective disclosure and information dissemination campaign.” (EIB, ESH, ESS 10, para. 20).</p> <p>“The EIB Public Disclosure Policy (PDP) reflects the requirements of the EU Aarhus Regulation. It commits the Bank to making public on request relevant environmental information in its possession, subject to the constraints described in the PDP. In particular, it promotes the public availability of the non-Technical Summary (NTS) (in the EU) and the Environmental Impact Study or Statement (EIS) (outside the EU, along with the NTS, when a separate document) for all projects financed by the Bank that require a formal EIA. Publication of the NTS and/or EIS</p>	<p>nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment.” (Environmental Safeguards Policy Principle #5, ADB SPS, 2009)</p> <p>“meaningful consultation is a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making” (Para. 32, ADB SPS 2009)</p> <p>“for environment category A projects, draft environmental impact assessment reports at least 120 days before Board consideration.” (Para 53, ADB SPS 2009)</p>	<p>on the information board of the executive agency and/or representative body of the relevant municipalities (Chapter 8, Article 2);</p> <p>2. Following the receipt of the statement about the environmental decision, “within 3 days of the registration, the Ministry shall ensure disclosure of the given statement and enclosed documents on its official web-site and on the information board of the executive agency and/or representative body of the relevant municipalities” (Chapter 8, Article 2).</p>	<p>relevant administrative units.</p> <p>In addition, within the scope of the EIA document, the Georgian legislation does not consider the working conditions/terms of the employees of the working camps or the requirements to observe the relevant standards.</p> <p>The EIA in hand comprised two rounds of consultations as part of the EIA as well as multiple consultations as part of the LARP. The reports will also be disclosed on the RD website.</p>
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<p>should take place before finance is disbursed on a particular project either by the Bank or its authority. For a single scheme investment project located outside the EU and the Enlargement Countries, the NTS should be made public in advance of the relevant meeting of the Board of Directors of the Bank. " (Para. 60 EIB SESPS, 2009)□</p>			
Grievance Redress Mechanism			
<p>"For projects outside the EU, a <i>stakeholder engagement plan, including a grievance mechanism, is mandatory as part of the ESIA process</i>". In line with Standards 7 and 10, where the EIB operations and/or components thereof impact or threaten the customary rights and interests of indigenous communities, the Team is to ascertain that a satisfactory FPIC process has been carried out." (EIB, Handbook Volume II, Environmental and Social Practices and Procedures (ESPP), para. 164).</p>	<p>"ADB requires that the borrower/client establish and maintain a grievance redress mechanism to receive and facilitate resolution of affected peoples' concerns and grievances about the borrower's/client's social and environmental performance at project level. The grievance redress mechanism should be scaled to the risks and impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people." (Para 59. ADB SPS 2009)</p> <p>"In May 2003, ADB adopted a new accountability mechanism whereby people adversely affected by ADB-financed projects can express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies. The accountability mechanism</p>	<p>The Georgian legislation does not consider similar mechanisms either in the project development, or implementation phase.</p>	<p>As part of this EIA an GRM has been prepared in line with the GRM prepared for section F4 of this road Project (funded by JICA).</p>

		replaced ADB's <i>Inspection Function</i> (1995). ADB's accountability mechanism comprises two separate, but related, functions: (i) consultation, led by ADB's special project facilitator, to assist people adversely affected by ADB-assisted projects in finding solutions to their problems; and (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel." (Para 18. ADB SPS 2009)		
Structure of the Environmental Impact Assessment document				
	<p>Includes:</p> <ul style="list-style-type: none"> • Description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases. • Description of the main characteristics of the production processes, for instance, nature and quantity of the materials used. • An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed project. • Where appropriate an outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into 	<p>Includes:</p> <ul style="list-style-type: none"> • Executive Summary - describes concisely the critical facts, significant findings, and recommended actions. • Policy, Legal, and Administrative Framework - discusses the national and local legal and institutional framework within which the environmental assessment is carried out. It also identifies project-relevant international environmental agreements to which the country is a party. • Description of the Project - describes the proposed project; its major components; and its geographic, ecological, social, and temporal context, including any associated facility required by and for the project. It normally includes drawings and maps showing the project's layout and components, the project site, and the project's area of influence. • Description of the Environment - 	<p>The Georgian legislation considers social factor only with regard to life and health safety (e.g. if a project contains a risk of triggering landslide, or emission/discharge of harmful substances or another anthropogenic impact). Thus, the national legislation does not consider resettlement as an issue in the process of issuing environmental permits, unlike the EIB which takes comprehensive approach to this issue.</p>	<p>The EIA in hand follows the structure of the requirements of the ADB as the Detailed Design and EIA are funded by ADB. The Consultants ToR indicates that the ADB guidelines shall be followed. This is the same procedures followed for Section F4 of the Project (funded by JICA). The ADB requirements follow all of the EIB requirements with the exception of the NTS, instead the ADB format has an 'Executive Summary'.</p>

<p>account the environmental effects.</p> <ul style="list-style-type: none"> • A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors. • A description of the likely significant effects of the proposed project on the environment resulting from: the existence of the project, the use of natural resources, the emission of pollutants, the creation of nuisances and the elimination of waste; (1) This description should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project. • A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment. • A non-technical summary of the information provided under the above headings. 	<p>describes relevant physical, biological, and socioeconomic conditions within the study area. It also looks at current and proposed development activities within the project's area of influence, including those not directly connected to the project.</p> <ul style="list-style-type: none"> • Anticipated Environmental Impacts and Mitigation Measures - predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic (including occupational health and safety, community health and safety, vulnerable groups and gender issues, and impacts on livelihoods, and physical cultural resources in the project's area of influence, in quantitative terms to the extent possible; identifies mitigation measures and any residual negative impacts that cannot be mitigated; explores opportunities for enhancement; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions and specifies topics that do not require further attention; and examines global, transboundary, and cumulative impacts as appropriate. • Analysis of Alternatives - examines alternatives to the proposed project site, technology, design, and operation—including the no project alternatives. • Information Disclosure, Consultation, 		
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	<ul style="list-style-type: none"> • An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information. 	<p>and Participation □ - describes the process undertaken during project design and preparation for □ engaging stakeholders, including information disclosure and consultation with □ affected people and other stakeholders; summarizes comments and concerns received from affected people and other □ stakeholders and how these comments have been addressed in project design and mitigation measures.</p> <ul style="list-style-type: none"> • Grievance Redress Mechanism □ - describes the grievance redress framework, setting out the time frame and mechanisms for resolving complaints about environmental performance. • Environmental Management Plan - deals with the set of mitigation and management measures to be taken during project implementation to avoid, reduce, mitigate, or compensate for adverse environmental impacts (in that order of priority). • Conclusion and Recommendation - provides the conclusions drawn from the assessment and provides recommendations. 		
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E. Baseline Data Collection Methodology

E.1 General

Background data and information was obtained from reputable published and unpublished sources, e.g., on: climate, topography, geology and soils, natural resources, flora and fauna, agriculture, and socio-economic data.

Several site inspections were conducted by the International Environmental Specialist during 2017 and 2018. The project area was reviewed and areas of potential environmental significance assessed carefully.

In addition, several surveys were undertaken to collect additional baseline data by a Local Consulting Firm (LCF) specializing in environmental and social studies. They include:

- Instrumental Noise and Vibration Monitoring.
- Instrumental Air Quality Monitoring.
- Instrumental Water Quality Surveys.
- Flora and Fauna Surveys.
- Physical and Cultural Resources Surveys.
- Socio-economic Surveys.

Formal discussions were held with a number of stakeholders (see **Section I**) in order to identify any specific areas of interest, or concern that needed to be surveyed or identified as part of the baseline collection phase.

E.2 Detailed Methodology

The following section outlines the detailed methodology followed for the collection of data.

E.2.1 Geology

Methodology for collection of baseline data – Geological maps were collected and geological information from the Feasibility Study (FS) reviewed and incorporated into the report. Discussions with the Detailed Design Consultants Geotechnical specialist were also undertaken to discuss the geological conditions within the Project area based on information collected during the detailed design phase.

Sources of Data:

- Detailed Design Consultant.

E.2.2 Topography

Methodology for collection of baseline data – The topography of the project area was assessed using Google Earth and Topographical maps.

Sources of Data:

- Detailed Design Consultant – Site plans and profiles.
- Google Earth.

E.2.3 Soils

Methodology for collection of baseline data – Soils maps were collected and soils information from the FS reviewed. Other relevant EIAs were reviewed to determine the status of roadside contamination on the E-60.

Sources of Data:

- Detailed Design Consultant.
- Feasibility Study for E-60 Highway Section from Zemo Osarui to Argveta.
- Environmental and Social Impact Assessment of Works for the Improvement of Chumateleti-Khevi Section of E-60 Highway (Section F1).

E.2.4 Climate and Climate Change

Methodology for collection of baseline data – Meteorological data, including atmospheric pressure, air temperature, relative humidity, precipitation, wind speed and direction, were collected from secondary sources. Recently completed climate change reports were collected and reviewed.

Sources of Data:

- Climate Risk and Vulnerability Assessment and Independent Proof Check. ADB April 2018.
- Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014.
- Office of the Deputy Prime Minister (2005). Planning Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England. Annex1: Dust.
- Meteoblue: <https://www.meteoblue.com>.

E.2.5 Air Quality

Methodology for collection of baseline data – Instrumental air quality monitoring was undertaken at six locations within the Project area during March 2018 to determine baseline conditions. NO₂, SO₂, CO, PM₁₀, PM_{2.5} and Total Dust were monitored four times (30 minute averaging period) over a 24 hour period. The following equipment was used:

- Carbon monoxide meter (China), range 0-100ppm
- Dust measuring unit CW-HAT 200, range 0-500 µg/m³
- Air analyser, TESTO-350 (Germany), range: CO (0-10 000 ppm); NO (0-4 000 ppm); NO₂ (0-500 ppm); SO₂ (0-5 000 ppm).

Site visits were also undertaken to assess if there were any other point sources of air pollution within the Project corridor.

Reference Documents:

- IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Air Emissions and Ambient Air. April 2007.

E.2.6 Hydrology

Methodology for collection of baseline data – Maps and locations of surface water courses were reviewed and discussions with the Detailed Design Consultant undertaken.

Instrumental monitoring of surface water quality was undertaken at twelve locations in March 2018 to determine baseline conditions in the Project area, specifically in the areas close to the bridge sites. Parameters monitored included pH, electrical conductivity (EC), turbidity, BOD, COD, dissolved oxygen (DO), Temperature, Total suspended solids (TSS), Total Coliform Bacteria, Oil and Grease, Total Phosphorus, Total Nitrogen, Total Ammonium, Petroleum

Hydrocarbons, Total Residual Chlorine, Total Zinc, Magnesium, Dissolved Copper. Groundwater samples were also taken from two sites in March 2018.

The protocol for the surface water monitoring was as follows:

- Water sampling for chemical analysis was done in line with requirements of the technical regulation of the Sanitary rules on water sampling, approved by the Governmental decree #26 (dated January 3, 2014).
- Sampling protocol was filled in on the sampling site. Samples marked.
- The samples were stored in secure location to preclude conditions which could alter the properties of the sample or lead to its contamination/loss.
- Samples were in custody sealed during storage and/or transportation and kept in the custody of the sampler until the samples were relinquished to another party.
- The samples were delivered to the lab within 24 hours from sampling. Prior to delivery to the lab the samples were kept in portable refrigerator.

Containers:

- Samples were collected in 1 litre Plastic PET bottles.
- For hydrocarbons amber glass bottles were used.
- BOD samples were collected in 300ml bottles.
- 1 litre sterile bottle was used for the sample intended for microbiological examination.

In addition to the samples for offsite analysis, parameters such as temperature, dissolved oxygen, pH, important for fish wellbeing were measured on the spot.

Sources of Baseline Data:

- Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

E.2.7 Natural Hazards

Methodology for collection of baseline data – The FS was reviewed to determine areas where flood events occur. In addition, consultations with the Detailed Design Consultants geotechnical specialist was undertaken to determine areas where natural hazards exist, such as landslides.

E.2.8 Biodiversity

Methodology for collection of baseline data – Works included desk top data gathering and field works for verification of available information and additional data gathering. Field surveys were carried out on August 8-9, 2017; September 22-23, 2017 and 1-2 March 2018. In addition to that results of the field survey in the area of interest implemented for feasibility stage of the project (April 2015).

Fora - Following to desk top data gathering and analysis site 4 site visit have been carried out. Collection of the floristic data on the study area included covered two components: 1) collection of the data on the vegetation diversity in the study area and 2) field sampling of the vegetation of the study corridor(s) for obtaining precise empirical data. For identification of the plant species was used determinats and checklists of the flora of Georgia (Ketzkhoveli & Gagnidze, 1971-2011; Czerepanov, 1995; Gagnidze, 2005). Information on the species distribution in the local habitats was obtained from the primary and secondary sources of information (Ketzkhoveli, 1960; Doluchanov, 2010, Akhalkatsi, Tarkhnishvili, 2012; Nakhutsrishvili, 2013, survey reports carried out by the team in the region under other assignments). Validity of the taxonomic statuses of the identified plant taxa was verified using the widely accessible plant taxonomic database "The Plant List" (The Plant List Vers. 1, 2010). Threat categories for the identified plant taxa were determined according the categories and criteria of International Union for

Conservation of Nature (IUCN) guidelines (IUCN, 2003) and The Red List of Georgia (2006). Particular attention was paid to identification of any protected species in the project impact area. (Note: inventory of the trees diameter >8cm and <8cm is in process)

For the vegetation study 1x1m, 5x5m, 10x10m, 25x25m sampling plots were selected depending on the type of vegetation (forest, shrubs, wetland area, meadow) and the size of the area.

Plots were sampled in every type of existing habitat. Along with identification of diversity individual coverage scale in the total projecting coverage was determined. Braun-Blanquet cover-abundance scale was used for assessment.

Fauna - Following desk top data gathering and analysis four site visits have been carried out. The surveys were carried out in August 8-9, 2017; September 22-23, 2017; March 1-2, 2018. The aim of the study was to identify of animal species within the study area; to reveal significant habitats for inhabitant species; to determine possible impact on animal biodiversity on construction and operation phases and to develop impact mitigation measures. Species, protected under Georgian legislation and international treaties (included in the Red List and species having other conservation status), species bearing special significance for local population have been paid particular attention to.

Walkover method has been used during the survey, along the species on transect, all observed species were visually recorded and identified. In addition with registration of the physical presence - traces, excrements, holes, burrows, feathers, fur, etc. were registered.

The surveyed corridor width was ranging from 50 to 2500m depending on location and potential species available. The surveys were carried out in different periods of the day. The peak activity periods (such as April for squirrels; end of March (peak of activity, reproduction period, from mid March until mid June) - for herps) were taken into account while survey planning.

The species composition of birds was determined by voice if it was not possible to observe them visually.

Reptiles and amphibians were studied in transects, shelters and water bodies – checked. The fact that activity of the reptiles depends on weather was taken into account. Keeping in mind that the species start to ‘appear’ end of March (Peak of activity is from mid March until mid June which is the reproduction period. In July and August they can be registered only in the morning and late evening when it is not too hot.)

Recording of adult phase of large invertebrates (butterflies, bugs, dragonflies, bees, grasshoppers, spiders, mollusks) was visually carried out on transects. Research methodology comprises the following activities: catching and identification of insects; turning over the stones and soil layer; checking of plants and plant residues; photographing; shacking off the insects on an awning and checking pond bottom - sieving.

Aquatic fauna - In addition to the desk top work the ichthyofauna study included:

- Visual audits for identification of habitats suitable for fish species expected to be found in the stream (geomorphology of the substrate, general hydrological data, hypsometry, landform, landscape-visual features);
- Field surveys:
 - Control catches with cast net, trammel net and kick net,
 - Determination of length, weight, gender, maturity stage, fattening coefficient, meristic and plastic characteristics, digestive tract content;
 - Collection of scales for identification of age, growth and growth rate;
 - Study of food base - hydroflora and hydrofauna; identification of macroinvertebrates and insects used for feeding, assessment of periphyton composition. Registration of

- periphyton and invertebrates within the wetted perimeter of the stream. Examination of stoned in the riverbed/wetted perimeter;
- On-site measurements - determination of suspended solids; dissolved oxygen (using filed tester Oxi 330i); water and air temperature; pH;
 - Interview of the local population and amateur fishermen with at least 5-10 years of fishing experience); and
 - Laboratory processing of the obtained material (identification of age, growth and growth rate based on scales collected during the field survey (Note catch and release principle was complied with).

A survey of state forest fund areas was also undertaken and an inventory of species prepared along with a shape file of the state forest fund within the Project corridor.

Sources of Baseline Data:

- <http://aves.biodiversity-georgia.net/>
- <http://caucasus-spiders.info/checklist/country-checklists/?country=2>
- <http://www.lepidoptera.eu/>
- საქართველოს წითელი ნუსხა, 2014 წელს 20 თებერვალს <https://goo.gl/isUraC>
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- The red list of Georgia 2006. Tbilisi
- Tarkhnishvili, D. Chaladze G. [Editors]. (2013). Georgian biodiversity database [<http://www.biodiversity-georgia.net/index.php>]. <http://biodiversity-georgia.net/>
- TARKHNISHVILI, D.N. & K. GOKHELASHVILI (1999): The amphibians of the Caucasus . – advanes in Amphibian Research of the Former Sovier Union 4: 1- 233
- გოგინაშვილი ნ. 2012. მოკლე ენტომოლოგიური ორენოვანი ნომენკლატურა . საქართველოს აგრარული უნივერსიტეტი . გამომცემლობა „უნივერსალი“ თბილისი, საქართველო
- Akhalkatsi, M.&Tarkhbishvili D. 2012.Habitats of Georgia Natura 2000. Tbilisi.
- Bukhnikashvili A. K., Kandaurov A. S. (2001). The Annotated List of Mammals of Georgia. Proceedings of the institute of Zoology, Vol. XXI. pp. 319-340.
- Didmanidze E. (2004). Annotated List of Diurnal Butterflies (Lepidoptera: Rhopalocera) of Georgia and adjacent territory from Southern Caucasus. Raptors and Owls of Georgia. GCCW and Buneba Print Publishing. Tbilisi. Georgia.
- Кутибидзе М. К. (1966). изучению Орнитофауны лесов Боржоми-Бакуриани и ее хозяйственного значения. Издательство „Мециереба,, Тбилиси Prosidings of the institute of Zoology, Vol. XXI. pp. 306-309.
- Merkviladze M. Sh., Kvavadze E. Sh. (2002). List of Ladybirds (Coleoptera, Coccinellidae) of Georgia. Prosidings of the institute of Zoology, Vol. XXI. pp. 149-155.
- Grossheim, A.A., Sosnovski, D.I., Troytski, N.A. 1928. Vegetation of Georgia. Tbilisi, Publishhouse Georg. SSR Planing Commision.
- Kvachakidze, R. 2009. Vegetation of Georgia. Tbilisi, TBG&IB.
- Ketskhoveri, N. 1935. Main types of Georgian Vegetation. Tbilisi.
- Ketskhoveri, N. (Ed.) 1969. Sakartvelos mtsenareebis sarkvevi (Key to Georgian Plants), v. 1, 2, Metsniereba, Tbilisi.
- Nakhutsrishvili G. (Ed.) 1985. Flora and Vegetation of Svaneti. Tbilisi. Metsniereba.
- Kvachakidze, R. 2001. Forests of Georgia. Tbilisi, Metsniereba. pp 168.
- Nakhutsrishvili G. 1999. The vegetation of Georgia (Caucasus). - Braun-Blanquetia 15:1-74.
- Grossheim, AA. 1948. Vegetation Cover of the Caucasus. Moscow, MOIP.
- Gulisashvili, V.Z. (Ed.), 1961. Dendroflora Kavkaza (Dendroflora of the Caucasus), vol. 2. Tbilisi, Izdatel'stvo AN GSSR, 334 pp. pp. 334.
- Dolukhanov, A. 1989. Rastitel'nost' Gruzii (Vegetation of Georgia). v. 1. Metsniereba, Tbilisi.

- Gulisashvili VZ, Makhatadze LB, Prilipko LI. 1975. Rastitel'nost Kavkaza. (The vegetation of the Caucasus.) Moscow: Nauka 232p.
- Ochiauri, D. 1965. Materials for flora of Pshavi and Khevsureti. Tbilisi, Metsniereba, pp. 105.
- Dolukhanov, AG. 1946. Osnovnye cherty rastitel'nogo pokrova verkhnei Svaneti (Main features of vegetation cover of the Upper Svaneti). Works Tbilisi Bot. Inst. 9.
- Dolukhanov, AG., Sakhokia, MF., Kharadze, AL. 1945. K voprosu o vysokogornyykh rastitel'nykh poiasakh Kavkaza (About high mountainous vegetation belts of the Caucasus). Works Tbilisi Bot. Inst. 8.
- Kolakowski, AA. 1961. Rastitel'nyi mir Kolkhidi (Plants of the Kholkheti). Moscow, Nauka.
- Kimeridze, K. 1966. Kavkasiashi chaobis mcenareulobis gavrcelebis kanonzomierebis sakitkhisatvis. (Distribution pattern of wetland vegetation in Caucasus). Bull. Georg. Acad. Scien. 43, 2:234-245.

E.2.9 Protected Areas and IBAs

Methodology for collection of baseline data – Maps and data relating to Important Bird Areas (IBAs) and protected areas were collected and reviewed.

Sources of Data:

- Birdlife International - <http://datazone.birdlife.org/site/mapsearch>)
- Protected Plant - <https://www.protectedplanet.net/borjomi-strict-nature-reserve>
- Agency of Protected Areas of Georgia - <http://apa.gov.ge/en/>

E.2.10 Socio-economic conditions

Methodology for collection of baseline data – A review of existing data, including information provided by GEOSTAT as well as the information collected as part of the social surveys provided by the Detailed Design Consultants social specialists. Data on traffic accidents was also reviewed.

Sources of Data:

- <http://www.geostat.ge/>
- Draft Land Acquisition and Resettlement Plan, Section F2 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway), April 2018
- Feasibility Study for E-60 Highway Section from Zemo Osarui to Argveta
- Environmental and Social Impact Assessment of Works for the Improvement of Chumateleti-Khevi Section of E-60 Highway (Section F1).

E.2.12 Infrastructure

Methodology for collection of baseline data – The existing infrastructure in the Project area was identified during site visits and in consultation with the Detailed Design Consultant.

E.2.13 Land Use

Methodology for collection of baseline data – A review of the land uses was undertaken based on existing maps of the project area, satellite images, aerial photos and site visits.

E.2.14 Waste Management

Methodology for collection of baseline data – A review of the existing waste management situation in the region was undertaken and local waste management facilities were identified.

E.2.15 Health and Educational Facilities

Methodology for collection of baseline data – Site visits identified the health and educational facilities within the Project area. This was confirmed by a web-based search.

Sources of Data:

- Ministry of Education and Sciences Georgia - <http://www.mes.gov.ge/>
- Ministry of Health Georgia - <http://cloud.moh.gov.ge>

E.2.16 Cultural Resources

Methodology for collection of baseline data – Existing data was reviewed and a site walkover was undertaken to determine what PCR was present within the Project area.

Sources of Data:

- Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

E.2.17 Noise and Vibration

Methodology for collection of baseline data – Baseline noise monitoring has been undertaken at twelve locations along the Project road by the LCF. Four half hour measurements were undertaken over a 24 hour period in residential areas and close to sensitive receptors. Weather conditions were recorded, including wind speed. A noise model of the existing road was also prepared by an international company.

Sources and Reference Documents:

- IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Noise. April 2007.

E.3 EIA Project Area

The potential impacts of the Project on its surrounding physical and biological environments include air and water quality impacts, noise generation, land transformation and changes to soil. These are expected to reduce with the increased distance from the Project facilities, affecting more the areas located closer, up to one kilometer, to the Project alignment. For this, a study area of one kilometer around the site was delineated, to assess the baseline conditions in the areas likely to be affected by the Project due to its proximity to the Project site. This is referred to as the Study Area in this report. The Study Area selected for the EIA includes sensitive receptors⁷ that are most likely to be impacted by the Project's development activities.

⁷ Sensitive receptors include, but are not limited to, residential areas, schools, places of worship, wetlands, and habitats. These are areas which are more susceptible to the adverse effects of an anthropogenic activity such as noise, air emissions, traffic influx, and privacy issues

F. Description of the Environment

This section of the report discusses the existing environmental and social conditions within the Project area under the following headings:

- Physical Resources (air quality, hydrology, topography, etc.);
- Ecological Resources (flora, fauna, protected areas);
- Economic Resources (infrastructure, land use, etc.);
- Social and Cultural Resources (health, education, noise, cultural resources, etc.)

F.1 Physical Resources

F.1.1 Air quality

F.1.1.1 Site Observations

The Project road is located within a rural setting with no point sources of industrial emissions noted within the Project area. Apart from rural household emissions from wood burning stoves and heating the only other source of air emissions are from road transport, including vehicles on the existing E-60.

F.1.1.2 Sensitive Receptors

The Project road passes close to a number of residential properties and sensitive receptors. Those within 200 meters have been mapped and are included as part of the air quality and noise assessment provided in **Section G** of this EIA.

F.1.1.3 Baseline Ambient Air Quality

Air quality monitoring was carried out at nine different locations during March, 2018 to characterize the current air quality within the Study Area.

The pollutants selected for evaluation are based on the expected emissions from the Project activities and the level of risk to human health posed by these pollutants. They include:

- Total Suspended Particulates (TSP), or Dust;
- Carbon Monoxide (CO);
- Nitrogen Dioxide (NO₂);
- Sulfur Dioxide (SO₂); and
- Particulate Matter (PM₁₀ and PM_{2.5})

The locations of the sampling points are indicated in Figure 32 and Table 29. The ambient air quality data was compared against applicable IFC, EU and Georgian Standards.

Figure 32: Air Quality Monitoring Locations



Table 29: Ambient Air Quality Monitoring Locations

#	ID	Coordinates	
		X	Y
1	F2-A1	367851	4661799
2	F2-A2	365078	4662569
3	F2-A3	364623	4662883
4	F2-A4	362258	4663231
5	F2-A5	360268	4662822
6	F2-A6	356695	4663242

The results of the ambient air quality monitoring are provided in Table 30. In all instances the parameters monitored were below national, and where applicable, IFC standards.

Table 30: Ambient Air Quality Monitoring Results

#	Time	Wind speed, m/s	Wind direction	CO, µg/m3	NO ₂ , µg/m3	SO ₂ , µg/m3	PM10, µg/m3	PM 2.5, µg/m3	Total dust, µg/m3
F2-A1									
1	8:00	0.8	W	2000	<200	<500	42	34	<100
2	13:00	1.2	W	1000	<200	<500	38	30	<100
3	18:10	<0,1		<1000	<200	<500	28	25	<100
4	23:10	<0,1		<1000	<200	<500	25	23	<100
F2-A2									
1	8:40	1	W	1000	<200	<500	23	21	<100
2	13:50	1.1	W	1000	<200	<500	35	28	<100
3	19:00	<0,1		<1000	<200	<500	25	23	<100
4	0:05	<0,1		<1000	<200	<500	20	18	<100
F2-A3									
1	9:25	0.9	W	<1000	<200	<500	44	34	<100
2	14:35	1.2	W	1000	<200	<500	45	37	<100
3	19:50	<0,1		<1000	<200	<500	30	21	<100
4	0:50	<0,1		<1000	<200	<500	20	18	<100
F2-A4									
1	10:10	1.1	W	1000	<200	<500	32	25	<100

2	15:20	1.1	W	1000	<200	<500	42	35	<100
3	20:30	<0,1		<1000	<200	<500	28	24	<100
4	1:40	<0,1		<1000	<200	<500	25	23	<100
F2-A5									
1	11:00	1.1	W	1000	<200	<500	17	15	<100
2	16:00	1.1	W	1000	<200	<500	23	21	<100
3	21:20	<0,1		<1000	<200	<500	9	7	<100
4	2:20	<0,1		<1000	<200	<500	5	3	<100
F2-A6									
1	11:45	1.5	W	<1000	<200	<500	25	23	<100
2	16:50	1.2	W	<1000	<200	<500	30	27	<100
3	22:20	<0,1		<1000	<200	<500	15	11	<100
4	3:20	<0,1		<1000	<200	<500	5	4	<100
	MPC/guideline values/limits		Average period	CO, µg/m3	NO ₂ , µg/m3	SO ₂ , µg/m3	PM10, µg/m3	PM 2.5, µg/m3	TSP, µg/m3
1	National limit – max.permmissible one time (volley) concentration (MPC), µg/m ³ *		24 h	3000	40	50	n/a	n/a	150
			30 min	5000	200	500	n/a	n/a	500
2	IFC/WHO (updated 2016) –guideline value, µg/m3		1 year	n/a	40	50	20	10	n/a
			8h	10000	n/a	n/a	n/a	n/a	n/a
			24 h	n/a	n/a	20	50	25	120
			1h	30000	200	n/a	n/a	n/a	n/a
			30 min	60000	n/a	n/a	n/a	n/a	n/a
			10 min	100000	n/a	500	n/a	n/a	n/a
3	EU limit, µg/m3		1 year	n/a	40	n/a	40	25	n/a
			8h	10000	n/a	n/a	n/a	n/a	n/a
			24 h	n/a	n/a	125	n/a	n/a	n/a
			1h	n/a	200	350	n/a	n/a	n/a

F.1.2 Climate

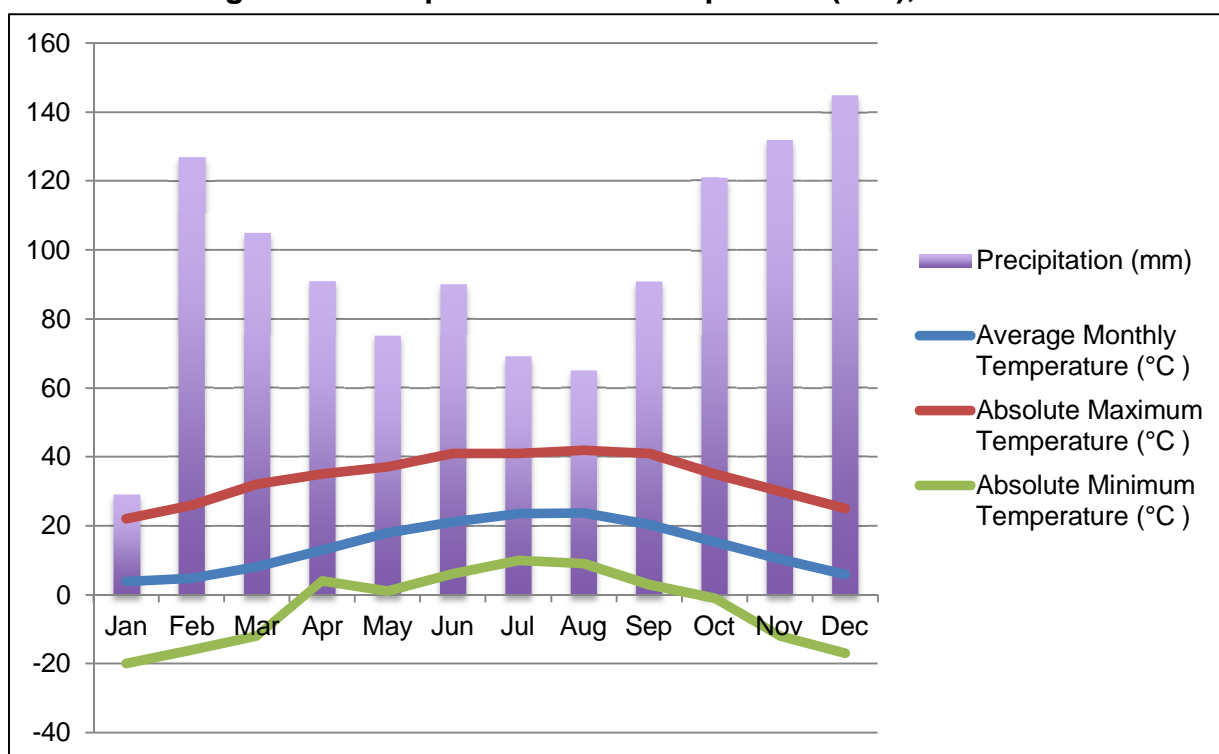
Due to the peculiar geographical position of Georgia between the Black and Caspian seas and the presence of powerful natural climatologic in the North of the Main Caucasus Range, and also owing to the large range of elevations above sea level, the climate of Georgia is varies quite widely for a small country. Climates of all types, ranging from subtropical, characteristic of the coastal zone of the Black sea, to the Arctic, prevailing in the most mountainous region of the Caucasus range can be found.

According to technical document GOST 16350-80 the Project road is located in district II9, which is characterized by a temperate warm climate with mild winters.

F.1.2.1 Precipitation & Temperature

Annual precipitation in Zestafoni (the nearest weather station) is around 1,200 mm. Rainfall is highest in the Winter, Autumn and Spring, although rainfall can still be observed during the hotter summer months (see Figure 33).

Figure 33: Temperature and Precipitation (mm), Zestafoni



Snow cover is not formed every year, as winter precipitation often falls as rain. The average duration of snow cover is an average of 6-20 days. Snowstorm in the mountains to the north of the Project area are possible from November to April. The average total duration of snowstorms per year is 8 hours. Average per year number of days with Blizzard is three, maximum – ten. Most often blizzards occur in the winter months, in which the average duration of snowstorms per day snowstorm is 2.7 hours

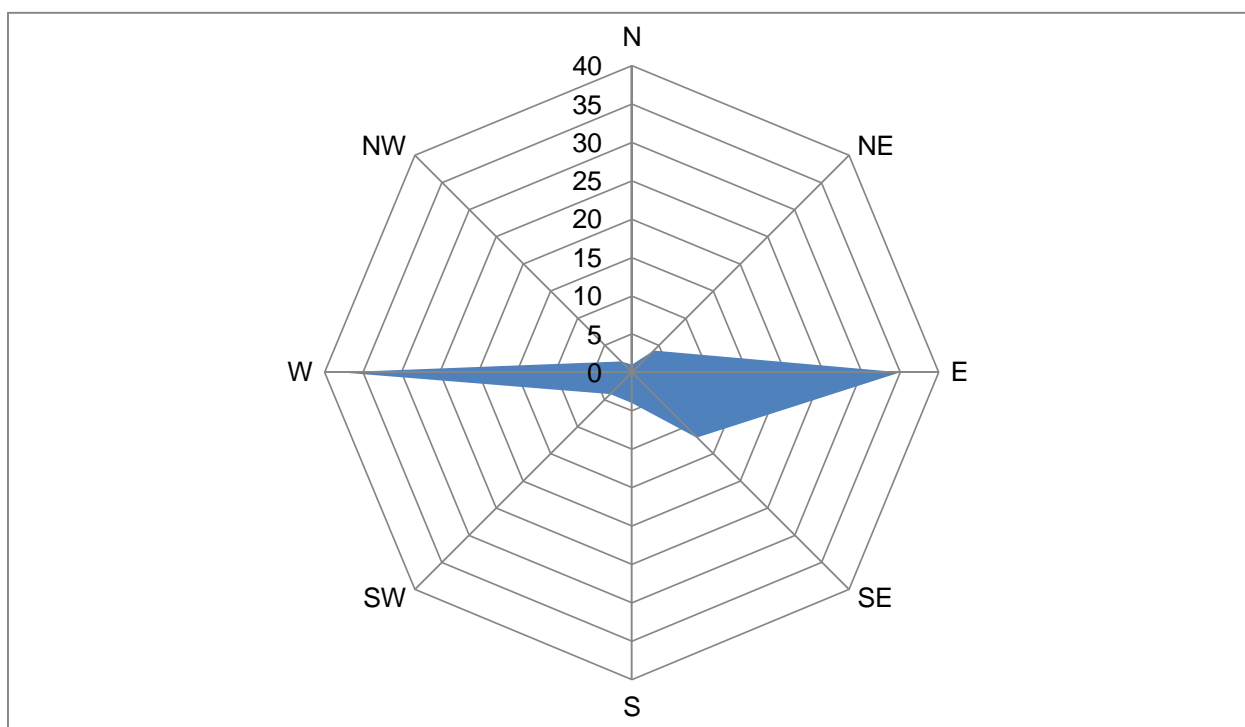
Thunderstorms occur in all months of the year. The maximum number of days with thunderstorms refers to June (6 days), and the average duration of thunderstorms in the afternoon with thunderstorm is 1.5 hours and the maximum continuous – 12.3 hours.

Figure 33 illustrates the monthly temperature for Zestafoni which ranges on average, from 5 °C in the winter months to around 25 °C in the summer. Absolute maximum and minimum temperatures show that it is possible for the temperatures to reach as low as 20 °C and more than 40 °C in the summer.

F.1.2.2 Prevailing Winds

Wind strength, direction and frequency is shown in Figure 34. The wind rose illustrates that the dominant wind direction is from the east. However, strong winds from the west are also experienced quite frequently.

Figure 34: Wind Rose, Zestafoni



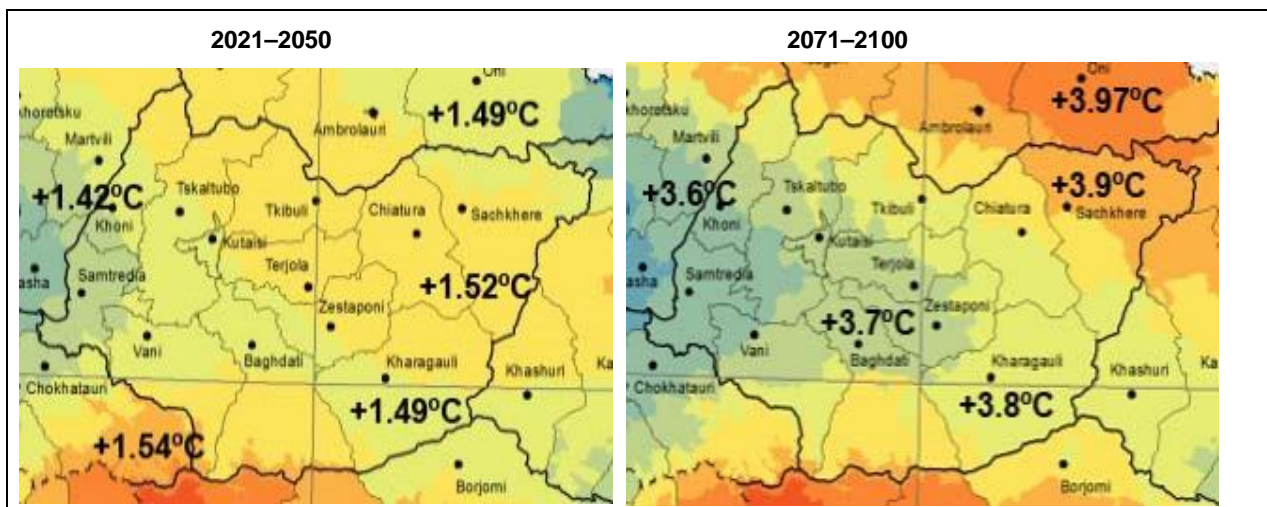
F.1.2.3 Climate Change

General – The following section is reproduced from the Climate Risk and Vulnerability Assessment & Independent Proof Check prepared for the Project by the ADB in April, 2018.

Projected Climate Changes in Georgia - Projected climate changes in Georgia are outlined below.

Average annual temperatures are expected to increase by 1.3°–1.6°C by 2050 and 3°–4°C toward 2100 (Figure 35).

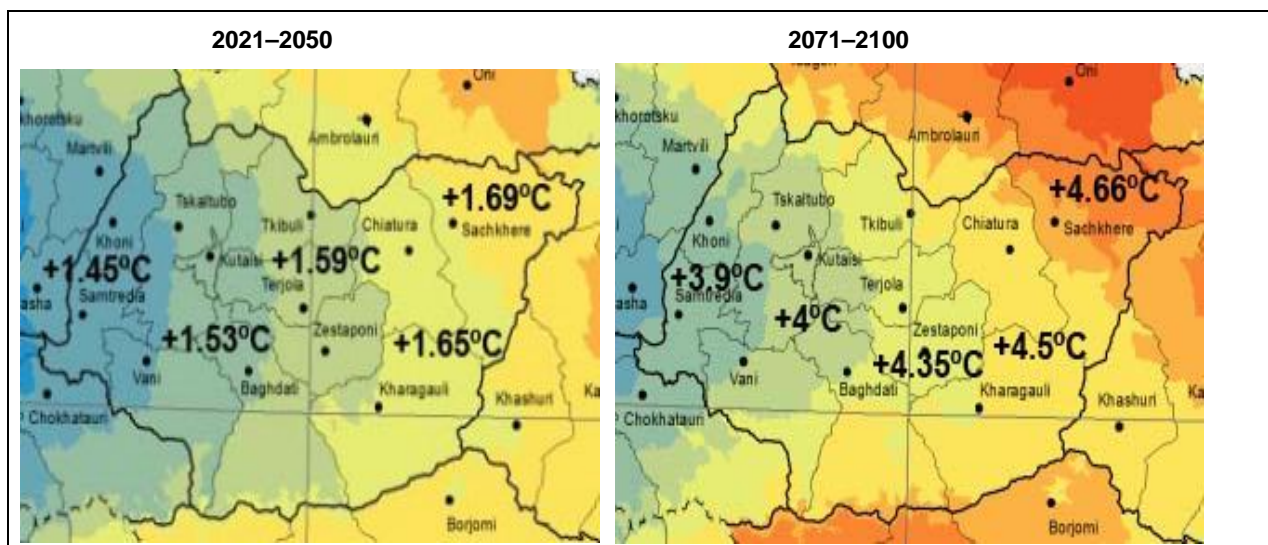
Figure 35: Projected changes in annual mean temperature (in °C) in the Imereti Region



The increases are highest in September, when temperatures are already at their highest. The greatest overall increase is expected in northwest Georgia, especially in the Kakheti region

(Sagarejo, Signaghi and Dedoplistskaro municipalities). The least warming is expected in the Black Sea coastal area and Kolkheti Lowland of Georgia. In the project area, by 2100, summer temperatures may be higher by 4.5°C (Figure 36).

Figure 36: Projected changes in summer temperature (in °C) in the Imereti Region



The increase in temperatures will be accompanied by an increase in the number of hot days (days where the average daily temperature is higher than 25°C). In some mountain areas, the number of hot days may double. In the project area, by 2050, the number of hot days will increase to 38 days per annum (p.a.), and by 2100 the number of hot days will increase to 66 days p.a.

In addition, more frequent heat waves will occur during June–August. The population in the project area is considered to be highly vulnerable to heat waves (80% vulnerability). Concurrent with the increase in temperatures, and the increase in droughty conditions, a decrease in overall humidity (with some exceptions, such as Mestia, Khaishi and Keda) is expected.

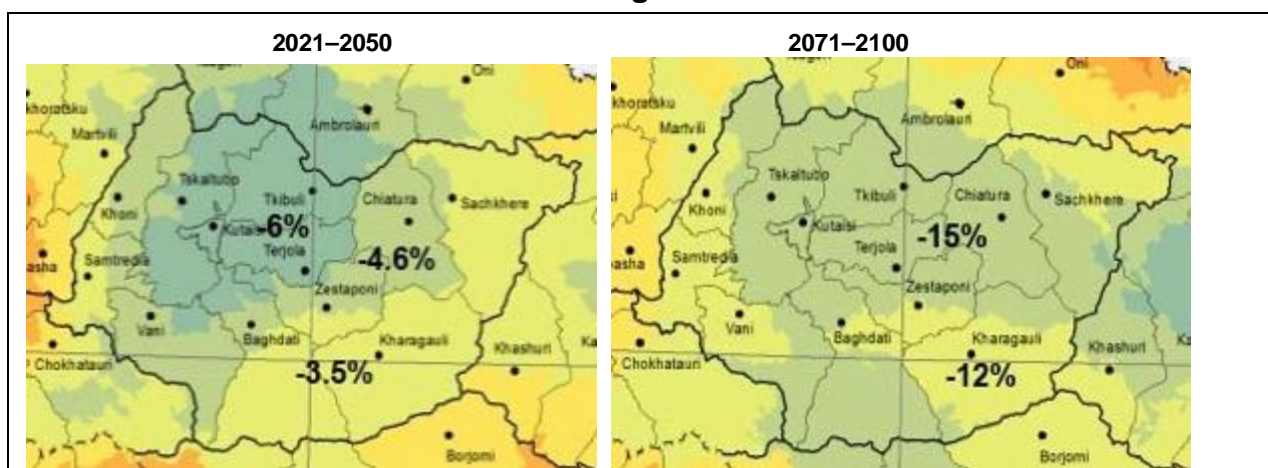
A decrease in the number of days and nights with frost (i.e., number of days when daily minimum temperature is less than 0°C) is also expected. The current range of frost days in Georgia is 80–120 days. In the project area, by 2050, the number of frost days will decrease by 21 days p.a., and by 2100 the number of frost days will decrease by 55 days p.a.

Wind speeds are not expected to strengthen, and wind direction will remain variable across the four road segments.

By 2160, due to higher temperatures a complete loss of Georgia's 637 glaciers is expected, leading to a decrease in the annual glacial runoff. By 2100, glacial runoff is predicted to decrease by up to 40%, and as a result, annual river runoff will decrease by about 13%.

Precipitation projections include a general increase of 5% up to 2050, followed by a drastic decline of up to 24% by 2100. The exception is the central part of the Likhi Range (in Mta-Sabueti) where precipitation is predicted to increase by 93%. In the project area, however, precipitation decreases will occur much faster. By 2050, annual mean precipitation will decrease by 4.5%, and by 2100 it will decrease by close to 13% (Figure 37).

Figure 37: Projected changes in annual mean precipitation (in %) in the Imereti Region



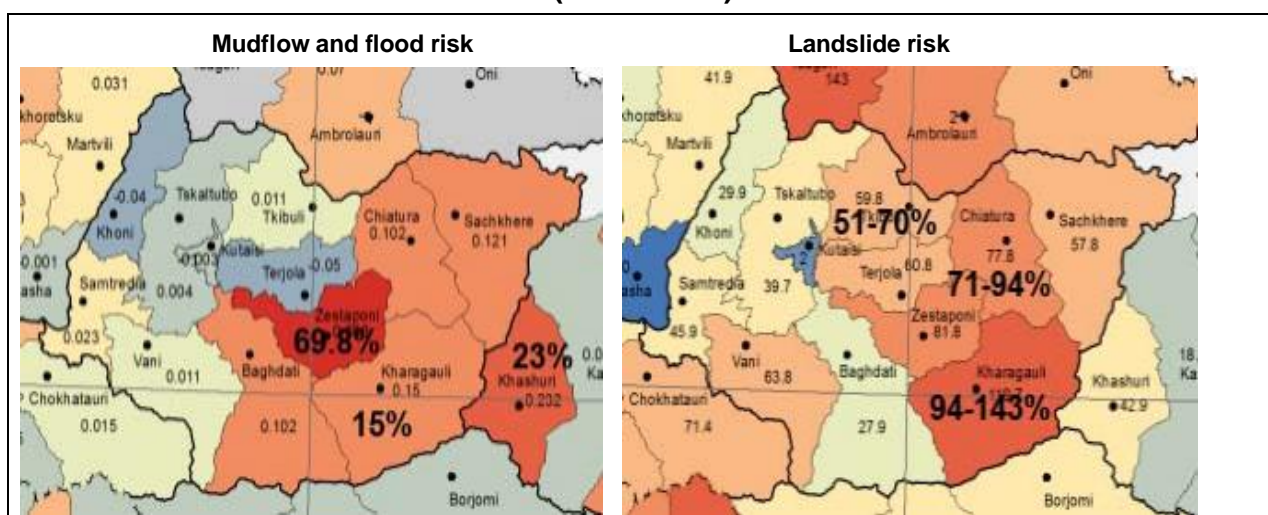
The seasonal variability of precipitation will increase in the project area. By 2050, precipitation decreases of -3.5%, -15%, -4%, and -3% are expected during the winter, spring, summer and autumn months, respectively. By 2100, the expected decrease in precipitation will be -4.5%, -23%, -32%, -10%, respectively, for the winter, spring, summer and autumn months.

Despite the long-term decrease in precipitation, an increase in the amount and intensity of daily and multi-day rainfall events is expected. In the project area, the number of days with heavy rain, when total daily precipitation exceeds 20 mm, will increase by 2050 to 44 days p.a.

These changes will lead to increased risk of flash floods, mudflows and landslides. In the project area, the risk of erosion processes, floods and landslides is expected to increase. For landslides, the project corridor has a high-risk range (94%–143%).

For mudflows and floods, the projected risk range for F2 is between 15% and 70% (Figure 38).

Figure 38: Projected mudflow, landslide and flood risk (in %) in the Imereti Region (2021–2050)



F.1.2.4 Greenhouse Gases (GHGs)

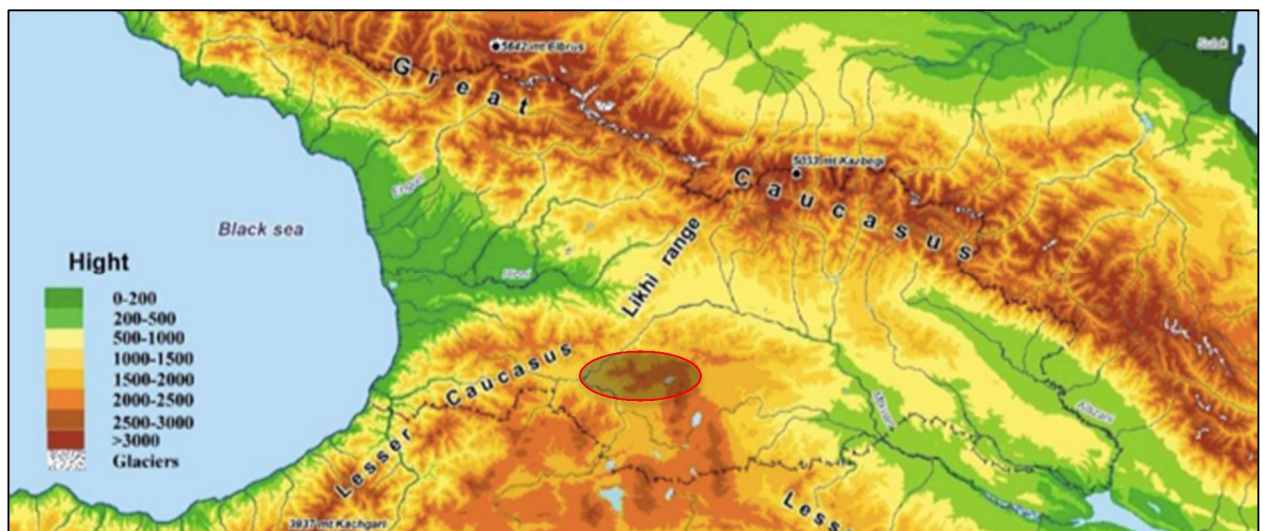
General - According to the World Resources Institute Climate Analysis Indicators Tool (WRI CAIT), Georgia's 2011 GHG profile was dominated by emissions from the energy sector, which accounted for 71% (7.5 million tons of CO₂ equivalent (MtCO₂e)) of Georgia's total emissions.

Land-use change and forestry was the second most significant sector. Of the 7.5 MtCO_{2e} % of emissions from the energy sector approximately 2 of the 7.5 MtCO_{2e} was attributable to the transport sector (resulting from purchases of large, inefficient, aging used cars, as well as economic growth and improved living conditions overall. From 2001-2009, the number of vehicles doubled, and the number of buses and minibuses tripled.⁸ In 2013 emissions data compiled by the World Resources Institute indicated that Georgia produced around 14 MtCO_{2e} or 0.0003% of global GHG emissions. 2 MtCO_{2e} represents 0.00004% of global GHG emissions.

F.1.3 Topography

The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucasus Mountains (see Figure 39). The Project corridor is set within a landscape of mountains, and rolling hills. The existing road is located within the bottom of the river valley and elevations vary from 300 meters above sea level at the start of the road to 200 meters above sea level at the end of the road section. Figure 40 illustrates the mountainous / rolling landscape around KM2.6.

Figure 39: Regional Topography



F.1.4 Geology & Soils

F.1.4.1 Geology

In the Project area, along the highway alignment, several major geological units can be identified:

- Quaternary soils, covering both the volcanic and the sedimentary rocky units, represented by:
 - mQ - Railway, motor road and other soil embankments. Mainly coarse.
 - aaQ - Current alluvial deposits. Coarse.
 - aQ - Recent alluvial and terraced deposits. Coarse.
 - cdQ - Colluvial deposits in the valley floors and debris at the slope bases. Coarse and/or fine.
 - eQ - Eluvial cover deposits on the upper plains. Coarse and/or fine.
- Effusive volcanic rocks covering the crystalline basement dated Middle Jurassic. They are represented by the porphyritic complex including the following geological formations:
 - J_{2b2} (A) - Tuff and tuff breccias, from moderately hard to hard. Mainly massive.

⁸ Greenhouse Gas Emissions in Georgia. USAID, July, 2016

- J_{2b2} (B) - Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive.

Figure 40: Landscape round KM2.6



- Intrusive and metamorphic rocks constituting the Proterozoic crystalline basement. They are represented by the following geological formations:
 - PzGr - Pink and grey granites and meta-granites and grano-diorites, from mildly to heavily weathered, from massive to heavily fractured;
 - PzQp - Pink quartz-porphyrites, from lightly to mildly weathered, from massive to heavily fractured;
 - PzQg - Grey quartz gneiss, from lightly to mildly weathered, from massive to heavily fractured.

From a geo-lithological point of view, along the alignment, two main homogeneous sections can be identified, depending on similar lithological conditions (See Table 31, below):

- From km 0+000 to 7+870 – Outcropping formations are represented by intrusive igneous rock prevalently constituted by pink and grey granites. Along the route of the tunnels, the presence of numerous infraformational faults has been detected. In this section, tunnels are expected to be excavated in PzGr and PzQg formations; bridges are expected to have their abutments and piers on quaternary deposits (aQ, aaQ and mQ with a variable thick) overlying PzGr and PzQg formations.
- From km 7+870 to 12+790 – Outcropping formations are represented by volcanic effusive rocks of the J_{2b2} (B) formation belonging to the porphyritic complex. Along the route of the tunnels, the presence of numerous infraformational faults has been detected. In this section, tunnels are expected to be excavated in J_{2b2} (B) formation and bridges are expected to have their abutments and piers on quaternary deposits (aQ, aaQ and mQ with a variable thick) covering the J_{2b2} (B) formation.

Table 31: Lithology – Rikoti - Argveta

Homogeneous segments	Chainages (km)	Structures	Geological formations	NOTES
A	0+000 – 7+870	BRI 3.1.01-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr formation	The structures interfere with numerous faults having indicative direction around N-S
		BRI 3.1.02-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr formation	
		TUN 3.0.01-TA/AT	The tunnel is excavated in PzGr and PzQPr formations	
		BRI 3.1.03-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr and PzQPr formations	
		TUN 3.0.02/AT	The tunnel is excavated in PzGr formation	
		BRI 3.1.04-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzQGn formation	
		TUN 3.0.03-TA/AT	The tunnel is excavated in PzQGn formation	
		BRI 3.1.05-TA/TA	The bridge crosses quaternary deposits (aQ, aaQ, mQ) bridge covering the PzQGn formation	
		TUN 3.0.04-TA/AT	The tunnel is excavated in PzGr formation	
		BRI 3.1.06-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr formation	
		TUN 3.0.05-TA/AT	The tunnel is excavated in PzGr formation	
		BRI 3.1.07-TA/AT	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr formation	
		BRI 3.1.08-TA/TA	The bridge crosses quaternary deposits (aQ, aaQ, mQ) covering the PzGr formation	
B	7+870– 12+790	TUN 3.0.06-TA/AT	The tunnel is excavated in J ₂ b ₂ (B) formation	The structures interfere with numerous faults having indicative direction around N-S
		BRI 3.1.09-TA/AT	The bridge crosses quaternary deposits (cdQ, aQ, aaQ, mQ) covering the J ₂ b ₂ (B) formation	
		BRI 3.1.10-TA/AT	The bridge crosses quaternary deposits (cdQ, aQ, aaQ, mQ) covering the J ₂ b ₂ (B) formation	
		BRI 3.1.11-TA/AT	The bridge crosses quaternary deposits (cdQ, aQ, aaQ, mQ) covering the J ₂ b ₂ (B) formation	
		TUN 3.0.07-TA/AT	The tunnel is excavated in J ₂ b ₂ (B) formation	
		TUN 3.0.08-TA/AT	The tunnel is excavated in J ₂ b ₂ (B) formation	
		BRI 3.1.12-TA/AT	The bridge crosses quaternary deposits (cdQ, aQ, aaQ, mQ) covering the J ₂ b ₂ (B) formation	
		TUN 3.0.09-TA/AT	The tunnel is excavated in J ₂ b ₂ (B) formation	

F.1.4.2 Soils

Within the eastern part of the Dzirula Gorge, three types of soils are observed: grey soils, yellow-grey soils, and humus-grey soils.

Podzolic grey soils mainly appear on the intensively exhausted clay soils and clays. Their profiles are characterized with thin underlying formation followed by 3-5-cm humus horizon and 15-20-cm obviously faded podzolic horizon. The profiles end with alluvial-metamorphic hardened straw-colored and yellow or reddish-yellow horizon turning into the main rock. The humus content is low and the reaction is the acid one. Yellow soils are mainly spread on terrace formations and piedmont plains. The humus soil is represented by a granular soil layer (19-15 cm). Deeper there is an alluvial-metamorphic horizon that gradually turns into the main soil-forming

rock. The content of the humus horizon in this type of soil makes 6-10%, and the level of acids prevails higher than the level of base materials.

Humus-calcareous soils are limestones, dolomites and their fission products. Their upper part has dark grey color that fades lower. In the upper part of the profile the reaction is neutral, in the lower part - alkaline. The lower part of the profile is enriched with carbonate. Concentration of humus in the upper part of the horizon is 6-10%. This soil type is met in the limestone rock zones characteristic for Cretaceous rocks along the Caucasus. Topsoil thicknesses along the road alignment is shown below.

Table 32: Topsoil Thickness in the Project Corridor

Chainage (km)	Topsoil Thickness (m)
0+000 - 0+245	0,2
0+245 - 0+479	0,3
0+479 - 0+552	0,3
0+552 - 1+386	0,3
1+386 - 1+540	0,3
1+540 - 2+428	0,25
2+428 - 2+662	0,4
2+662 - 2+678	0,2
2+678 - 2+999	0,35
2+999 - 3+046	0,3
3+046 - 3+632	0,2
3+632 - 4+468	0,2
4+468 - 4+857	0,2
4+857 - 4+969	0,3
4+969 - 5+105	0,2
5+105 - 5+271	0,2
5+271 - 6+408	0,35
6+408 - 7+054	0,25
7+054 - 7+355	0,2
7+355 - 7+443	0,3
7+443 - 7+679	0,3
7+679 - 7+749	0,3
7+749 - 7+909	0,3
7+909 - 8+711	0,25
8+711 - 8+773	0,2
8+773 - 9+480	0,3
9+480 - 9+543	0,4
9+543 - 9+845	0,2
9+845 - 10+020	0,25
10+020 - 10+892	0,2
10+892 - 12+085	0,2
12+085 - 12+147	0,2
12+147 - 13+054	0,2

Three petrol stations were noted within the Project corridor:

- Petrol Station 1 KM0.1
- Petrol Station 2 KM9.9
- Petrol Station 3 KM12.2

All of these petrol stations will need to be demolished to make way for the new alignment. Fuel is stored in either underground storage tanks (UST) or above ground storage tanks (AST) at all three sites. The integrity of the AST/USTs is not currently known and as such the potential does exist for soil contamination to have occurred around the area of the AST/USTs if any previous or current leaks from these tanks has occurred. Its is also possible that site run-off from the fueling areas has led to contamination of the soils around the sites.

The petrol stations at KM9.9 and KM12.2 are located beneath the new alignment below bridges BRI-3.1.11-TA/AT and BRI-3.1.12-TA/AT respectively and as such structural demolition will be limited to above ground structures, such as any ASTs and thereby eliminating the requirement for any significant excavation of soils and the removal of any UST. Partial excavation of soils from the area around the petrol stations will however be required to construct bridge piers. The petrol station at KM0.1 will need to be demolished in its entirety and it is likely that any AST/UST at this site will need to be removed.

Soil sampling and analysis was undertaken in February, 2018. One sample was collected and analyzed at KM9.9 to determine the existing soil quality. Table 33 provides the soil monitoring results for this location.

Table 33: Soil Monitoring Results

#	Parameter	Units	F3_S1	Method/standard	National limit, maximum allowable concentration, mg/kg
1	Copper, Cu (mobile)	mg/kg	1.0	GOST P50683-1994	3
2	Zinc, Zn (mobile)	mg/kg	4.85	GOST P50686-1994	37
3	Nickel, Ni (mobile)	mg/kg	<0.5	GOST P50683-1994	4
4	Chromium, Cr (mobile)	mg/kg	<0.7	GOST P50683-1994	6
5	Lead, Pb (total)	mg/kg	25.5	ISO 14869-.1-2001	32
6	Arsenic, As (total)	mg/kg	4.6	GOST 4152-89	10
7	Cadmium, Cd (total)	mg/kg	<2.0	ISO 14869-.1-2001	-
8	Mercury, Hg (total)	mg/kg	0.021	SOP AEL 2003 (ISO17025 accredited) complied with EPA245.1 Standard Method	2.1
9	Polychlorinated biphenyl PCB	mg/kg	<0.05	EPA 8082 A-2007	0.06
10	Asbestos		nd	NIOSH 9002 -1989	-

The results of the general soil sampling show that all parameters are within the current Georgian limits.

Regarding lead in roadside soils; soil monitoring was undertaken in Section F1 (which ends at the start point of F2 in Khevi village) along the roadside verges. Although the samples were above the current national limit for lead, they are below EU standards and also below the new proposed soil standards for Georgia (which are planned to enter into force sometime in 2018 and are based around EU standards). In addition, the Project is a new alignment, with only very minor areas following the existing road so there will be little disturbance of existing roadside soils.

F.1.5 Geomorphology

The area is drained by the river Dzirula which, in the initial part of the F3, presents sub-angular pattern, an index of considerable tectonic influence. The erosion of the river bank is present in the correspondence of meanders. Along the river Drizula, in correspondence of the change of slope, where the alluvial plain appears wider, some alluvial fans have been detected. A secondary fluvial system, consisting mainly of temporary flows, is widespread throughout the study area. The small valley is narrow, mainly V-shaped when the water is on the rocks. Also the gravity-related soil forms are widespread, represented mainly by the edges of the natural slopes.

A detailed description of the alignment of the project road along Section F3, in terms of geomorphology, is given below.

- KM0.0 – KM1.3. On this segment of the alignment, the valley of the river Dzirula, is affected by bank of erosion and alluvial fan. There are changes of direction of the water flow in correspondence of the observed fault and in correspondence of the meanders the erosion of the river bank is present. The bank of erosion is the expression of the river Dzirula stream whereas the alluvial fan (affect the South edge river) are generated by the erosion process of the slopes by the temporary rivers and stream. In this case the small V shaped valley and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the fault. The valley slopes involve natural escarpment on the colluvial deposits (cdQ formation).
- KM1.3 – KM2.3. On this segment of the alignment, the river Dzirula is more linear and there are not alluvial fans. However, on the slope, there are small V shapes generated by temporary rivers; the small V shaped valley and the secondary fluvial system suffer the tectonic influence and are set on the correspondence of the faults.
- KM2.3 – KM3.3. On this segment of the alignment, the river Dzirula is linear and bend at the km 3+100 for the presence of a meander. The river is linear till the km 3+100, after this point there are some meanders; in correspondence of the meanders the erosion of the river bank is present. There is a tectonic contact between the meta-granites (PzGr formation) and quartz Porphyrites (PzQPr formation) regulated by faults oriented NNW-SSE. Also in this case the small V shaped valley and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the faults.
- KM3.3 – KM4.7. On this segment of the alignment, the river Dzirula evidences some meanders, as in the previous one whit erosion phenomena of the river bank; also in this segment of the stream there is a considerable tectonic influence. On the slopes where is predominant the presence of the meta-granites (PzGr formation), they are interested by the presence of minor superficial erosion forms due to the influence of the secondary fluvial system, consisting mainly of temporary flows, set on the correspondence of the presumed fault (tectonic influence). The prevalent geomorphological structures generated by the temporary rivers are the small V shaped valley.
- KM4.7 – KM6.3. Along this segment of the alignment, the river Dzirula is subjected to a considerable tectonic influence; there are changes of direction of the water flow in correspondence with the observed faults and in correspondence of the meanders relevant phenomena of erosion of the river bank are presents.
- There are two tectonic contacts between the meta-granites (PzGr formation) and quartz-gneiss (PzQGn formation) regulated by two faults oriented NNE-SSW. Also in this case the small V shaped valley and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the faults. It is also observed the edge of an anthropic escarpment on the quartz-gneiss (PzQGn formation) on the northern slope.
- KM6.3 – KM8.2. On this segment of the alignment, the river Dzirula its subjected of a considerable tectonic influence; there are changes of direction of the water flow in correspondence with the observed faults and in correspondence with the meanders where huge phenomena of erosion of the river bank are present. Along this segment the secondary fluvial system composed by temporary rivers is very developed on the meta-granites (PzGr formation). In the same context there are present some alluvial fans, on the colluvial deposits (cdQ formation), fed by the temporary rivers. In this segment of the alignment there are some edges of natural escarpments on the colluvial deposits (cdQ formation): the segment of major interest is at the km 7+600.
- KM8.2 – KM9.6. On this segment of the alignment, the river Dzirula takes a more linear course in direction N-S but in correspondence of the meanders the erosion of the river bank is present. On the slope there are some small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the fault with orientation E-W. The irregular succession of Porphyrites (J₂B₂B formation) and the colluvial deposits (cdQ formation) are the predominant lithology; edges of natural

escarpment are present in correspondence of the changes of the lithology. In this segment the alignment on the west slope runs parallel to the edge of anthropic escarpment

- KM9.6 – KM12.0. On this segment of the alignment, the river Dzirula presents some meanders, as in the previous ones in correspondence with the meanders the erosion of the river bank is present; in this segment of the stream there is a considerable tectonic influence. Differently from the previous observation segment there is a minor presence of the secondary fluvial system; also in this case the small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set in correspondence of the faults. On both slopes of the valley the irregular succession of Porphyrites (J₂B₂B formation) are the predominant lithology with the presence of the colluvial deposits (cdQ formation); edges of natural escarpment are present at the change of the lithology. The alignment passes on the north slope (in parallel with the river); on the same slope there are two active landslides but they do not involve the alignment because in this very point the alignment passes through the slope. In the meantime the alignment is interested by some faults intercepted along the way; in correspondence with these faults, with orientation NNW-SSE, is reported the presence of cataclastic belts with a width of 20m.
- KM12.0 – End of Project Road. Along this final segment of the alignment, the river Dzirula changes the direction of the water flow with minor curvature but in correspondence of the meanders the erosion of the river banks is presents. This segment is affected by many faults in the Porphyritic complex (J₂B₂B), with a prevalent orientation towards NNE-SSW; also in this case the small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the faults.

F.1.6 Natural Hazards

Regional Context - Georgia is one of the more complex mountainous regions living through the development of natural disasters, in which multi-spectral natural hazards are distinguished by their high recurrence rates and negative consequences for the population and infrastructure, as well as high rates of land resource losses and economic damage. Among the different types of natural disasters that periodically cause significant damage to the country's economy and often cause human casualties, the most relevant to the Project are landslides.

Almost all morphological-climatic zones in Georgia, starting with the sea coastline up to the high altitude mountain alpine-nival zone, have experienced damage to different extents. Over 50,000 landslides of different sizes and over 3,000 mudflow-transforming watercourses (rivers, canyons) have been identified in the country, as well as hundreds of kilometers of eroded riverbanks and coastline. Up to 70% of the territory and around 63% of the population are permanently at risk of natural disasters of different intensities.

Landslides – Generally, the landslides do not affect continuously the project alignment, except for two mass movements that have been identified at around KM1.4 to KM1.6 and at KM6.4. The first identified landslide area at TUN 3.0.01-TA/AT resulted in the realignment of the tunnel in order to have its western portals outside the landslide area. The second smaller landslide affects the western abutments of BRI 3.1.06-TA/AT and the eastern portals of TUN 3.0.05-TA/AT. The Bridge piers will be constructed on piles that will eliminate impacts to the bridge, while the tunnel portal will be strengthened for a distance of 6 meters to ensure the landslide does not affect the tunnel.

Seismicity - According to the Seismic Hazard Map of Building Norms and Rules effective in Georgia "Earthquake-resisting construction (SSM III, 21.10.2009 N 128, article 1477) PN 01.01-09)", the study area is located in the 8-point earthquake zone (MSK 64 scale⁹) with the dimensionless coefficient of seismicity (A) equaling 0.164 (Boriti village) under the same

^{9 9} MSK-64, is a macro-seismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. The MSK scale has 12 intensity degrees. Magnitude VIII can be compared to 6 – 7 on the Richter scale.

document. Table 34 illustrates the seismic conditions in Georgia.

Table 34: Seismicity Map of Georgia (MSK Scale)

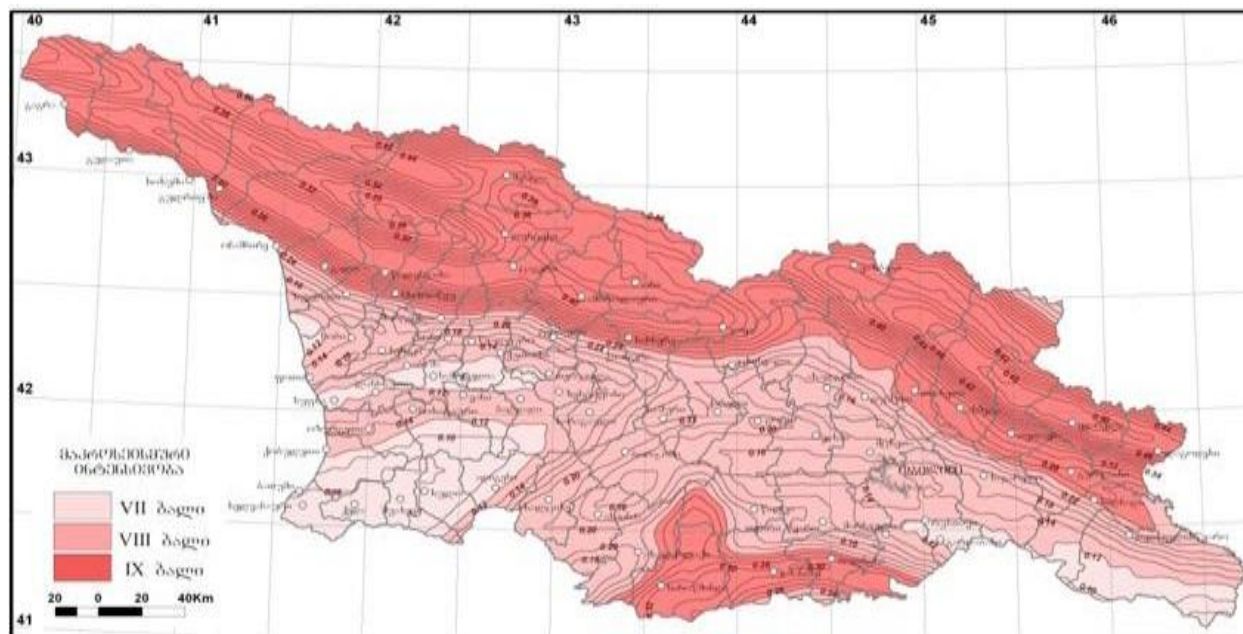


Table 35: Seismicity in the Region

Settlement	Region	Municipality	Seismicity coefficient	Magnitude (MSK64 scale)
Khunevi	Imereti	Kharagauli	0.15	8
Vertkvichala	Imereti	Kharagauli	0.14	8
Boriti	Imereti	Kharagauli	0.14	8
Makatubani	Imereti	Kharagauli	0.14	8

F.1.7 Hydrology

F.1.7.1 Surface Water

Regional Context – In Georgia there are 26,060 rivers and stream with a total length of 60,000 km. They belong both to the Caspian and Black Sea basins. 25,075 (99.4%) of the rivers are small (less than 25km length), with total length of 54,768 km. More than 18,109 (70%) of the rivers belong to the Black Sea basin, and 7,951 (30%) belong to the Caspian Sea basin. Figure 41 illustrates the division on the Caspian and Black Sea basins.

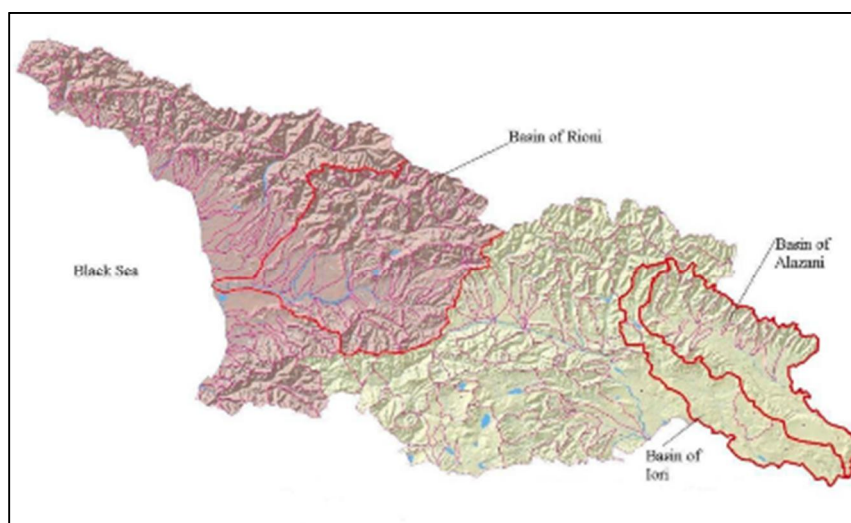


Figure 41: Rioni Sub-basin

The Project road is located within the Black Sea basin in the Rioni sub-basin. The Rioni sub-basin dominates western Georgia and has a total catchment area of 13,400 km², which is approximately 20% of the whole Georgian territory.

Local Context – The main river in the Project area is the Dzirula. The river heads at 1,252 m above sea level where several brooks merge on the western slopes of Likhi Range and flow into the river Kvirila from its left bank. The length of the river is 89 km, its total fall is 1,052 m and the area of its catch basin is 1,270 km². The river comprises 1,386 tributaries with the total length of 1,677 km. The major tributaries are the Dumala (34 km), Chkherimela (39 km) and Khelmosula (16 km). Within the Project area the main tributaries are: 1) Chkherimela River, 2) Macharula River, 3) Gezrula River and 4) Khelmosmula River.

The river basin is located on Imereti Plateau and is bordered by Likhi Range from east and south-east and by the river Kvirila basin from north and north-west. The river basin is well developed in the lower zone due to the confluence with the river Chkherimela. The relief of the river basin within the limits of the Likhi Range is strongly dissected with deep gorges of the river tributaries. The geology of the river basin is represented by granites, gneisses, limestones and sandstones. The soil cover of the basin is represented by loamy soils, and the vegetation cover in almost all basin is presented as a dense hardwood forest.

The river gorge is winding and mostly V-shaped. The width of the gorge bed varies from 20-25 m to 300-350 m. The slopes of the river gorge merge with the slopes of the adjacent ridges. The river has terraces only in its middle and lower reaches. The width of the terraces varies from 50 to 400 m; their height is from 2-3 m to 7-8 m. The river floodplain is weakly developed.

Figure 42: Dzirula River, Shrosha



The river bed is moderately winding and mostly non-branched. The bed in the upper reaches is stony giving the current a mountainous character. The width of the current varies from 10 to 30 m, its depth is 0,5-1,8 m, and its speed is within the limits of 0,8 and 1,5 m/sec. The river is mostly fed with snow and rain waters. Its water regime is characterized by spring flood often accelerated by freshets caused by rains, non-stable low-water periods in summer and freshets in autumn and winter caused by rains and rapid air warming. The yearly distribution of the river flow is extremely uneven. On average, 48% of the annual flow flows in spring, 9-12% flows in

summer and autumn and 30% flows in winter. Short icy events mostly as icy edges are fixed only at the river mouths.

Table 36: Average monthly discharges of the Dzirula River (million m³)

River	Station	Catchment (km ²)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dzirula	Tseva	1190	21.6	33.5	54.0	58.2	29.8	19.4	13.5	9.59	8.93	16.0	20.1	25.9

Table 37: Peak Discharges of the Dzirula River (million m³)

River	Station	Catchment (km ²)	Reoccurrence □ Year					
			1000	100	50	20	10	5
Dzirula	Tseva	1190	965	670	575	455	380	315

Surface Water Quality – To assess the status of water quality in the Project area, monitoring was undertaken in the Dzirula river in March, 2018. A total of eight surface water samples were collected and analyzed to determine the baseline water quality levels. Figure 43 illustrates the monitoring locations and Table 38 provides a table of the monitoring locations.

Figure 43: Surface Water Monitoring Locations

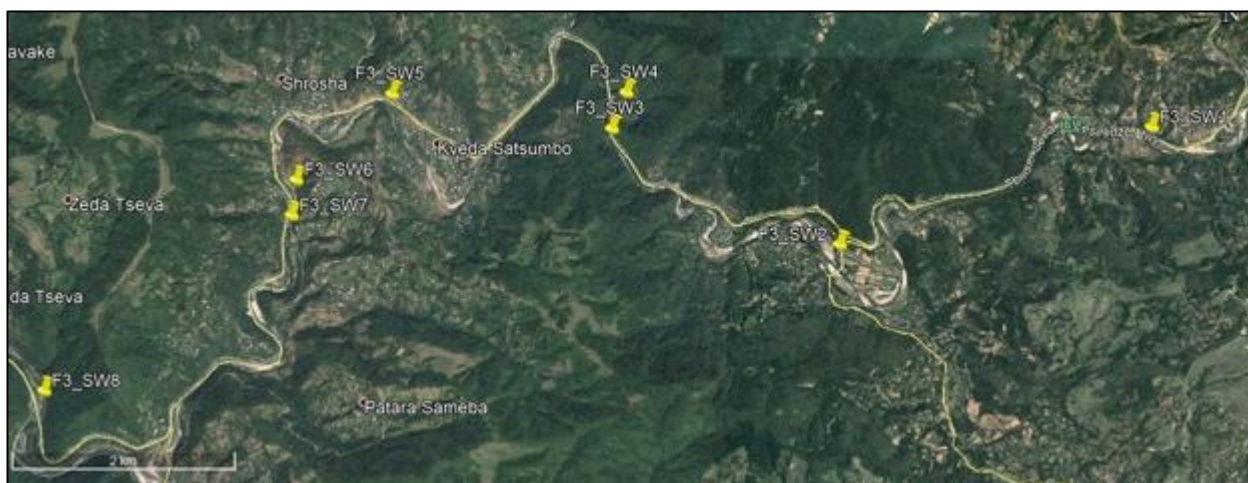


Table 38: Surface Water Monitoring Locations

Reference ID	Coordinates	
	X	Y
F3-SW1	356154	4663231
F3-SW2	353404	4662255
F3-SW3	351420	4663305
F3-SW4	351553	4663622
F3-SW5	349487	4663649
F3-SW6	348630	4662910
F3-SW7	348584	4662598
F3-SW8	346363	4661094

The results of the water quality monitoring are presented in Table 39 below show that both the Dzirula river meets the national MACs for surface water quality at the sampling locations.

Table 39: Surface Water Quality Monitoring Results

#	Parameter	Units	F3-SW1	F3-SW2	F3-SW3	F3-SW4	F3-SW5	F3-SW6	F3-SW7	F3-SW8	Method/standard	National, maximum allowable concentration
1	pH	-	7.1	7.15	7.2	7.35	7.3	7.3	7.15	7.3	ISO 10523-08	6.5-8.5
2	Electrical conductivity (EC)	S/m	0.0086	0.0083	0.0099	0.0089	0.0098	0.0092	0.0098	0.0120	ISO 7888-85	n/a
3	Turbidity	FTU	135.0	211.0	203.0	230.0	94.0	158.0	119.0	237.0	ISO 7027-99	n/a
4	BOD ₅	mg/l O ₂	1.1	1.6	1.3	1.7	1.4	1.5	1.3	1.6	ISO 5815-03	6
5	COD	mg/l O ₂	17.0	<15.0	18.0	17.4	<15.0	<15.0	<15.0	16.8	ISO 6060-89	30
6	Dissolved oxygen (DO)	mg/l	10.5	11.2	10.4	12.1	10.6	12.0	10.9	10.8	ISO 5815-03	≥4
7	Total suspended solids(TSS)	mg/l	38.4	30.2	41.9	45.6	43.5	35.8	44.1	41.0	ISO 11923-97	increase by ≤ 0.75
8	Oil and grease	mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	EPA 413,1-97	n/a
9	Total Phosphorus	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ISO 6878-04	2
10	Total Nitrogen	mg/l	0.61	0.45	0.59	0.7	0.52	0.55	0.59	0.54	GOST 18826-73	n/a
11	Total Ammonium	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	GOST 4192-82	0.5 mg/l NH ₄
12	TPH	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	EPA 48,1-97	0.3
13	Total residual chlorine	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	GOST 18190-72	n/a
14	Total Zinc	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	ISO 8288-A-86	1
15	Dissolved Copper	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	ISO 8288-A-86	1
16	Manganese	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	EPA 3005 A-92	1
17	Total Coliform Bacteria	1000ml	4530	3000	2800	2500	2700	3000	5400	6000	ISO 9308-1:2014	≤10 000
18	temperature	°C	11.5	10.7	11.9	11.8	8.7	8.3	11.3	11.6		

No fisheries are known to exist within the Project area, although recreational fishing was observed during surveys performed by the LCF.

F.1.7.2 Groundwater Water

Local Context – A survey of groundwater sources was undertaken within the Project area by the LCF. The survey found that in general the residents of the villages within the Project area do not use groundwater from wells in the Project area. Water is tapped from a piped network located in the hills above the villages in the valley.

As part of the Projects Geological study a number of boreholes were excavated within the Project area. Groundwater levels between generally ranged between 0.3 and 8.8 meters in depth.

Groundwater Quality - A sample of groundwater was collected from a well in the village of Kveda Satsumbo to assess the baseline groundwater quality in the Project area. The groundwater level in the well was around 6 meters and according to the owner of the well the water level does not change seasonally. Figure 44 and Table 40 provide the monitoring location and Table 41 provides the results.

Figure 44: Groundwater Monitoring Locations



Table 40: Groundwater Quality Monitoring Locations

#	Point #	Coordinates		Description
		X	Y	
1	F3-GW1	350004	4663329	vil.Kveda Satsumbo Well depth approximately 11 m. Water level (from the top of the well to water table) 6m. Note: distance from ground level till the top of the well is 0.70cm. According to the owner (Gogi Tabagari) water level does not change seasonally.

Table 41: Groundwater Quality Monitoring Results

#	Parameter	Units	F3_GW1	Method/standard	National limit, maximum allowable concentration	WHO, guidance values, mg/l
1	pH	-	7.25	ISO 10523-08	6.5-8.5	n/a

#	Parameter	Units	F3_GW1	Method/standard	National limit, maximum allowable concentration	WHO, guidance values, mg/l
2	Dissolved oxygen (DO)	mg/l	6.10	ISO 5815-03	n/a	n/a
3	Electrical conductivity (EC)	S/m	0.0692	ISO 7888-85	n/a	n/a
4	Alkalinity	mg-eq/l	5.74	Gost 23268.3-78	n/a	n/a
5	Hardness	mg-eq/l	5.27	Gost 23268.5-78	7-10	n/a
6	Total suspended solids (TSS)	mg/l	<2.0	ISO 11923-97	n/a	n/a
7	Total dissolved solids	mg/l	537.7	Calculated	1000-1500	n/a
8	Arsenic, As	mg/l	<0.005	Gost 4152-89	<0.01	0.01
9	Chlorides	mg/l	33.4	Gost 23268,17-78	<250	n/a
10	Iron, Fe	mg/l	0.03	EPA 3005 A-92	<0.3	n/a
11	Nitrates	mg/l	13.3	Gost 18823-73	<50	50
12	Sodium, Na	mg/l	34.1	ISO 9964-3-93	<200	n/a
13	Potassium, K	mg/l	1.60	ISO 9964-3-93	n/a	n/a
14	Calcium, Ca	mg/l	54.0	Gost 23268,5-78	<140	n/a
15	Magnesium, Mg	mg/l	31.2	Gost 23268,5-78	<85	n/a
16	Lead, Pb	mg/l	<0.01	ISO 8288-A-86	<0.01	0.01
17	Sulphates	mg/l	44.0	Gost 23268,3-78	<250	n/a
18	Manganese, Mn	mg/l	<0.02	EPA 3005 A-92	<0.4	0.4*

Results – The results of the groundwater monitoring indicate all parameters in sample location F3_GW1 meet the national MACs and where applicable, World Health Organization (WHO) standards.

F.2 Ecological Resources

The project road crosses the natural forest areas, agricultural land plots, hilly forest slopes, residential areas and riparian ecosystems. Due to anthropogenic impact in the main part of the area natural vegetation is lost to agricultural and other development. In these areas arable lands and pastures have developed. Some of the animal species typical for the area moved to other areas in search of a safe shelter. Over the time the fauna of the region has changed significantly. Animals currently found in the area of interest are mainly presented by those species that live in forested areas and/or can tolerate presence of humans.

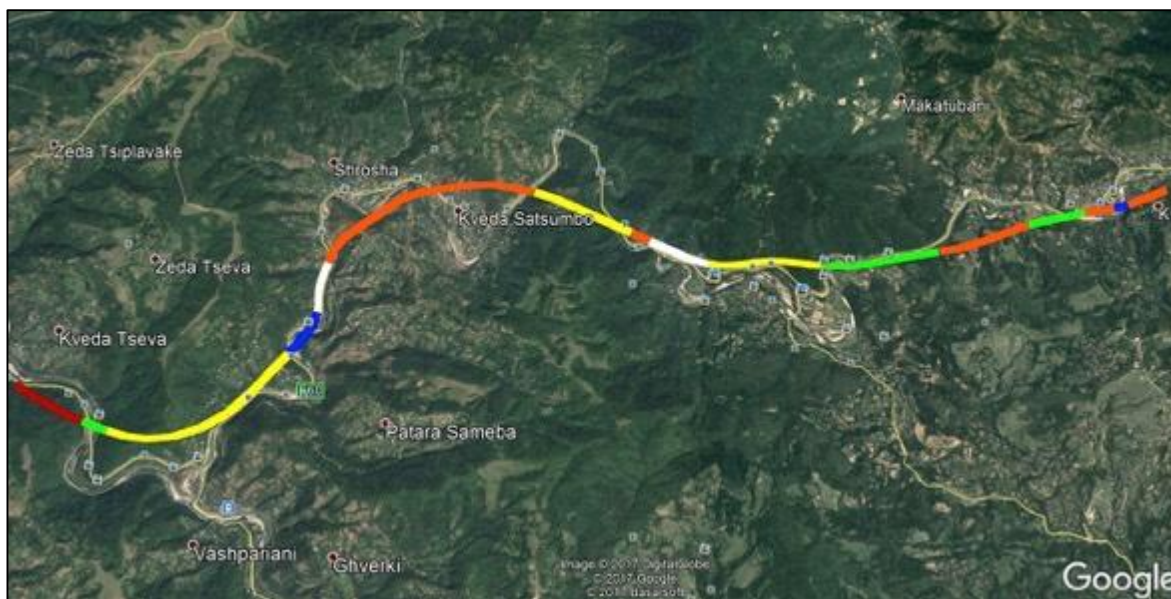
The natural forest massifs have significant value from biodiversity protection viewpoint, because of their importance as migration route for the local animal species.

Biodiversity Study – To fully understand the biodiversity in the Project area a biodiversity study was carried out by the LCF. The study was based on two aspects, firstly existing data was collected and analyzed in the form of a 'desk-top' study'. This was then followed up with field surveys. The aim of the study was to identify of animal species within the study area; to reveal significant habitats for inhabitant species; to determine possible impact on animal biodiversity on construction and operation phases and to develop impact mitigation measures.

E.2.1 Habitat

Main Habitats in the Project Area - The study are has been divided in 5 sections according to the habitats types (see Figure 45).

Figure 45: The Study Area with Indication of the Transects and Boundaries of the Habitats



1	Code of Georgia 62GE04 Vegetation of agricultural-economic settlements and cultivable land
2	Code of Georgia 91EO Alluvial forest with Adler trees - <i>Alnus glutinosa</i> and ash tree - <i>Fraxinus excelsior</i>
3	Code of Georgia 323GE Clayey and rock riverine vegetation with duckweed/Alpine rivers and their ligneous vegetation`
4	Code of Georgia: 9260CS-GE Chestnut forest and broadleaf mixed forest
5	Code of Georgia: 91CB-GE Hornbeam forest with Colhic undergrowth
6	Code of Georgia 9160GE Oak or oak-hornbeam forests (<i>Quercitum</i> - <i>Carpinion betuli</i>)

Habitat 1. Code of Georgia 62GE04 vegetation of urban and rural areas - Vegetation of village settlements and cultivable land is extremely interesting from the point of view of plants of economic importance. In this habitat there are various species of aborigine, invasive and adventive cosmopolitan plants related to wild relatives of cultural plants and those used in traditional (people's) and scientific medicine, including, Chicory - *Cichorium intybus*, meliot - *Melilotus officinalis*, yarrow - *Achillea millefolium*, agrimony – *Agrimonia eupatoria*, creeping couch-grass - *Agropyron repens*, shepherd's purse - *Capsella bursa-pastoris*, henbane - *Hyoscyamus niger*, mother of nettle - *Lamium album*, forest mallow - *Malva sylvestris*, great plantain - *Plantago major*, coltsfoot - *Tussilago farfara*, Henbane - *Hyoscyamus niger*, white nettle - *Lamium Album* , etc.

These plants are distributed on the territories of the city and village settlements, roadsides and transformed habitats. Most of them, as pioneer plants, create primary successions on eroded slopes as a result of human activities and construction works. Within this habitat, in residential and homestead plots cereals and fruits are cultivated (Figure 46).

Figure 46: View of the village area



Habitat 2 - Code of Georgia 91EO - Alluvial forest with Adler trees and Ash.¹⁰ Riverside forests are developed both in the forest zone and places without the forest, where it grows as a narrow line along the river-bed. Along with Ash (*Fraxinus oxycarpa*), European alder (*Alnus barbata*) and Eurasian aspen (*Populus tremula*), Aspen (*Populus tremula*) and Smilax (*Smilax excelsa*) are also met. In the forest zone, riparian forest does not differ from adjacent forest structure. In the riverside areas species like Common alder (*Alnus barbata*) are met, however less often than in wetland forests. Near the river Date-plum (*Diospyrus lotus*) and Black locust (*Robinia pseudoacacia*) are registered.

Figure 47: Secondary Mixed Forest of Dzirula with Dominance of Alder Black Locust



¹⁰ Corresponding categories:

1. United Kingdom classification: "W5 *Alnus glutinosa*-*Carex paniculata* woodland", "W6 *Alnus glutinosa*-*Urtica dioica* woodland)" and "W7 *Alnus glutinosa*-*Fraxinus excelsior*-*Lysimachia nemorum* woodland". 2. German classification: "43040401 Weichholzaunenwald mit weitgehend ungertörter Überflutungsdynamik", "43040402 Weichholzaunenwald ohne Überflutung", "430403 Schwarzerlenwald (an Fließgewässern)", "430402 Eschenwald (an Fließgewässern)", "430401 Grauerlenauenwald (montan, Alpenvorland, Alpen). 3. Nordic classification: "2234 *Fraxinus excelsior*-typ" and "224 Alskog". 4) Associated habitat Forests of this type border with moist meadows and flood plane forests

Habitat 3 - Code of Georgia 323 GE Clayey and rock riverine vegetation with duckweed - On river banks covered with silt or mud thin scrub can be found - hawthorn (*Crataegus kyrtostyla*), oriental hornbeam (*Carpinus orientalis*) and Jerusalem thorn (*Paliurus spina-christi*). Riverside vegetation is under the influence of floods during which it can completely disappear and then revive again. Mainly annual plants *Carex capillaris*, *Agrostis verticillata*, *Chamaenerion hirsutum*, *Verbascum gnaphalode*, cereals and perennial dicotyledons can be found.

Figure 48: View of Riverside Vegetation



Habitat 4 - Code of Georgia: 9260CS-GE Chestnut forest and mixed broadleaf forest¹¹
- Pure stand of the chestnut forest is rare. It is mainly mixed with beech *Fagus orientalis* or hornbeam *Carpinus betulus*. It is typical on shaded slopes. The border of vertical distribution varies between 100 and 900-1000 meters. It reaches highest altitude at 1450 meters. It grows on brown soils, does not like calcium. Is met in various undergrowth: 1. Chestnut (*Castanea sativa*) with *Trachystemon*, 2. Chestnut (*Castanea sativa*) with Cherry laurel (*Laurocerasus officinalis*), 3. Chestnut (*Castanea sativa*) with Caucasian blueberry (*Vaccinium arctostaphylos*).

¹¹ Corresponding categories

1. 9260 *Castanea sativa* woods. PAL.CLASS.: 41.9

2. 91L0 Illyrian oak –hornbeam forests (Erythronio-Carpinion). PAL.CLASS.: 41.2A

Figure 49: River Dzirula north slope – broadleaf forest with dominance of chestnut



Habitat 5 - Code of Georgia: 91CB-GE Hornbeam forest with Colchic undergrowth - It grows on fertile, well-drained soil. From mixed species dominate beech or the oak in other locations. The hornbeam is the component of the polydominant forest and is common together with other species. For Hornbeam forest with Colchic type understory four communities are characteristic:

1. Hornbeam forest with the understory of azalea, *C. betulus* - *Rhododendron luteum*
2. Hornbeam forest with the understory of blueberry, *C. betulus* - *Vaccinium arctostaphylos*,
3. Hornbeam forest with the understory of Pontic rhododendron , *C. betulus* - *Rhododendron ponticum*,
4. Hornbeam forest with laurel understory, *C. betulus* - *Laurocerasus officinalis*. It occupies rocky, stretching downhill slopes of northern exposition both on limestone and non-limestone places 300- 800 meters above the sea level.

Figure 50: Hornbeam Forest with Colchic Undergrowth



Habitat 6 - Code of Georgia: 9160GE- Oak or oak-hornbeam forests (*Quercitum* - *Carpinion betuli*)¹² - The study corridor and next to it two types of Oak are met: the

¹² Corresponding categories:

1. 91G0 * Pannonic woods with *Quercus petraea* and *Carpinus betulus*
2. PAL.CLASS.: 41.2B, 41.266, 41.267

Georgian oak (*Quercus iberica*) and Imeretian oak (*Quercus imeretina*). The following species can be found together with the oak: Oriental hornbeam (*Carpinus orientalis*), Maple (*Acer* sp.), Black locust (*Robinia pseudoacacia*), European ash (*Fraxinus excelsior*). In such forest massives oak forms mono-dominant groups and mixes with abovementioned plant species. In sub-communities Oak-Hornbeam with Ruscus bushes is worth to mention.

Figure 51: Oak-Hornbeam with Ruscus Bushes



The Study Area does not meet the criteria for Critical Habitat because it does not have high biodiversity value. It is not located in a legally protected area or an area officially proposed for protection.

Critical, Natural and Modified Habitat

Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.¹³

3. German classification: "430703 Stieleichen-Hainbuchenwald feuchter bis frischer Standorte".

4. Nordic classification: "2223 Fagus sylvatica-Mercurialis perennis-Allium ursinum-typ".

¹³ IFC Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources. January, 2012

Further, large portions of the Project road are located within tunnels (approximately 7km, around 55% of the road length) which eliminates impacts to habitat in the areas above the tunnels (but not at the portals). Other portions of the road are located within agricultural and urban areas, classified as modified habitat.

However, there are numerous areas within the Project buffer zone which can be classified as natural habitat (If the habitat still largely contains the principal characteristics and key elements of its native ecosystem(s), such as complexity, structure and diversity, than it should be considered a natural habitat regardless of the presence of some invasive species, secondary forest, human habitation or other human-induced alteration¹⁴), these areas are shown below and include the State Forest Fund (SFF) areas identified as part of the SFF inventory.

Figure 52: Buffer, KM1.9 – KM3.1 (Area: 77,366 m³)



¹⁴ Guidance Note 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources. IFC 2012

Figure 53: Buffer, KM4.6 – KM5.6 (Total Area:97,419 m³)



Figure 54: Buffer, KM6.3-KM6.5 (Area:12,049 m³)

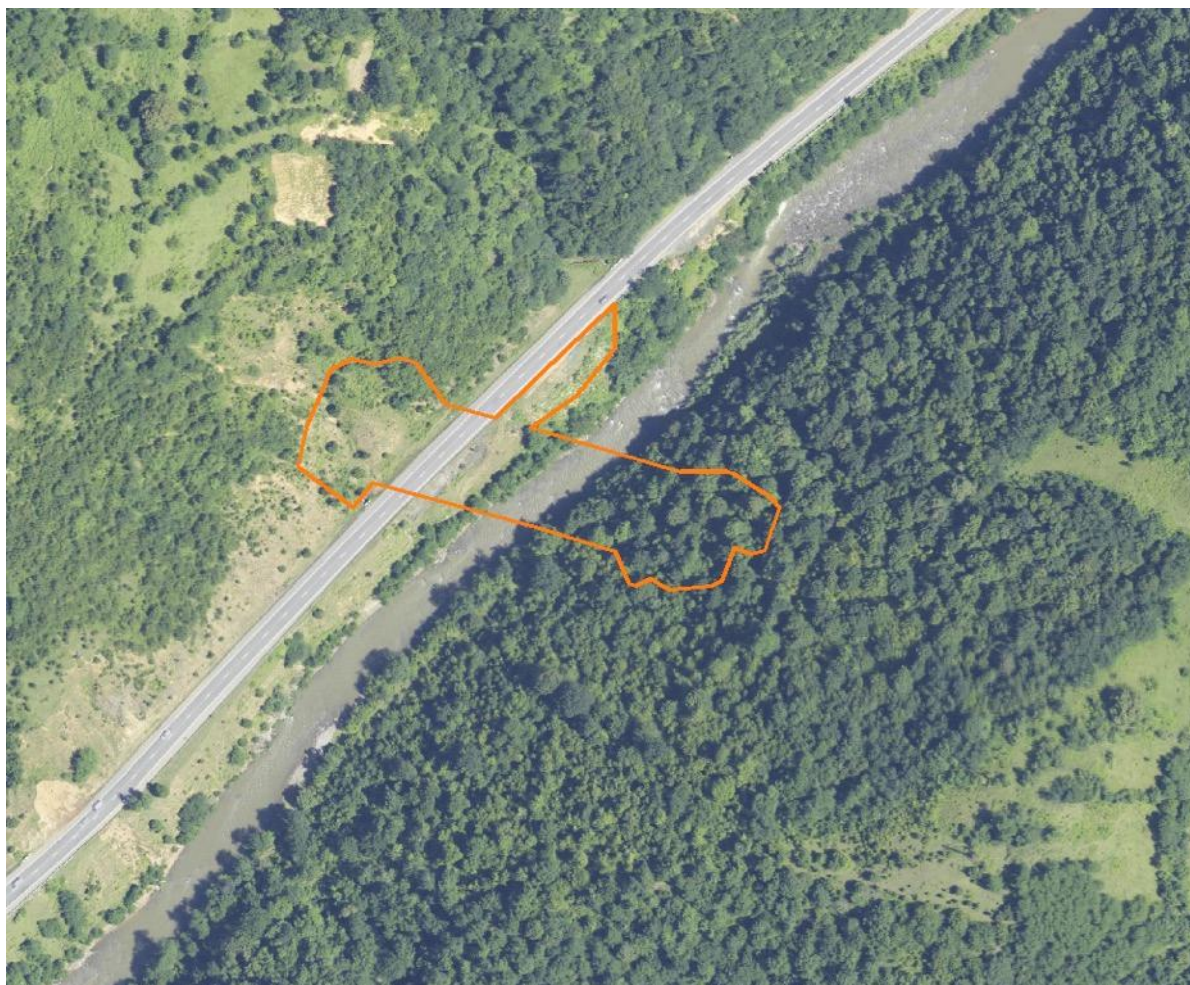


Figure 55: Buffer, KM8.5 – KM9.8 (Area: 104,105 m³)



Figure 56: KM8.5 – KM9.8 - Continued (Total Area: 104,105 m³)

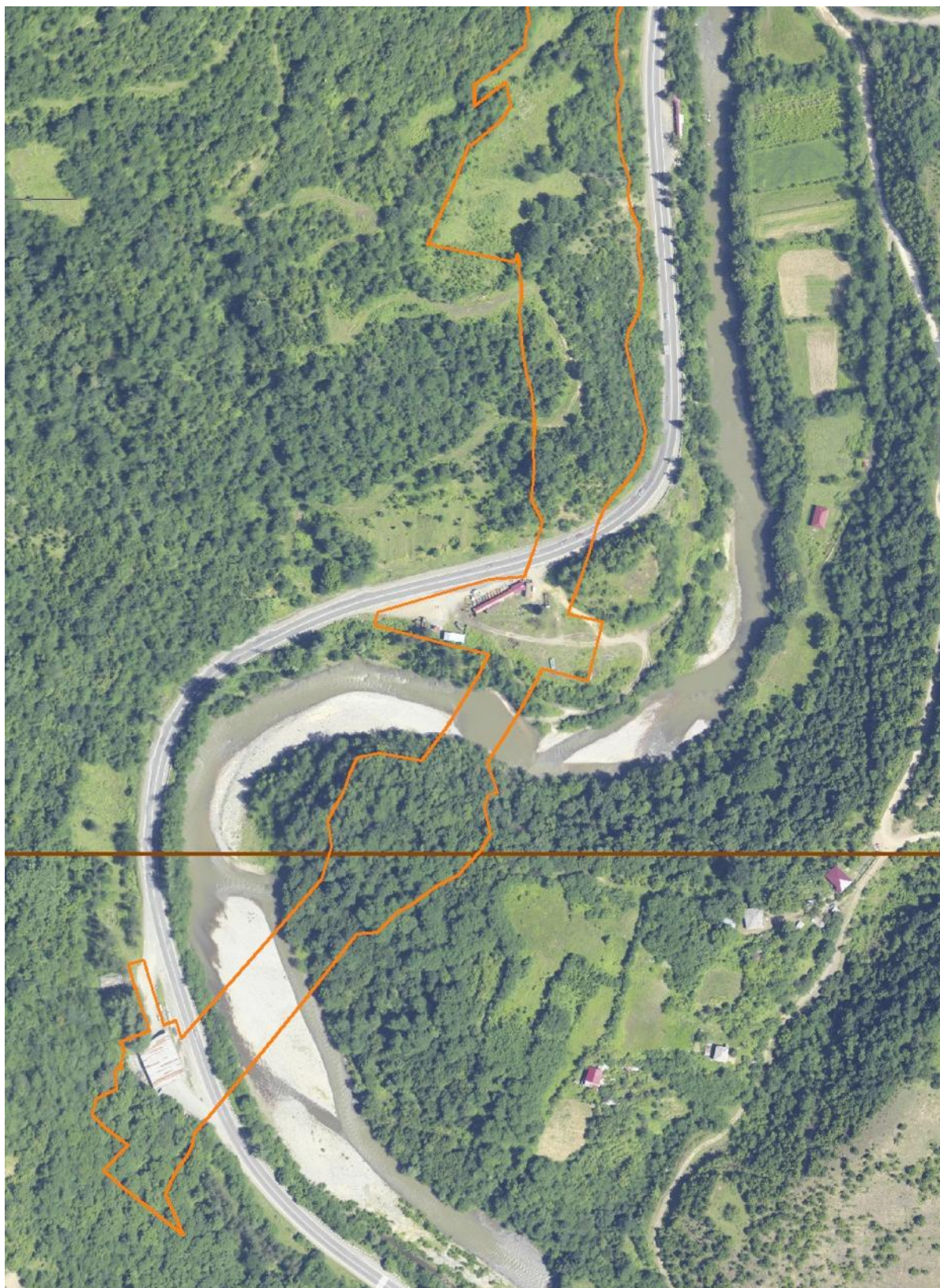


Figure 57: Buffer, KM10.3 – KM10.9 (Total Area: 47,620 m³)



Figure 58: Buffer, KM 12.0 – 12.2 / KM12.8 – KM12.9 (Total Area: 20,682 m³)



The total size of the identified areas is 359,241m², or approximately 36 hectares. Around 10% of this total area can be removed as it comprises residential properties and the existing alignment, leaving a total of around 33 hectares. All of these areas comprise the State Forest Fund areas (total 18.6 hectares) that will be de-listed as per the national requirements outlined in this report.

F.2.2 Fauna

Mammals - According to available information there are two species (Caucasian squirrel and Eurasian otter) considered as vulnerable in Georgia (Georgian Red List). The Otter is also included in the IUCN red list as nearly threatened (NT) (see Table 42). During the site visit the list of species listed above was taken as guidance. Objective of the survey was to double check available information on the site. Particular attention was paid to detection of the species listed under protected category. Therefore, specific focus was on the study of the habitats suitable for these mammals.

Otter (*Lutra lutra*) is known to be found in Kvirila/Dzirula river basin, however the sources does not provide any information on community structure and number of species in the area of interest. The Otter is river associated species mainly met in slow flowing sections of the streams/rivers. It isn't uncommon for them to travel great distances on land or through the water. This can be up to 26 square kilometers. However, it is important to remember that otters home range differs from their territory. The actual territory that is distinctly their own is very small. Otters mark their habitat with droppings (spraints). So, they can be registered by smell (smell of fresh cut hay). Generally the otters are not afraid of people and can be met

in the limits of residential areas. The aquatic habitats of otters are extremely vulnerable to man-made changes. Canalization of rivers, removal of bank side vegetation, dam construction, draining of wetlands, aquaculture activities and associated man-made impacts on aquatic systems are all unfavorable to otter population.

Site surveys undertaken by local ecologists did not reveal actual evidence of otters in the Project area, such as spraints and holts, but that does not preclude the fact that there are possibly several locations within the Project area that would provide suitable habitat for otters. For example, several suitable otter habitats were noted in Section F2. In addition, other anecdotal and photographic evidence provided by the ADB shows that otters are present within the vicinity of the Project area, notably at the confluence of the Rikotula and Dzirula rivers. As such, it is considered highly likely that otters can be found within the Project area.

Figure 59: Evidence of the Presence of Otters at the Confluence of Rikotula and Dzirula Rivers, April 2018



Source: Duncan Lang, ADB Environmental Specialist

Caucasian squirrel (*Sciurus anomalus*) can be met in the deciduous forest. Their nests are usually found in the tree hollows, under rocks, inside heaps of stones, and in residential areas, such as graveyards and abandoned cattle sheds. They are diurnal, are not active in winter. The peak of activity is in summer. Caucasian squirrels become most active during the early morning to morning and during the two hours before sunset in early summer. Like other tree squirrels, they are territorial. The animal marks territories with urine and feces. The marks are renewed several times every day. There is no information available regarding home range. Caucasian squirrels are herbivorous; they eat seeds and fruits and therefore, likely have an important influence on the forest ecosystem as seed dispersers.

During the site visit the trees within the RoW of the new alignment (with exclusion of the areas where tunnels are planned) have been checked. Neither burrows, nor squirrels have been registered in the studied area. The review of the habitat along the alignment is not optimum for existence of the Caucasian squirrel. Therefore construction and subsequent presence (operation) of the highway will not change the population trend.

Bats – Bats are considered as vulnerable group. They are rather limited in selection of nesting shelters. Favourable shelters are hollow trees, caves and abandoned buildings. All species of bats observed in Georgia are included in the Annex II of Bonn Convention and

protected by the agreement of EUROBATS. Based on this agreement, Georgia is mandatory to protect all bats inhabiting the Project area and in its vicinities, they include:

- **Lesser horseshoe bat** (*Rhinolophus hipposideros* Bechstein – IUCN Status: Least Concern (LC)) It forages close to ground within and along the edges of broadleaf deciduous woodland, which represents its primary foraging habitat, but also in riparian vegetation, Mediterranean and sub-mediterranean shrubland. Its prey consists mainly of midges, moths and crane flies. Foraging activities take place nearly exclusively within woodland areas, while open areas are avoided. Habitat loss and fragmentation may therefore reduce the amount of suitable habitats for the Lesser Horseshoe Bat and pose a threat to this species. Summer roosts (breeding colonies) are found in natural and artificial underground sites and in attics and buildings. In winter it hibernates in underground sites (including cellars, small caves and burrows). A sedentary species, winter and summer roosts are usually found within 5-10 km (longest distance recorded 153 km). Recommended conservation measures include protecting maternity roosting sites, hibernation caves and foraging habitats.
- **Particoloured bat** (*Vespertilio murinus* – IUCN Status: LC) forages in open areas over various habitat types (forest, semi-desert, urban, steppe, agricultural land). It feeds on moths and beetles. Summer roosts tend to be situated in houses or other buildings; also rarely hollow trees, nest boxes, or rock crevices. Winter roost sites include rock fissures, often (as a substitute) crevices in tall buildings (including, or especially, in cities), occasionally tree holes or cellars. Winter roosts are usually in colder sites that are exposed to temperature changes. Migrations of up to 1,780 km have been recorded, although the species is sedentary in a large part of its range. This nocturnal species appears late in the evening, sleeping in narrow crevices during the day. It lives in small colonies and often single individuals are sighted. It hibernates throughout the winter. Young are born in June/July, generally 2 at a time, and are stuck onto the chest of the mother during flight.
- **Common pipistrelle** (*Pipistrellus pipistrellus* Schreber – IUCN Status: LC) forages in a variety of habitats including open woodland and woodland edges, Mediterranean shrublands, semi-desert, farmland, rural gardens and urban areas. It feeds on small moths and flies. Summer roosts are mainly found in buildings and trees, and individuals frequently change roost site through the maternity period. Most winter roost sites are located in crevices in buildings, although cracks in cliffs and caves and possibly holes in trees may also be used. It is not especially migratory in most of its range, but movements of up to 1,123 km have been recorded. In at least parts of its range it seems to benefit from urbanization.
- **Serotine** (*Eptesicus serotinus* Schreber – IUCN Status: LC) is found in a variety of habitats across its wide range including semi-desert, temperate and subtropical dry forest, Mediterranean-type shrubland, farmland and suburban areas. Favoured feeding areas include pasture, parkland, open woodland edge, tall hedgerows, gardens, and forested regions. Feeds on larger beetles, moths and flies. Most summer (maternity) colonies are in buildings and occasionally tree holes or rock fissures. In winter it roosts singly or in small numbers in buildings and rock crevices, or often in underground habitats in north central Europe. Winter roosts are usually in fairly cold, dry sites. It is a largely sedentary species, with movements to 330 km recorded.

Table 42: Mammals Identified Within the Project Area Based on Literary Sources

Latin name	Common name	GRL	IUCN	Other protection	Number of section
<i>Erinaceus concolor</i> Martin.	Southern whitebreasted Hedgehog		LC		1/2/3/4/5
<i>Suncus etruscus</i> Savi.	Pygmy whitetoothed shrew		LC	Appendix III of the Bern Convention.	1/2/3
<i>Rhinolophus hipposideros</i> Bechstein.	Lesser horseshoe bat		LC	Bonn Convention (Eurobats); Bern Convention; Annex II (and IV) of EU Habitats and Species; Some habitat protection through Natura 2000	1/2/3
<i>Pipistrellus pipistrellus</i> Schreber.	Common pipistrelle		LC	Bonn Convention (Eurobats); Bern Convention in parts of its range where these apply, and is included in Annex IV of the EU Habitats and Species Directive.	1/2/3
<i>Eptesicus serotinus</i> Schreber.	Serotine		LC	Bonn Convention (Eurobats); Bern Convention in parts of range where these apply. It is included in Annex IV of EU Habitats and Species Directive, and there is some habitat protection through Natura 2000.	1/2/3
<i>Vespertilio murinus</i> Linnaeus.	Particoloured bat		LC	Bonn Convention (Eurobats); Bern Convention, in parts of its range where these apply. It is included in Annex IV of EU Habitats and Species Directive	1/2/3//5
<i>Dryomys nitedula</i> Pallas.	Forest dormouse		LC	Bern Convention (Appendix III); EU Habitats and Species Directive (Annex IV), in parts of its range where these apply.	1/2/3
<i>Arvicola terrestris</i> Linnaeus.	Eurasian water vole		LC		4
<i>Microtus arvalis</i> Pallas.	Common vole		LC		1/2/3/4/5
<i>Terricola nasarovi</i> Shidlovsky.	Nazarov pine vole		LC		1/2/3
<i>Sylvaemus uralensis</i> Pallas.	Pygmy wood mouse				1/2/3
<i>Mus musculus</i> Linnaeus.	House mouse		LC		1/3/4/5
<i>Sciurus anomalus</i> Gmelin.	Caucasian squirrel	VU	LC	EU Habitats Directive (92/43) IV 21/05/92; Bern Convention II 01/03/02, in parts of its range where these apply. Occurs in protected areas. Population monitoring is recommended, particularly in parts of the range where declines have been noted.	4/5
<i>Lutra lutra</i> Linnaeus.	Eurasian otter,	VU	NT	Appendix I of CITES, Appendix II of the Bern Convention, Annexes	3/4

	Common otter			II and IV of the EU Habitats and Species Directives.	
<i>Mustela nivalis</i> <i>Linnaeus.</i>	Least weasel		LC	Appendix III of the Bern Convention.	1/2/3/4/5
<i>Felis silvestris</i> <i>Shreber.</i>	Wild cat		LC	CITES Appendix II (http://www.cites.org/eng/app/appendices.php); is fully protected across most of its range in Europe and Asia, but only some of its African range; is listed on the EU Habitats and Species Directive (Annex IV) as a "European protected species of animal"; listed in Appendix II of the Bern Convention. It is classed as threatened at the national level in many European range states (IUCN 2007).	4/5
<i>Canis aureus</i> <i>Linnaeus.</i>	Golden jackal		LC		2/3/4
<i>Vulpes vulpes</i> <i>Linnaeus.</i>	Red fox		LC		1/2/3/4
<i>Canis lupus</i>	Wolf		LC	Bern, CITES Appendix II	2/4/5
<i>Sus scrofa Linnaeus.</i>	Eurasian wild boar		LC		3/4
<i>Martes martes</i>	European pine marten		LC	Appendix III of the Bern Convention and Annex V of the European Union Habitats Directive, and it occurs in a number of protected areas across its range.	4/5

GRL – Red List of Georgia; IUCN - International Union for Conservation of Nature; VU = Vulnerable; LC = Least Concern.

Avifauna - The majority of birds found on the study area are presented by forest, shrubbery and other species, birds related to rocky places and waterfowls. The list of bird species potentially available in the project area (based on the desk top analysis of available data) is given Table 43 in below. None of these species are protected. The territory is not significant habitat for birds and does not include priority habitats for avian species (see Figure 60).

Figure 60: Significant Bird Habitat in Georgia

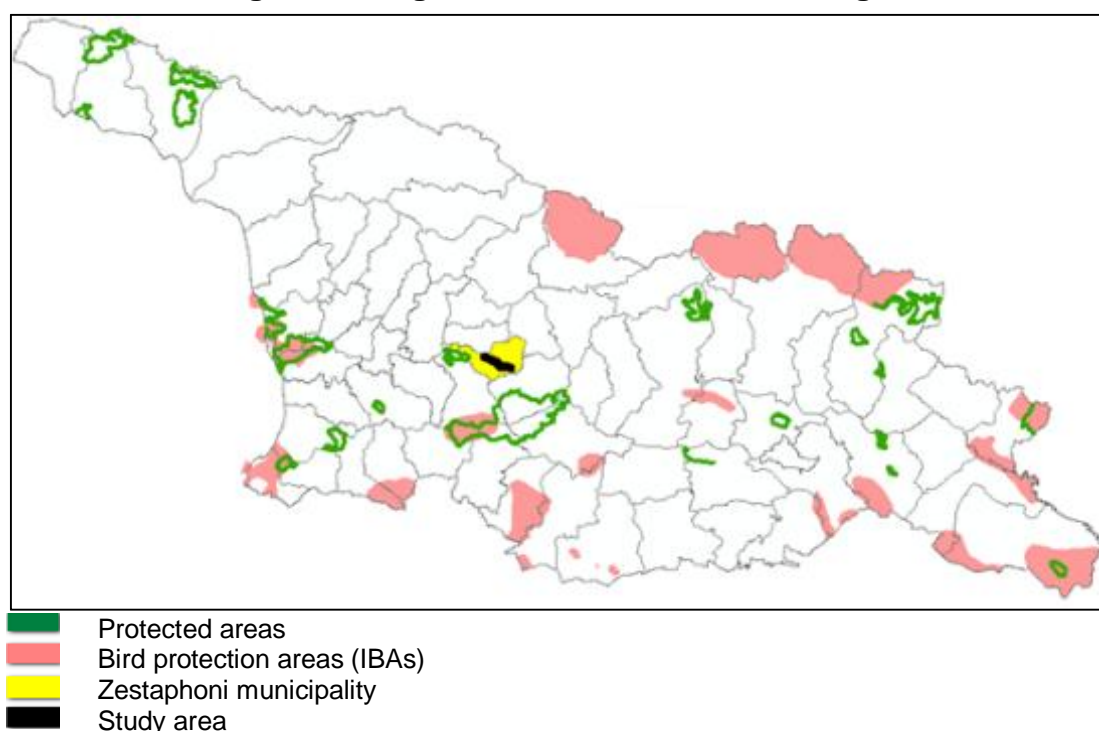


Table 43: Birds within the study area, known according to literary sources

№	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section N
1.	<i>Motacilla alba</i>	White Wagtail	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
2.	<i>Apus apus</i>	Common Swift	-	BB, M	LC	Bern Convention	1/2/3/4/5
3.	<i>Merops apiaster</i>	European Bee-eater	-	BB, M	LC		1/2/3/4/5
4.	<i>Corvus cornix</i>	Hooded Crow	-	YR-R	LC		1/2/3/4/5
5.	<i>Garrulus glandarius</i>	Eurasian Jay	-	YR-R	LC		1/2/3/4/5
6.	<i>Turdus merula</i>	Eurasian Blackbird	-	YR-R	LC	Bern Convention	1/2/3/4/5
7.	<i>Delichon urbicum</i>	House-Martin	-	BB, M	LC	Bern Convention	1/2/3/4/5
8.	<i>Sturnus vulgaris</i>	Common Starling	-	YR-R, M	LC		1/2/3/4/5
9.	<i>Columba livia</i>	Rock Dove	-	YR-R	LC		1/2/3/4/5
10.	<i>Columba oenas</i>	Stock Dove	-	YR-R	LC		1/2/3/4/5
11.	<i>Columba</i>	Wood-Pigeon	-	YR-R	LC		1/2/3/4/5

Section F3 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
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	<i>palumbus</i>						
12.	<i>Hirundo rustica</i>	Barn Swallow	-	BB, M	LC	Bern Convention	1/2/3/4/5
13.	<i>Oriolus oriolus</i>	Golden Oriole	-	BB, M	LC	Bern Convention	1/2/3/4/5
14.	<i>Turdus viscivorus</i>	Mistle Thrush	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
15.	<i>Erithacus rubecula</i>	European Robin	-	YR-R	LC	Bern Convention	1/2/3/4/5
16.	<i>Fringilla coelebs</i>	Chaffinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
17.	<i>Cuculus canorus</i>	Common Cuckoo	-	BB, M	LC	Bern Convention	1/2/3/4/5
18.	<i>Phoenicurus phoenicurus</i>	Common Redstart	-	BB, M	LC	Bern Convention	1/2/3/4/5
19.	<i>Passer domesticus</i>	House Sparrow	-	YR-R	LC		1/2/3/4/5
20.	<i>Carduelis carduelis</i>	European Goldfinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
21.	<i>Carduelis chloris</i>	Greenfinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
22.	<i>Parus major</i>	Great Tit	-	YR-R	LC	Bern Convention	1/2/3/4/5
23.	<i>Parus caeruleos</i>	Blue tit	-	YR-R	LC	Bern Convention	1/2/3/4/5
24.	<i>Lanius collurio</i>	Red-backed Shrike	-	BB, M	LC	Bern Convention	1/2/3/4/5
25.	<i>Turdus philomelos</i>	Song Thrush	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
26.	<i>Aegithalos caudatus</i>	Long-tailed Tit	-	YR-R, M	LC	Bern Convention	1/2/3/4/5
27.	<i>Falco tinnunculus</i>	Common Kestrel	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5
28.	<i>Buteo buteo</i>	Common Buzzard	-	YR-R, M	LC	Bonn Convention, Bern Convention	4
29.	<i>Ardea cinerea</i>	Grey Heron	-	YR-R	LC	Bonn Convention, Bern Convention	4
30.	<i>Egretta garzetta</i>	Little Egret	-	YR-R	LC		4
31.	<i>Nycticorax nycticorax</i>	Night-Heron	-	BB, M	LC	Bonn Convention, Bern Convention	4
32.	<i>Tadorna ferruginea</i>	Ruddy Shelduck	-	YR-R	LC		4
33.	<i>Anas platyrhynchos</i>	Mallard	-	YR-R, M	LC	Bonn Convention, Bern Convention	4
34.	<i>Milvus migrans</i>	Black Kite	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5

35.	<i>Accipiter nisus</i>	Sparrowhawk	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5
36.	<i>Accipiter gentilis</i>	Goshawk	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5
37.	<i>Larus ridibundus</i>	Black-headed Gull	-	YR-R, M	LC		4
38.	<i>Upupa epops</i>	Common Hoopoe	-	BB, M	LC	Bern Convention	4
39.	<i>Corvus frugilegus</i>	Rook	-	YR-R, M	LC		1/2/3/4/5
40.	<i>Luscinia megarhynchos</i>	Luscinia megarhynchos	-	BB, M	LC		1/2/3/4/5
41.	<i>Phylloscopus collybita</i>	Common Chiffchaff	-	BB, M	LC		1/2/3/4/5

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

Surveys were carried out in: Aug 8-9 2017 - summer, Sept 22-23 2017- autumn;
March 1-2 2018 – spring; April 2015 - spring (feasibility stage walkover); and April 22-23, 2018. The schedule allowed a site survey for April which is the start of the breeding period. (Note: Breeding period is April-May, for some species – end of March.). Raptors are not registered in the area, but may be observed there while chasing a prey. Birds registered during the site surveys and information about their presence in the area is presented below.

Table 44: Birds, observed within the project area during the survey

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
1	<i>Motacilla alba</i>	White Wagtail	-	YR-R, M	LC	Bern Convention
2	<i>Apus apus</i>	Common Swift	-	BB, M	LC	Bern Convention
3	<i>Merops apiaster</i>	European Bee-eater	-	BB, M	LC	-
4	<i>Charadrius dubius</i>	Little Ringed Plover	-	YR-R, M	LC	Bonn Convention, Bern Convention
5	<i>Larus ridibundus</i>	Black-headed Gull	-	YR-R, M	LC	Bern Convention
6	<i>Corvus cornix</i>	Hooded Crow	-	YR-R	LC	-
7	<i>Garrulus glandarius</i>	Eurasian Jay	-	YR-R	LC	-
8	<i>Turdus merula</i>	Eurasian Blackbird	-	YR-R	LC	Bern Convention
9	<i>Delichon urbicum</i>	House-Martin	-	BB, M	LC	Bern Convention
10	<i>Upupa epops</i>	Common Hoopoe	-	BB, M	LC	Bern Convention
11	<i>Luscinia megarhynchos</i>	Luscinia megarhynchos	-	BB, M	LC	-
12	<i>Turdus viscivorus</i>	Mistle Thrush	-	YR-R, M	LC	Bern Convention
13	<i>Erithacus</i>	European	-	YR-R	LC	Bern Convention

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
	<i>rubecula</i>	Robin				
14	<i>Fringilla coelebs</i>	Chaffinch	-	YR-R, M	LC	Bern Convention
15	<i>Phoenicurus phoenicurus</i>	Common Redstart	-	BB, M	LC	Bern Convention
16	<i>Passer domesticus</i>	House Sparrow	-	YR-R	LC	-
17	<i>Carduelis carduelis</i>	European Goldfinch	-	YR-R, M	LC	Bern Convention
18	<i>Parus major</i>	Great Tit	-	YR-R	LC	Bern Convention
19	<i>Parus caeruleos</i>	Blue tit	-	YR-R	LC	Bern Convention
20	<i>Aegithalos caudatus</i>	Long-tailed Tit	-	YR-R, M	LC	Bern Convention
21	<i>Lanius collurio</i>	Red-backed Shrike	-	BB, M	LC	Bern Convention
22	<i>Phylloscopus collybita</i>	Common Chiffchaff	-	BB, M	LC	
23	<i>Turdus philomelos</i>	Song Thrush	-	YR-R, M	LC	Bern Convention
24	<i>Sylvia atricapilla</i>	Blackcap	-	BB, M	LC	

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round.; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction;
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

The project area is located far from protected areas and areas important for birds (see Figure 61: Overwintering Sites below). The area is not considered as migration corridor.

Figure 61: Overwintering Sites
(Project road in yellow, overwintering sites in red)



Reptiles - According to the literary sources, 8 species of reptiles are known to be present in the study area, out of which 2 are lizards, 2 – turtles and 4 – snakes. The only Red-Listed Vulnerable species that is recorded on the nearby territory of the Project road is Mediterranean turtle. This species prefers dry, open scrubby habitats, meadows and pastures, sand dunes, forest, heathlands, and open habitats through its wide range, generally on a sandy-calcareous substrate. The turtle is feeding on wide leaves, buds, flowers, seeds and fruits of grasses, herbs and shrubs, as well as small invertebrates such as snails, arthropods, and carrion. They emerge from hibernation around March or April depending on the weather. The species are vulnerable to death/injury when in hibernation and less able to escape from disturbance. They are vulnerable to disturbance during breeding season.

Table 45: Reptiles, known within the project area based on literary sources

No	Latin name	Common name	GRL	IUCN	Other protection	Section N
1	<i>Natrix natrix</i> Linnaeus.	Ring snake	LC	LR/LC	Bern Convention	1/4
2	<i>Natrix tessellate</i> Laurenti.	Dice snake	LC	LC	Bern Convention	4
3	<i>Coronella austriaca</i> Laurenti.	Smooth snake	LC	LC	Bern Convention	4/5
4	<i>Xerotyphlops vermicularis</i> Strauch.	Blind Snakes	DD	LC	Bern Convention	4/5
5	<i>Darevskia derjugini</i>	Artwin Lizard	LC	LC	Bern Convention	1/2/
6	<i>Testudo graeca</i> Linnaeus	Mediterranean turtle	VU	VU	Bern Convention	1/2/3
7	<i>Emys orbicularis</i>	European Pond Turtle	LC	NT	Bern Convention	1/2/3
8	<i>Lacerta strigata</i>	Striated Lizard	LC	LC	Bern Convention	1/2/3
9	<i>Darevskia rudis</i>	Spiny-Tailed Lizard	LC	LC	Bern Convention	2
10	<i>Anguis fragilis</i>	Caucasian Slow Worm	LC	LC	Bern Convention	1/4

VU = Vulnerable; NT = Near Threatened and LC = Least Concern, LR = Low risk, DD-Data Deficient

Site surveys were carried out in Aug 8-9 2017- summer, Sept 22-23 2017- autumn, March 1-2 2018 – spring and April 22-23, 2018. Activity of the species depends on weather. In summer, because of the hot weather activity of reptiles was low as they were avoiding overheating. In July and August they can be registered only in the morning and late evening when it is not too hot. During the August and September site survey only the Artwin lizards have been registered. The reptiles usually appear at the end of March. Peak of activity is from mid March until mid June which is the reproduction period. During the March and April surveys the snakes were not registered, however their presence in the areas where lizards are found exists. During the site survey Striated Lizard (4 units). Artwin lizard (3 units) and Slow worm (3 units) have been registered. The Mediterranean turtle was not encountered.

Figure 62: Reptiles Encountered During Site Surveys



354. Amphibians - According to the literary sources, the main amphibian species present in the area include:

Table 46: Amphibians, known within the project area based on literary sources

No	Latin name	Common name	GRL	IUCN	Other protection	Section N
1	<i>Hyla orientalis</i> Linnaeus	European Tree Frog	LC	LC	Bern Convention	4/5
2	<i>Bufo viridis</i>	European green toad	LC	LC	Bern Convention	4/5
3	<i>Pelophylax ridibundus</i> Pallas.	Marsh frog	LC	LC	Bern Convention	3/4
4	<i>Rana macrocnemis camerani</i> Boulenger.	Long-legged Wood Frog	LC	LC	Bern Convention	4/5

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; LC = Least Concern

355. During the site survey the listed species have one individual Marsh frog, tadpole and Long-legged wood frog have been registered near the Dzirula riverbed.

Figure 63: Amphibians Identified During Sites Surveys



359. Insects - The insects known to be present in the project area are listed below.

Table 47: Insects known within the project area based on literary sources

#	Latin Name	Common name	Georgian Red List	IUCN
1.	<i>Nymphalis antiopa</i>	Mourning-cloak butterfly	NE	NE
2.	<i>Lampyris noctiluca</i>	Glow-worm	NE	NE
3.	<i>Geotrupes spiniger</i>	Dumbedor beetle	NE	NE
4.	<i>Purpuricenus budensis</i>	Red long-horned Beetle	NE	LC
5.	<i>Polyommatus amandus</i>	Amanda's blue butterfly	NE	NE
6.	<i>Polyommatus corydonius</i>	False chalkhill blue	NE	NE

#	Latin Name	Common name	Georgian Red List	IUCN
		butterfly		
7.	<i>Polyommatus thersites</i>	Chapman's blue butterfly	NE	NE
8.	<i>Cercopis intermedia</i>	Frog hopper	NE	NE
9.	<i>Vanessa atalanta</i>	Red admiral butterfly	NE	NE
10.	<i>Mylabris quadripunctata</i>	Four-spotted blister beetle	NE	NE
11.	<i>Dorcus parallelipipedus</i>	Lesser stag beetle	NE	LC
12.	<i>Libellula depressa</i>	Broad-bodied chaser	NE	NE
13.	<i>Pieris rapae</i>	European cabbage butterfly	NE	NE
14.	<i>Plebeius argus</i>	Silver-studded blue butterfly	NE	NE
15.	<i>Aphis urticae</i>	Dark green nettle aphid	NE	NE
16.	<i>Pieris brassicae</i>	Cabbage butterfly	NE	NE
17.	<i>Pyrrhocoris apterus</i>	Firebug	NE	NE
18.	<i>Lymantria dispar</i>	Gypsy moth	NE	NE
19.	<i>Gryllus campestris</i>	Field cricket	NE	NE
20.	<i>Decticus verrucivorus</i>	Wart-biter	NE	NE
21.	<i>Tettigonia viridissima</i>	Great green bush-cricket	NE	NE
22.	<i>Sympetrum sp.</i>	Meadowhawks	NE	NE
23.	<i>Panorpa sp.</i>	Scorpion-flies	NE	NE
24.	<i>Lampyris noctiluca</i>	Common glow-worm	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluated

360. Within the project area Red cricket, blue railed damselfly have been met. No butterflies were registered.

Figure 64: Species Encountered During Site Surveys



Meadowhawk (Simpetrum sp.)

Scorpion-fly (Panorpa sp.)

Table 48: Spiders known within the project area based on literary sources

#	Latin name	Common name	Georgian Red List	IUCN
1.	<i>Pseudeuophrys sp</i>	jumping spiders	NE	NE
2.	<i>Trochosa sp.</i>	wolf spider	NE	NE
3.	<i>Amaurobius sp.</i>	araneomorph spiders	NE	NE
4.	<i>Argiope lobata</i>	Silver-faced	NE	NE
5.	<i>Menemerus semilimbatus</i>	Jumping spiders	NE	NE

#	Latin name	Common name	Georgian Red List	IUCN
6.	<i>Pardosa hortensis</i>	Wolf spiders	NE	NE
7.	<i>Larinioides cornutus</i>	Furrow orb spider	NE	NE
8.	<i>Misumena vatia</i>	Goldenrod crab spider	NE	NE
9.	<i>Pisaura mirabilis</i>	Nursery web spider	NE	NE
10.	<i>Micrommata virescens</i>	Green huntsman spider	NE	NE
11.	<i>Agelena labyrinthica</i>	Eurasian grass spiders	NE	NE
12.	<i>Asianellus festivus</i>	Jumping spiders	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluate

Fish – Table 49 indicates the fish species that can be found in the Project area.

Table 49: List of fish species available in the Rikotula and Dzirula River

#	Latin name	Common name	Protection status
1	<i>Leuciscus leuciscus</i> Linnaeus, 1758	Common dace	Low commercial value; IUCN – LC
2	<i>Chondrostoma colchicum</i> Derjugin, 1899 / <i>Chondrostoma colchicum</i> (Kessler) Derjugin	Colchic nase	Low commercial value due to limited stock. IUCN – LC
3	<i>Capoeta sieboldi</i> Steindachner, 1864 / <i>Varicorhinus sieboldi</i> (Steindachner)	Colchic khramulya	GRL-VU (B2a)
4	<i>Neogobius fluviatilis</i> , Pallas 1814 / <i>Gobius fluviatilis</i> Pallas	Monkey goby	GRL-VU (B2a), IUCN – LC
5	<i>Cobitis taenia</i> Linnaeus, 1758	Spined loach	Bern Convention, Annex III, IUCN – LC
6	<i>Alburnus alburnus</i> , Linnaeus, 1758	Bleak	IUCN - LC

IUCN-The International Union for Conservation of Nature; GRL – Red List of Georgia
LC – Least Concern; NE - Not Evaluated; VU-Vulnerable

Control catches have been carried out in two sections of the Dzirula river and also on several sections of the river in Sections F4 and F2. Table 50 Indicates the fish caught during the surveys which are deemed to be representative of this portion of the Dzirula river.

Table 50: Species found as the result of fishing in the project area

Common name	Latin name	Qty	Length, cm	Weight, g	Gender and maturity stage	Age
Barbel	<i>Barbus tauricus rionica</i> Kamensky, 1899	1	14.5	52	♂ III	3+
Colchic khramulya	<i>Capoeta sieboldi</i> Steindachner, 1864	3	18.0	64	♂ III	4+
			32	372	♀ V	4+
			24	225	♂ V	3+
Common dace	<i>Leuciscus leuciscus</i> Linnaeus, 1758	1	27	358	♀ V	3
Colchic nase	<i>Chondrostoma colchicum</i> Derjugin, 1899	1	17.5	94	♂ III	3+

Figure 65: Active Spawning Periods

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
<i>Barbus tauricus rionica</i> Kamensky, 1899					←→	←→	←→	←→				
<i>Leuciscus leuciscus</i> Linnaeus, 1758					←→	←→	←→	←→	←→			
<i>Chondrostoma colchicum</i> Derjugin, 1899			←→	←→	←→	←→	←→	←→				
<i>Capoeta sieboldi</i> Steindachner, 1864					←→	←→	←→	←→				
<i>Neogobius fluviatilis</i> , Pallas 1814				←→	←→	←→	←→					
<i>Cobitis taenia</i> Linnaeus, 1758					←→	←→	←→	←→	←→			
<i>Alburnus alburnus</i> , Linnaeus, 1758					←→	←→						

Figure 66: Controlled Catches



Barbel (*Barbus tauricus rionica* Kamensky, 1899), Colchic khamulya (*Capoeta sieboldi* Steindachner, 1864)



Colchic nase (*Chondrostoma colchicum* Derjugin, 1899)



Colchic khamulya (*Capoeta sieboldi* Steindachner, 1864)



Common dace (*Leuciscus leuciscus* Linnaeus, 1758)

F.2.3 State Forest Fund

The SFF is a state-managed/controlled forest area under the management of the MoEPA but is not a protected area. Though it is not protected, for the purpose of controlling its use, the MoEPA requires all trees to be taken of the SFF registration or “de-listed” before they can be cut.

According to the ToR for this EIA:

“Particular attention should be given to the presence of land plots registered as the State Forest Fund (SFF). If the right of the way of the selected alignment of the road section overlaps with the territory of the SFF, The consultant should prepare:

- 1. Cadastral measurement drawing for the relevant plot of the alignment (.shp files);*
- 2. According to the effective law, conduct preliminary inventory of timber resources existing at the territory, which should be taken of the SFF registration, or ‘de-listed’;*
- 3. In accordance with the Georgian legislation, provide relevant information on obtaining a cutting permit for species included in the Red List (if any);*
- 4. Prepare Tree Compensation Plan according to the de-listing documentation”*

The Project area has been surveyed to determine the extent of the SFF that will be affected by the Project. Cadastral drawings are provided as part of **Appendix F** which reproduces the survey in full.

An inventory of the timber resources has also been prepared. A total of 9,709 trees more than 8cm in diameter were recorded for de-listing, including the following Georgian red-listed species:

- 49 Zelkova (greater than 8cm in diameter).
- 603 Chestnut (greater than 8cm in diameter).
- 5 Yew Tree (greater than 8cm in diameter).

In addition a further 108,536 trees less than 8cm in diameter were recorded for de-listing.

Information relating to the compensation for tree cutting according to national legislation is outlined in **Section G.6.1**.

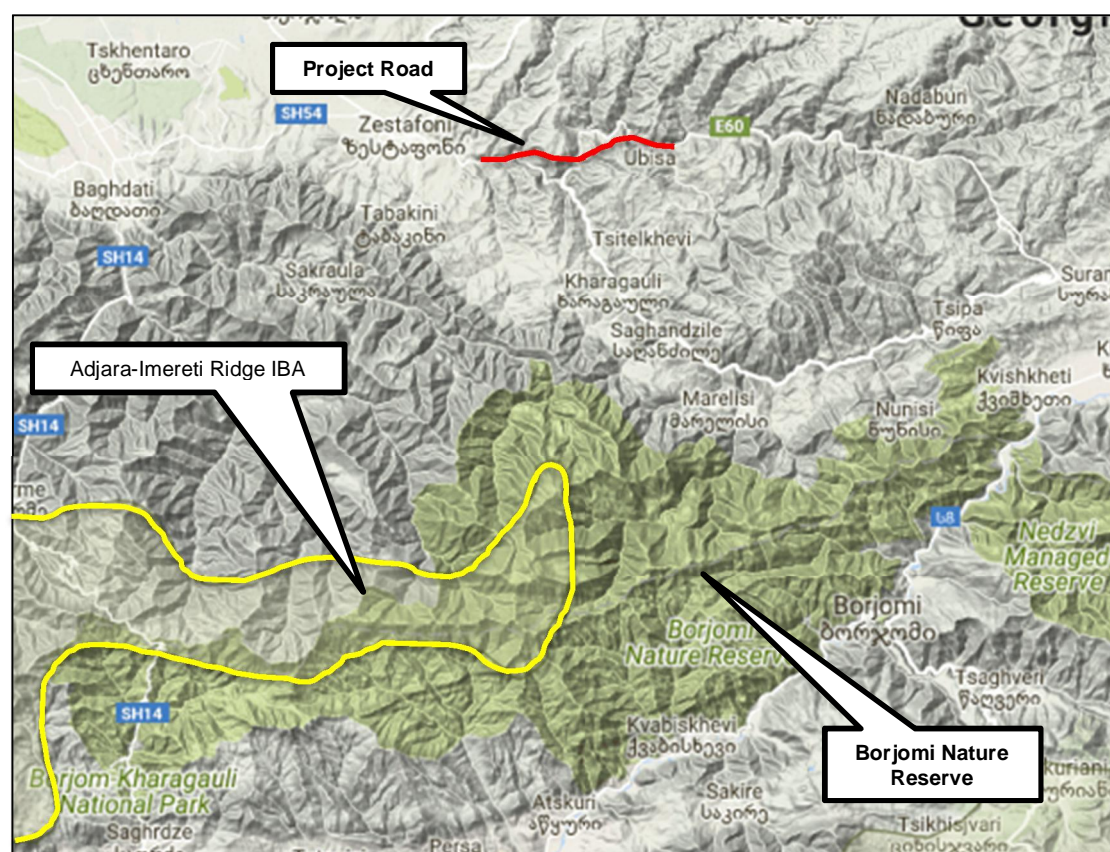
F.2.4 Protected Areas & Important Bird Areas

The nearest protected area in the region is the Borjomi Nature Reserve which is located more than 15 kilometers south of the Project road, see Figure 67.

The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road which overlaps with the Borjomi Nature Reserve. The IBA comprises populations of the following IBA trigger species:

- Caucasian Grouse *Lyrurus mlokosiewiczii* (IUCN Category – NT)
- Corncrake *Crex crex* (IUCN Category – LC)
- Great Snipe *Gallinago media* (IUCN Category – NT)
- Eastern Imperial Eagle *Aquila heliaca* (IUCN Category – VU)

Figure 67: Protected Areas and IBAs Within the Vicinity of the Project Road



Source: Birdlife International (<http://datazone.birdlife.org/site/mapsearch>)

F.3 Economic Development

F.3.1 Industries, Agriculture & Business

Agriculture - Viticulture is the main economic activity in the municipality of Zestaphoni providing 80% of agricultural output. Its development is supported by favorable soil-climatic conditions. Vineyards occupy 5,000 hectares within the municipality. There are two active wine producing factories in the municipality. There are no large industrial units in Kharagauli. Marble, limestone, wood, mineral and medicinal waters are noteworthy in the field of mineral and natural resource abstraction. Small business is limited to distribution of local produce.

Agricultural land plots cover 7,027 ha of Zestaphoni or 46% of the whole territory. 5,159 ha out of the above-mentioned area are arable lands. As for greenhouse areas, it totals approximately 6 ha. Detailed information on Imereti region and Zestaphoni Municipality is given in Table 51. Other than grapes, melon and maize are predominant crops grown in the region and have been noted within the Project corridor, specifically from KM 7.0 onwards.

Table 51: Agricultural Areas (Hectares)

	Imereti	Zestaphoni
Total Agricultural	65,737	7,027
Arable	51,033	5,159
Pasture	5,410	363

	Imereti	Zestaphoni
Greenhouse	462	6

Source: www.geostat.ge

1.5% of the total area of Kharagauli municipality is used for agricultural purposes. 70.9% of this territory is occupied by pastures and 29.1% is used for ploughing and sowing, annual crops grow over 22.5% of the area, permanent plantings grow over 11,5% and perennial plants grow over 6,6% of the area. Out of agricultural branches, cattle-breeding and bee-keeping are developed the best. Kharagauli municipality is the leading municipality of bee-keeping in Georgia.

Industry - During the Soviet times, industry was well-developed in Kharagauli municipality, with food enterprises, mining industry and timber plants, wine, milk and furniture complexes of enterprises. However, industrial activity has declined in the area since then and few large scale industrial activities remain such as the mineral water company “Zvare”. Folk trade is highly developed in the municipality including weave baskets, vintage baskets, flower bowls and breadbaskets with lime-tree and cherry-tree bark and nut wicker with high techniques and make pots, jugs, wine bowls and pitchers with clay. They decorate the clay ware by glazing, painting, scratching and with relief figures.

Businesses - Within the Project area, it is important to underline the role of the restaurant and coffee shops along the alignment that, other than employing local people (both men and woman), offer important services for the national and international travellers such as parking rest areas and small workshop repairs that are very important for road safety and travellers comfort. Moreover those services represent a valuable source of income for the locals that sell their products both to the restaurants and directly to the travellers the road.

F.3.2 Infrastructure and Transportation facilities

F.3.2.1 Road, Rail and Air

Roads – The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed directly onto the existing E-60 in the Project area, and these roads vary in condition from good to very poor.

Rail – The main line from Tbilisi to Batumi runs close to the Project road (within 200 m) from around KM 11.4 until the end of the road. The Project road crosses the rail line once at KM 12.0 (see Figure 68). Georgian Railways own and operate the rail services in Georgia. There are two live lines on the route within the Project area, one on a higher elevation and one on a lower elevation. The line on the higher elevation operates 4 trips per day, the lower line accommodates approximately 40 journeys per day.

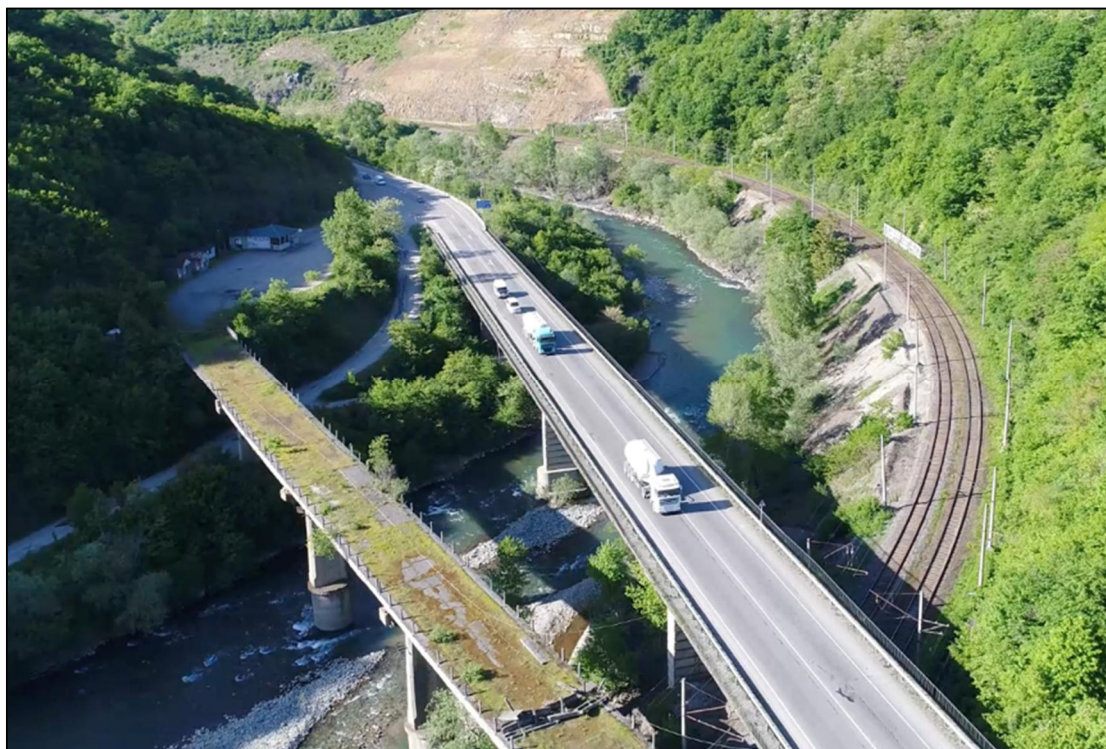
F.3.2.2 Utilities

A detailed assessment of the utilities was undertaken by the design consultants. After official correspondence with the companies and utilities in the region it was established that the following companies have utilities services in the Project area:

- Telecoms: Delta-Comm, FOPTNET, PCMAX, Silknet.
- Gas supply: Socar Georgia.
- Electricity Transmission and Distribution: Energo-Pro.

All the companies provided drawings and information on the precise locations of the utilities to the Design consultant and the RD.

Figure 68: Railway at KM12.0



F.3.2.3 Housing Stock

The housing stock in the Project area comprises almost exclusively of older one or two storey houses that are distributed mainly along the valley slopes.

F.3.3 Tourism and Recreation

Tourism plays an important role in the economics of the Kharagauli, with Borjomi-Kharagauli National Park and Nunisi resort being popular destinations. Tourism in Zestaphoni is less popular and is limited to areas such as the Shorapani Fortress (located close to Section F4).

Within the Project area, St Georges Monastery in Ubisa (Kharagauli municipality) is can be found approximately 250 meters south of the new alignment (which is located within a tunnel in this area). According to recent reports by the World Bank, the monastery is one of the top five tourist attractions in Imereti.¹⁵ Shrosha ceramics and pottery market is also an important stop on the tourist trail in Imereti. Both of these sites are discussed in more detail below under the heading of **Physical Cultural Heritage – Section F.4.6**.

The new alignment bypasses the According to RD environmental division, there are no exceptional landscapes requiring special attention along the project corridor.

¹⁵ Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

F.4 Social and Cultural Resources

F.4.1 Socio-economic conditions

F.4.1.1 Administrative Issues

The Project road is located within the Region of Imereti. Imereti occupies a territory of approximately 6,552km² (9.4% of Georgia's area). Imereti consists of twelve administrative districts: Kutaisi (the Capital of the region), Tkibuli, Tskaltubo, Chiatura, Baghdadi, Vani, Zestaphoni, Terjola, Samtredia, Sachkhere, Kharagauli, Khoni. There are 542 settlements in the region of which: 10 cities (Kutaisi, Tkibuli, Tskaltubo, Chiatura, Baghdadi, Vani, Zestaponi, Terjola, Samtredia, Sachkhere, and Khoni); 3 towns (Shorapani, Kulashi and Kharagauli); and 529 villages.

The Project road is located within Zestaphoni and Kharagauli Municipalities which covers a total area of 423 km². The following main settlements have been identified within the Project area.

Table 52: Main Settlements in the Project Area

Settlement	Population	Man	Woman
Kharagauli Municipality	19,473		
Ubisa	276	139	137
Zestaphoni Municipality	58,041	37,124	20,917
Shrosha	400	201	199
Dzirula	87	37	47
Achara	80	38	42

F.4.1.2 Regional Demographics

According to the most recent census data (2014), Imereti has a population of 533,906 which is a significant decrease from the 2002 census when the population was recorded as 699,666. The population of Zestafoni was 58,401 in 2014 of which the majority was classified as rural population. The population of Kharagauli was much smaller (19,473) the majority of which is also classified as rural and only 1,965 as 'urban' (see Table 53 below).

Table 53: Population of Imereti and its Municipalities

	Total Population	Urban	Rural
Imereti	533,906	258,510	275,396
Kutaisi, City of	147,635	147,635	-
Baghdadi Municipality	21,582	3,707	17,875
Vani Municipality	24,512	3,744	20,768
Zestafoni Municipality	58,401	20,917	37,124
Terjola Municipality	35,563	4,644	30,919
Samtredia Municipality	48,562	27,020	21,542
Sachkhere Municipality	37,775	6,140	31,635
Tkibuli Municipality	20,839	9,770	11,069
Tskaltubo Municipality	56,883	11,281	45,602

	Total Population	Urban	Rural
Chiatura Municipality	39,884	12,803	27,081
Kharagauli Municipality	19,473	1,965	17,508
Khoni Municipality	23,570	8,987	14,583

99.4% of the population of Imereti are Georgians, the remaining 0.6% is made up of Abkhazians (0.1%), Russians (0.3%), Armenians (0.1%) and Osetians (0.1%).¹⁶ There are no ethnic minorities or indigenous people in the project area.

F.4.2 Social Survey

During the months of October and November, 2017 as part of this Project a socio-economic survey was carried out into the Project area, namely in the villages of Ubisa, Shrosha, Achara and Dzirula. The people interviewed represent the 20% of the overall population of the residents in the villages. The following section summarizes the findings of the survey.

Project Awareness - The first question of the survey was aimed to establish the awareness of the people about the project. The results outlined in the following table shows that all the people interviewed was completely aware of the intention of the Government of the Republic of Georgia to proceed toward the design and the construction of the Project road.

Table 54: Awareness of the people about the project

Name of the Village	Number interviewed families	People Aware
Ubisa	21	21
Shrosha	26	26
Achara	8	8
Dzirula	6	6
Total	61	61

Family composition - The head of family interviewed represents the 28,2%, (62 units), then following the sons, and the daughters. The presence of a relative high numbers of grandchildren (33) confirms the reality of a total rural areas where the “extended family” still represents an asset, a place of social and economic protection. Male and females are equally represented being the women with a slight advantage.

Table 55: Family composition

A.3 Name of the Village	Number of interviewed	Household Status									Sex	
		Household head	%	Spouse	Son	Daughter	Father/mother	Sister/Brother	In laws	Grand children	Other	Male

¹⁶ www.geoxtati.ge. 2014

Ubisa	70	21		16	17	7	2	0	4	3	0	35	35
Shrosha	112	26		12	21	9	1	1	13	27	2	52	60
Achara	21	9		3	4	2	0	0	2	1	0	11	10
Dzirula	17	6		3	3	1	0	1	1	2	0	7	10
Total	220	62	28,2	34	45	19	3	2	20	33	2	105	115

Education - The education in the area is dominated by a secondary educational level that together with the higher and incomplete higher educational degree represent the 76,8% of the interviewed people. Taking in mind the rural nature of the area and of the presence of a conspicuous number of pensioners the educational level can be considered as a good.

Table 56: Education

Name of the village	Number of interviewed people	Educational Level									Total (e+f+g+h)
		a) None	b) Nursery	c) Primary	d) Incomplete secondary	e) Secondary	f) Vocational	g) Incomplete Higher	h) Higher	o) Other	
Ubisa	70	0	10	8	0	27	12	0	13	0	52
Shrosha	112	0	9	20	0	49	22	3	9	0	83
Achara	21	0	1	1	0	15	3	0	1	0	19
Dzirula	17	0	0	2	0	3	6	0	6	0	15
Total	220	0	20	31	0	94	43	3	29	0	169

Occupation – Unemployment rates are high with 85 out of the 221 people surveyed being unemployed compared to 62 people in work. 51 people surveyed were pensioners and 23 housewives.

Table 57: Occupation and unemployment

Name of the village	Number of interviewed people	Occupation & Unemployment											Total
		Public sector	Private sector	Self employed	Farmer	Total	%	Unemployed	Student	Pensioner	Housewife	Other	
Ubisa	70	10	6	2	0	18	25,7	29	0	14	9	0	52
Shrosha	112	2	2	31	0	35	31,3	42	1	22	12	0	77
Achara	21	3	1	1	0	5	23,8	7	0	8	2	0	17
Dzirula	17	3	1	0	0	4	23,5	7	0	7	0	0	14
Total	220	18	10	34		62	28,2	85	1	51	23	0	160

Vulnerability - The vulnerability of the people interviewed related to the level of poverty is not too high in itself (6.8%) but together with the disability factor (2.3%) the total vulnerability rate reaches 9.1% which can be considered near to critical.

Table 58: Vulnerability

Village	Number of interviewed people	Vulnerability							
		Below Poverty	%	Lonely Pensioner	Internally displaced person	Group of Disability	%	Woman headed household	Other
Ubisa	70	10		0	0	2		0	0
Shrosha	112	2		0	0	2		0	0
Achara	21	3		0	0	0		0	0
Dzirula	17	0		0	0	1		0	0
Total	220	15	6.8	0	0	5	2.3	0	0

Family income – 11.4% of the interviewed declared a very low income such as 300 GEL per month. 21% declared an income between 305 and 600 GEL, while only 3.2% reported an income between 605 and 100 GEL. The confirmation about the results can be matched with the fact that almost 20% of those interviewed declared an income derived from a pension, only 21% from a regular salary and 9.5% from an owned business. Income from own business is reported in Shrosha mainly from ceramic and handicraft and micro enterprises as well restaurants.

Table 59: Monthly income

Name of the village	Number of interviewed people	Class of Monthly income GEL							
		UP to 300	%	From 305 to 600	%	From 605 to 1000	%	From 1005 to 1500	>1500
Ubisa	70	6	8.6	10	14.3	2	2.8	0	0
Shrosha	112	13	11.6	7	6.3	2	1.7	0	0
Achara	21	4	19.0	2	9.5	1	4.7	0	0
Dzirula	17	2	11.8	2	11.8	2	11.7	0	0
Total	220	25	11.4	21	9.5	7	3.2	0	0

Table 60: Source of Income

Name of the village	Interviewed people	Source of Income											
		Wage salary	%	Own Business	%	From Rent	Self-employment	Agriculture	%	Remittance	Pensions	%	Money Borrowing
Ubisa	70	11	15.7	0	0	0	0	3	4	0	14	14	0
Shrosha	112	2	1.8	20	17.9	0	0	0	0	0	15	15	0
Achara	21	4	19.0	0	0	0	0	0	0	0	7	7	0
Dzirula	17	4	23.5	0	0	0	0	1	6	0	5	5	0
Total	220	21	9.5	20	9.1	0	0	4	1.8	0	41	18.6	0

Agriculture & Livestock - The type of crops are essentially typical of the area and are mostly intended for the self-consumption.

Table 61: Crops

Name of the village	Interviewed People	Crops							
		Corn	Fruit	Potatoes	Vegetables	Walnut/hazelnut	Grapes	Hay	Other
Ubisa	70	9	10	8	11	8	8	1	0
Shrosha	112	10	10	7	16	7	7	0	0
Achara	21	2	5	2	6	2	2	0	0
Dzirula	17	2	4	2	5	2	2	0	0
Total	220	23	29	19	38	19	19	1	0

Table 62: Livestock

Village	Interviewed people	Livestock					
		Cow/Ox Buffalo	Horse/donkey	Pigs	Sheep	Chicken / turkey	Other
Ubisa	70	0	0	3	0	10	0
Shrosha	112	4	0	3	0	16	0
Achara	21	2	0	1	0	3	0
Dzirula	17	3	0	0	0	4	0
Total	220	9	0	7	0	33	0

F.4.3 Community Health, Safety & Education

F.4.3.1 Health

No medical facilities have been identified within 500 meters of the Project area.

F.4.3.2 Safety

According to data provided by the RD, during the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured spread over the E-60 corridor, from km 18 to km 302 (284 km in total, from Tbilisi to Khobi) with some notable cluster locations. In other words, it means 1 collision every 16 hours, 1 person killed every 4 days and 1 person injured every 9 hours. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F3 section 115 collisions occurred, with 23 persons killed and 226 persons injured. This data is summarized in the Table 63, whereas Table 64 shows the collisions rates in terms of “crashes per km”.

Table 63: Collisions and Casualties in the Period 2012 – 2016

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	2,713	4,913	471
Khevi – Argveta	50	351	648	78
F3	13.0	115	226	23

Table 64: Collisions and Casualties Rates in the Period 2012 – 2016 (per km)

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	9.55	17.30	1.66
Khevi – Argveta	50	7.02	12.96	1.56
F3	13.0	6.39	12.56	1.28

F.4.3.3 Education and Educational Facilities

Two educational facilities are located within the Project area as listed in Table 65 below. Boriti school is located adjacent to the existing road and new alignment at KM0.0. Shrosha school is located adjacent to the existing road, but more than 450 meters from the new alignment.

Table 65: Schools in the Project Area (within 1 km)

#	Name	Location	No. of Pupils	Distance from the new alignment (m)
1	Public school of Boriti Village	Boriti	360	Adjacent to KM 0.0
2	Public school of village Shrosha / Zestafoni	Shrosha Village	80	450

Figure 69: Boriti School (approximately KM0.0)



Figure 70: Boriti School (new alignment will pass in the direction of the arrow)



Figure 71: Shrosha School



F.4.4 Waste Management

Waste management, in compliance with international standards, has been playing an increasingly important role for Georgia after the country signed the Association Agreement with the EU. Currently solid waste disposal at the landfill is the only form of waste management in Georgia. The situation in regards to domestic and industrial wastewater management is complicated, as in most cases industrial and non-industrial wastewaters are discharged into surface waters without prior treatment.

Inert waste, including construction waste, is partially disposed at non-hazardous waste landfills and is used for filling/leveling activities in the construction of infrastructure facilities. There are no management systems for specific waste, including separated collection systems. However, recycling of specific waste, such as tires, batteries, packaging waste, etc., or disposal (such as asbestos waste) does occur in fragmented and uncoordinated way.

Presently, 56 landfills are recorded in Georgia. Only four of them, one private and three state-owned landfills, comply with international standards and have an EIA permit. These are:

- Tbilisi Norio landfill;
- Rustavi landfill;
- Borjomi landfill;
- Privately owned BP landfill.

According to the active legislation (Waste Management Code), construction and management of non-hazardous (municipal) landfills (excluding Tbilisi and Adjara Autonomous Republic landfills) is the responsibility of the Waste Management Company of Georgia owned by the Ministry of Regional Development and Infrastructure. The company conducts active measures to improve the conditions of the old/current landfills and construct new regional landfills. As of 2016, the Solid Waste Management Company manages the existing landfills. Twenty of them were closed and 30 of them were improved. The company continues work to construct

new regional non-hazardous waste landfills. □Tbiliservice Group (municipal company established in 2007) manages Tbilisi's landfills.

Despite the above, the waste management problem remains very acute. There are still many illegal dumpsites in Georgia. Almost every rural settlement has one or more small dumpsites. They are often located on river banks or near the populated areas, thus posing a threat to human health and the environment.

One of the main causes of the above problem is related to the existing waste management system, especially in the rural areas. Specifically, no waste collection and removal services are provided in some of the rural areas, especially in remote villages located far from the municipal centers. Many villages are not equipped with waste containers, which forces local residents to dump their waste in the areas of their choosing. Around 18% of waste generated in the country is dumped into ravines, river banks and other illegal, spontaneously formed, dumpsites near residential areas.

Previously there was a landfill site in Zestafoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m³/year of waste. However, the Solid Waste Management Company of Georgia closed the Zestaphoni municipal land fill in 2016 due to the fact that it was overloaded.

Kharagauli Municipality previously used Boriti landfill located in Boriti Village. The landfill was put into operation in 2005 but is currently closed.¹⁷ As such there appears to be no landfill within the Project area for hazardous and non-hazardous waste.

F.4.5 Physical and Cultural Resources

Regional Context - Imereti is an important historical and cultural region of Western Georgia. There are more than 450 historical, archaeological, architectural and natural monuments in the region, which give a full picture of ancient settlements, its cultural development and history. The region is home to 78 Churches, 13 Castles, 39 Archaeological Monuments and 27 Museums.

Findings of archaeological excavations show that the first human being in Imereti lived during the lower Palaeolithic period. Numerous flint and obsidian items, including cutting instruments and knives have been discovered in caves and settlements. During the VIII century Kutaisi became the capital of west Georgia and the capital of all Georgia in the X-XII centuries. It was during this period that Imereti had its renaissance. Unique masterpieces of Georgian architecture were created at this time – Bagrati Cathedral and Gelati Monastery Complex (UNESCO heritage site). During the XV century, after the fall of the Georgian feudal monarchy, Imereti became a separate feudal kingdom.

Project Corridor – Within the Project corridor the following key physical cultural resources have been identified:

St Georges Monastery, Ubisa - The monastic complex of Ubisa comprises a 9th-century St. George's Monastery founded by St. Gregory of Khandzta, a 4-floor tower (AD 1141), fragments of a 12th-century defensive wall and several other buildings

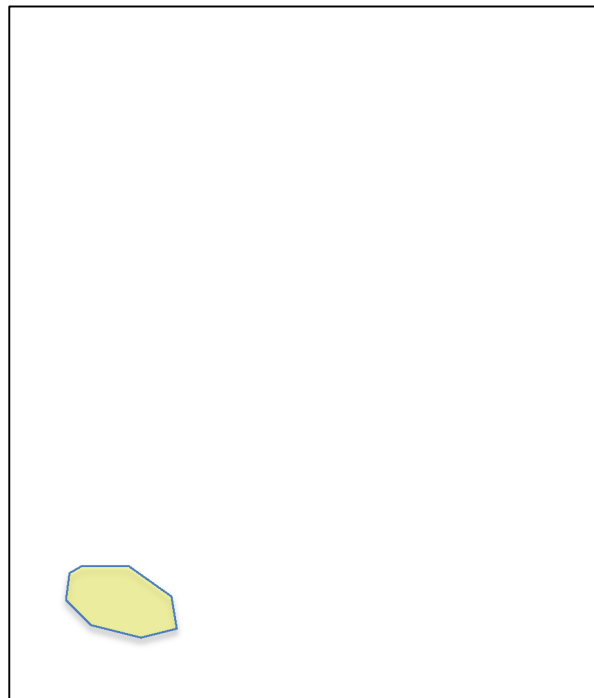
¹⁷ Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

and structures. The monastery houses a unique cycle of murals from the late 14th century made by Damiane apparently influenced by art from the Byzantine Palaiologan period (1261-1453). The monastery is also known for its honey made by the monks. The Monastery is located approximately 250 meters south of the new alignment (KM3.4) which will pass within a tunnel in this area (see Figure 73).

Figure 72: St Georges Monastery, Ubisa



Figure 73: Location of St Georges Monastery, Ubisa



Shrosha Caves – During site visits the Project team were informed about a cave in the area around Shrosha. Local villagers accompanied the Project team to the site which is located more than 1km north of the Project road. Figure 74 illustrates the current state of the cave. The cave is not known to be of any specific touristic or cultural value.

Figure 74: Shrosha Cave



Shrosha Village - Shrosha is the ancient home of clay-making in Georgia, known since ancient times for its masterpieces. The red soil in this area, useless for agriculture is perfect for making pottery. There was a factory built in Shrosha at the beginning of the 20th century to produce ceramic items, but traditional methods, passed on by ancestors, are still popular. While driving to Imereti, at the village of Shrosha, along the motorway people are selling beautiful articles made of clay. They are eager to invite enthusiasts at their workshop and demonstrate ceramic working process. This is one of the oldest and most popular handicraft in Georgia.¹⁸ The Project road is located more than 650 meters to the south of the roadside market (KM5.9) selling the clay and ceramic goods, see Figure 75.

¹⁸ Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

Figure 75: Shrosha Pottery and Ceramic Market



Monument – A religious monument is located at KM0.5 (see Figure 76). The monument is located within 20 meters of the new alignment, close to Bridge BRI 3.1.02-TA

Figure 76: Religious Monument



F.4.6 Noise & Vibration

F.4.6.1 General

Noise levels within the Project corridor are predominantly a result of vehicle traffic on the existing road. Very little commercial, residential or industrial activities can be observed in these areas that would give rise to significant noise levels.

F.4.7.2 Existing Noise & Vibration Levels

Baseline noise and vibration monitoring was undertaken in February, 2018 at twelve locations. Figure 77 and Table 66 provide the locations of the monitoring exercise.

Figure 77: Monitoring Locations

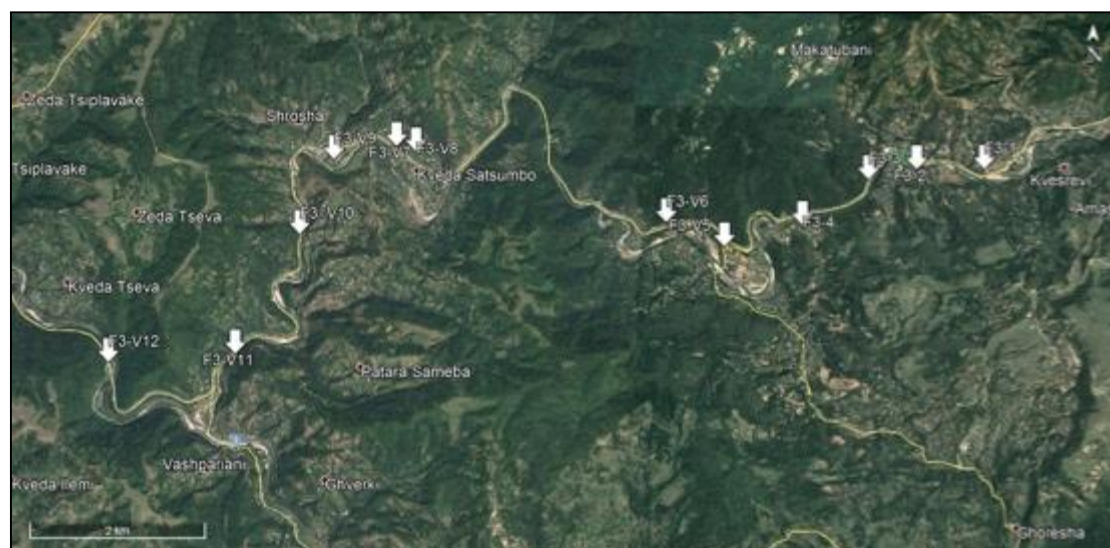


Table 66: Noise and Vibration Monitoring Locations

#	Reference ID	Coordinates	
		X	Y
1	F3-1	356452	4663205
2	F3-2	355678	4663215
3	F3-3	355116	4663106
4	F3-4	354347	4662590
5	F3-5	353448	4662361
6	F3-6	352797	4662644
7	F3-7	349678	4663578
8	F3-8	349905	4663508
9	F3-9	348949	4663440
10	F3-10	348543	4662580
11	F3-11	347776	4661211
12	F3-12	346302	4661136

Vibration Results – Table 67 provides the baseline vibration monitoring results. Vibration values in the control points are currently too low to cause any structural or cosmetic damage and/or cause nuisance of the residents. According to the national standard the values are ranked as weak and non-perceptible.

Table 67: Baseline Vibration Monitoring Results

Time	Displacement, mm; peak values			Velocity, mm/s; true RMS/ Transversal vibration value in dBV		
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z
F3-V1						
Day	0.000	0.000	0.001	0.00	0.03/55.6	0.00
Night	0.002	0.019	0.000	0.00	0.43/78.7	0.00
F3-V2						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V3						
Day	0.000	0.001	0.000	0.00	0.02/52	0.00
Night	0.001	0.005	0.000	0.02/52	0.08/64.1	0.00
F3-V4						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V5						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V6						
Day	0.014	0.002	0.001	0.00	0.23/73.3	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V7						
Day	0.001	0.004	0.002	0.00	0.40/78	0.09/65.1
Night	0.001	0.004	0.003	0.00	0.34/76.7	0.08/64.1
F3-V8						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V9						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V10						
Day	0.019	0.015	0.000	0.00	0.13/68.3	0.00
Night	0.006	0.016	0.000	0.00	0.09/65.1	0.00
F3-V11						
Day	0.000	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F3-V12						
Day	0.002	0.000	0.000	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00

Note:

Vibration velocity level (Lv) in dB has been defined as follows:

$$Lv = 20 \times \log_{10}(V/V_{ref})$$

Where:

Lv = velocity level in decibels, mm/s (dBV)

V = RMS velocity amplitude, mm/s

Vref = reference velocity amplitude, mm/s (Vref=0.00005 mm/s. Reference – Order #297/6 of the Minister of Labour, Health and Social Affairs on Approval of Standards of Quality of the State of Environment, Document ID 470.230.000.11.119.004.920.

$$Lv = 20 \times \log_{10}(0.44/0.00005)=20 \times 3.9=78\text{dB (NVA-1)}$$

$$Lv = 20 \times \log_{10}(0.01/0.00005)=20 \times 2=40\text{dB (NVA-2)}$$

Noise monitoring results – The results of the ambient noise monitoring show that the noise levels next to the existing road are currently elevated above IFC and national standards in all but one sample. However, all of the locations monitored that were more than 25 meters from the existing road (including Ubisa Monastery) recorded noise levels below or very close to IFC and national daytime and night time noise limits.

Table 68: Baseline Noise Monitoring Results

#	Time	Wind speed (m/s)	Wind Direction	L _{eq} , dBA	L _{min} ,, dBA	L _{max} , dBA	L _{eq} , dBA	L _{DN} , dBA	L _{DEN} , dBA	L ₁₀ , dBA	L ₅₀ , dBA	L ₉₀ , dBA	National limit (residential), Leq,dBA	IFC/WHO limit (residential), LAeq, dBA	EU limit, Leq, dBA
F3_N1 – Adjacent to Existing Road															
1	6:00-6:20	<0.1		58	44	80	71.2	71.4	71.7	44.7	65.5	88.0	55 (Day)	55 (Day)	60 (Day)
2	13:00-13:20	1.4	W	71	45	88							45 (Night)	45 (Night)	55 (Evening)
3	20:00-20:20	1.2	W	65	45	85									45 (Night)
4	03:00-03:20	<0.1		57	45	88									
F3_N2															
1	6:30-6:50	<0.1		46	45	47	52.8	55.7	56.1	45.0	48.0	50.3	55 (Day)	55 (Day)	60 (Day)
2	13:30-13:50	0.9	W	50	50	50							45 (Night)	45 (Night)	55 (Evening)
3	20:30-20:50	0.7	W	50	49	51									45 (Night)
4	03:30-03:50	<0.1		45	45	45									
F3_N3 – Adjacent to Existing Road															
1	7:00-7:20	<0.1		57	47	83	75.8	76.5	77.3	45.0	65.0	86.3	55 (Day)	55 (Day)	60 (Day)
2	14:00-14:20	0.9	W	76	45	87							45 (Night)	45 (Night)	55 (Evening)
3	21:00-21:20	<0.1		65	47	85									45 (Night)
4	04:00-04:20	<0.1		55	45	86									
F3_N4															
1	7:30-7:50	0.5	W	47	46	48	52.5	55.1	55.5	45.0	46.5	50.0	55 (Day)	55 (Day)	60 (Day)
2	14:30-14:50	0.8	W	49	45	50							45 (Night)	45 (Night)	55 (Evening)
3	21:30-21:50	<0.1		48	47	50									45 (Night)
4	04:30-04:50	<0.1		45	45	45									
F3_N5															
1	8:00-8:20	0.6	W	45	43	47	59.0	59.7	59.9	40.0	42.5	45.6	55 (Day)	55 (Day)	60 (Day)
2	15:00-15:20	0.9	W	43	42	45							45 (Night)	45 (Night)	55 (Evening)
3	22:00-22:20	<0.1		43	42	44									45 (Night)
4	05:00-05:20	<0.1		40	40	40									
F3_N6 – Adjacent to Existing Road															
1	8:30-8:50	<0.1		61	48	79	75.8	76.5	77.3	45.0	62.5	81.1	55 (Day)	55 (Day)	60 (Day)
2	15:30-15:50	1.3	W	74	45	86							45 (Night)	45 (Night)	55 (Evening)
3	22:30-22:50	<0.1		62	50	76									45 (Night)
4	05:30-05:50	<0.1		54	45	75									
F3_N7 – Close to Existing Road															
1	9:20-9:40	0.8	W	64	50	83	74.6	74.7	75.0	50.0	64.5	83.6	55 (Day)	55 (Day)	60 (Day)
2	16:00-16:20	0.9	W	59	55	81							45 (Night)	45 (Night)	55 (Evening)
3	23:00-23:20	<0.1		58	53	85									45 (Night)
4	06:00-06:20	<0.1		55	50	74									

Section F3 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
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#	Time	Wind speed (m/s)	Wind Direction	L _{eq} , dBA	L _{min} ,, dBA	L _{max} , dBA	L _{eq} , dBA	L _{DN} , dBA	L _{DEN} , dBA	L ₁₀ , dBA	L ₅₀ , dBA	L ₉₀ , dBA	National limit (residential), Leq,dBA	IFC/WHO limit (residential), LAeq, dBA	EU limit, Leq, dBA
	F3_N8														
1	9:50-10:10	0.7	W	44	43	45	44.1	47.4	48.6	40.0	41.5	43.6	55 (Day)	55 (Day)	60 (Day)
2	16:30-16:50	0.9	W	42	42	42							45 (Night)	45 (Night)	55 (Evening)
3	23:30-23:50	<0.1		40	40	41									45 (Night)
4	06:30-06:50	<0.1		40	40	40									
	F3_N9														
1	10:20-10:40	0.6	W	44	44	45	46.6	49.1	49.4	40.0	41.5	43.6	55 (Day)	55 (Day)	60 (Day)
2	17:00-17:20	0.8	W	44	43	45							45 (Night)	45 (Night)	55 (Evening)
3	24:00-00:20	<0.1		40	40	40									45 (Night)
4	07:00-07:20	<0.1		40	40	40									
	F3_N10 – Adjacent to Existing Road														
1	10:50-11:10	1.2	W	61	47	85	76.0	76.5	77.3	44.4	61.0	85.6	55 (Day)	55 (Day)	60 (Day)
2	17:30-17:50	1.1	W	64	50	87							45 (Night)	45 (Night)	55 (Evening)
3	00:30-00:50	<0.1		53	43	73									45 (Night)
4	07:30-07:50	<0.1		59	45	72									
	F3_N11 – Adjacent to Existing Road														
1	11:20-11:40	0.9	W	63	46	83	76.7	76.8	77.2	44.4	65.5	86.0	55 (Day)	55 (Day)	60 (Day)
2	18:00-18:50	1	W	74	48	86							45 (Night)	45 (Night)	55 (Evening)
3	01:00-01:20	<0.1		58	43	84									45 (Night)
4	08:00-08:20	<0.1		61	45	86									
	F3_N12 – Adjacent to Existing Road														
1	11:50-12:10	1	W	65	48	84	76.0	76.5	77.3	44.7	61.5	86.3	55 (Day)	55 (Day)	60 (Day)
2	19:00-19:20	1.2	W	73	46	87							45 (Night)	45 (Night)	55 (Evening)
3	01:30-01:50	<0.1		54	44	75									45 (Night)
4	08:30-08:50	0.3	W	64	45	86									

Note:

Daytime values are marked in red

Orange highlight indicated the sites where registered noise was found to be in allowable limits

L₉₀, L₅₀, L₁₀ – statistical level = level exceeded 90%, 50% 10% of time respectively

L_{eq} – equivalent sound level

L_{DEN} – equivalent sound level/average equivalent level over 24 hr period. 5dBA is added for the interval from 19:00 to 23:00; 10dBA added for the time interval from 23:00 to 07:00

L_{DN} – average equivalent sound level over a 24 hour period, with a penalty added for noise during the nighttime hours of 22:00 to 07:00

In addition to the baseline noise monitoring a noise model was prepared for the existing road based on existing traffic levels. The following table provides the results of the model at the model receptors (IFC compliance in Green). The receptor locations are defined in the noise model produced later in this report.

Table 69: Modeled Noise Levels on the Existing Road

Receptor	DAY	NIGHT
	Lg dB(A)	Ln dB(A)
L38	53.3	49.8
L39	46.4	43
L40	48.2	44.8
L41	51.7	48.2
L42	54.8	51.4
L43	61.4	57.9
L44	54.3	50.8
L45	54.1	50.7
L46	65.5	62.1
L47	60.7	57.3
L48	57.3	53.9
L49	53.8	50.4
L50	59	55.5
L51	56.4	53
L38	53.3	49.8
L39	46.4	43
L40	48.2	44.8
L41	51.7	48.2
L42	54.8	51.4
L43	61.4	57.9
L44	54.3	50.8
L45	54.1	50.7
L46	65.5	62.1
L47	60.7	57.3
L48	57.3	53.9
L49	53.8	50.4
L50	59	55.5
L51	56.4	53
R53	50.3	46.9
R54	55.5	52.1
R55	69.4	65.9
R56	52.4	49
R57	50.7	47.3
R58	55	51.5
R59	48.4	45
R60	55.6	52.2
R61	52.4	49
R62	44.4	41
R63	47.1	43.7

Receptor	DAY	NIGHT
	Lg dB(A)	Ln dB(A)
R64	41.7	38.3
R65	50.2	46.8
R66	56.1	52.7
R67	58.7	55.2
R68	55.5	52.1
R69	55.3	51.9
R70	55.6	52.1
R71	54.5	51.1
R72	53.8	50.4
R73	58.9	55.4
R74	59.2	55.8
R75	44.9	41.4
R76	53.7	50.3
R77	56.3	52.9
R78	61.1	57.6
R79	52.1	48.7
R80	65.3	61.9
R81	50.5	47.1
R82	58.7	55.3
R83	47.9	44.5
R84	53.1	49.7
R85	50.4	47
R86	40.8	37.4
R87	43.5	40.1
R88	41.8	38.4

G. Environmental Impacts and Mitigation Measures

G.1 Introduction

During the initial stage of the EIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in consideration the potential impacts. In this chapter, the potential environmental and social impacts are evaluated. The impacts have been identified based on consideration of the information presented in previous chapters. To avoid unnecessary repetition of supporting information, cross referencing to previous sections is given where necessary. Following the impact assessment, the mitigation measures related to each impact category is presented.

G.2 Impact Assessment Methodology

The general methodology used for impact assessment is described in this section. It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures.

G.2.1 Identification of Significant Environmental Aspects

The description of each impact will have the following features:

- Definition of the impact using an impact statement identifying the Project activity or activities that causes the impact, the pathway or the environmental parameter that is changed by the activity, and the potential receptors of the impact (aspect-pathway-receptor).
- Description of the sensitivity and importance value of the receiving environment or receptors.
- Extent of change associated with the impact.
- Rating of the significance of the impact.
- Description of appropriate mitigation and management measures and potential effectiveness of the proposed measures.
- Characterization of the level of uncertainty in the impact assessment.
- The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:
 - magnitude
 - spatial scale
 - timeframe□

Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

- Sensitivity of existing or reasonably foreseeable future receptors.
- Importance value of existing or reasonably foreseeable future receptors, described using the following:
 - inclusion in government policy.
 - level of public concern.
 - number of receptors affected.
 - intrinsic or perceived value placed on the receiving environment by stakeholders.
 - economic value to stakeholders□
- Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:

- legal thresholds—established by law or regulation
- functional thresholds if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
- normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
- preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
- reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project Site) to extensive (national or international extent). They also may vary depending on the component being considered.

The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

Once the impact consequence is described on the basis of the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity.

The reversibility of each impact at the end of construction and operation are important, as these impacts may need on-going management after operation. The reversibility of each impact at the end of construction and operation will be noted and described alongside the three primary characteristics of magnitude, spatial scale and duration.

The characteristics are outlined in Table 70.

Table 70: Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Construction, operation, decommissioning or post closure
Magnitude	Sensitivity of Receptor	High, medium or low capacity to

Characteristic	Sub-components	Terms Used to Describe the Impact
		<p>accommodate change</p> <p>High, medium or low conservation importance</p> <p>Vulnerable or threatened <input type="checkbox"/> Rare, common, unique, endemic</p>
	Importance or value of receptor	<p>High, medium or low concern to some or all stakeholders</p> <p>High, medium or low value to some or all stakeholders (for example, for cultural beliefs)</p> <p>Locally, nationally or internationally important</p> <p>Protected by legislation or policy</p>
	Severity or degree of change to the receptor	<p>Gravity or seriousness of the change to the environment</p> <p>Intensity, influence, power or strength of the change</p> <p>Never, occasionally or always exceeds relevant thresholds</p>
Spatial Scale	Area affected by impact - boundaries at local and regional extents will be different for biophysical and social impacts	<p>Area or Volume covered <input type="checkbox"/> Distribution <input type="checkbox"/> Local, regional, transboundary or global</p>
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	<p>Short term or long term <input type="checkbox"/> Intermittent (what frequency) or continuous</p> <p>Temporary or permanent</p> <p>Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)</p>
Probability - likelihood or chance an impact will occur		<p>Definite (impact will occur with high likelihood of probability)</p> <p>Possible (impact may occur but could be influenced by either natural or project related factors)</p>

Characteristic	Sub-components	Terms Used to Describe the Impact
		Unlikely (impact unlikely unless specific natural or Project related circumstances occur)
Reversibility/Sustainability		Potential for recovery of the endpoint from a negative impact Reversible or irreversible Sustainability for positive impacts
Confidence in impact evaluation (degree of certainty in the significance ascribed to the impact)		Scientific uncertainty – limited understanding of ecosystem (or community) and processes governing change Data uncertainty – restrictions introduced by incomplete or incomparable information, or by insufficient measurement techniques Policy uncertainty – unclear or disputed objectives, standards or guidelines

F.2.2 Impact Significance Rating

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in Table 71 and described as follows:

- **Part A:** Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- **Part B:** Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C:** Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

Using the matrix, the significance of each described impact is rated.

Table 71: Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	<ul style="list-style-type: none"> • Large number of receptors affected • Receptors highly sensitive and/or are of conservation importance • Substantial deterioration, nuisance or harm to receptors expected • Relevant thresholds often exceeded • Significant public concern expressed during stakeholder consultation • Receiving environment has an inherent value to stakeholders 	<ul style="list-style-type: none"> • Large number of receptors affected□ • Receptors highly amenable to positive change□ • Receptors likely to experience a big improvement in their situation • Relevant positive thresholds often exceeded
	Moderate	<ul style="list-style-type: none"> • Some receptors affected • Receptors slightly sensitive and/or of moderate conservation importance • Measurable deterioration, nuisance or harm to receptors • Relevant thresholds occasionally exceeded□ • Limited public concern expressed during stakeholder consultation • Limited value attached to the environment 	<ul style="list-style-type: none"> • Some receptors affected□ • Receptors likely to experience some improvement in their situation • Relevant positive thresholds occasionally exceeded
	Minor	<ul style="list-style-type: none"> • No or limited receptors within the zone of impact□ • Receptors not sensitive to change□ • Minor deterioration, nuisance or harm to receptors□ • Change not measurable or relevant thresholds never exceeded • Stakeholders have not expressed concerns regarding the receiving environment 	<ul style="list-style-type: none"> • No or limited receptors affected□ • Receptors not sensitive to change□ • Minor or no improvement in current situation • Change not measurable • Relevant positive thresholds never exceeded • No stakeholder comment expected
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects

	Short term / low frequency	<ul style="list-style-type: none">Less than 4 years from onset of impact	<ul style="list-style-type: none">Occurs less than once a year	
	Medium term / medium frequency	<ul style="list-style-type: none">More than 4 years from onset of impact up to end of life of project (approximately 30 years)	<ul style="list-style-type: none">Occurs less than 10 times a year but more than once a year	
	Long term / high frequency	<ul style="list-style-type: none">Impact is experienced during and beyond the life of the project (greater than 30 years)	<ul style="list-style-type: none">Occurs more than 10 times a year	
SPATIAL SCALE		Biophysical	Socio-economic	
	Small	<ul style="list-style-type: none">Within the defined 'area of influence'	<ul style="list-style-type: none">Within the defined 'area of influence'	
	Intermediate	<ul style="list-style-type: none">Within the district in which is the facilities are located	<ul style="list-style-type: none">Within the municipality in which the activity occurs	
	Extensive	<ul style="list-style-type: none">Beyond the district in which the facilities are located	<ul style="list-style-type: none">Beyond the municipality in which the activity occurs	
PART B: DETERMINING CONSEQUENCE RATING				
MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High
PART C: DETERMINING SIGNIFICANCE RATING				
		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Low	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

G.3 Mitigation, Management and Good Practice Measures

Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of management controls.

The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce the impact as far as possible by limiting the cause(s).
- Ameliorate the impact by protecting the receptor from the cause(s) of the impact.
- Providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate.

G.4 Screening of Impacts

Based on the impact assessment methodology discussed above, Table 72 presents the possible impacts of the proposed Project. Each impact is discussed further in this chapter.

Table 72: Impact Screening

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Air Quality	C	Emissions from stationary sources	Nearby communities	L	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Exhaust Emissions from construction vehicles and generators	Nearby communities	M	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Dust from the movement of vehicles, stockpiles, etc.	Nearby communities / Agric. Crops	M	M	M	M	MOD	H/F	SMALL	MED	DEF	M
	O	Vehicle Emissions from traffic using the road.	Nearby communities	M	H	M	M	MOD	LT	SMALL	MED	DEF	M
Climate Change	C	GHG Emissions from road construction.	Global	H	L	L	-	MIN	H/F	EXT	MED	DEF	M
	O	GHG Emissions from vehicle emissions.	Global	H	L	L	-	MIN	LT	EXT	MED	DEF	M
Soils	C	Soil erosion on unstable slopes caused by poor construction works.	Nearby communities / Water bodies	L	M	M	M	MOD	M/F	INTER	MED	POSS	M
	O	Soil erosion caused by poorly designed erosion protection measures, drainage, etc.	Nearby communities / Water bodies	L	M	M	M	MOD	MT	INTER	MED	POSS	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	C	Soil contamination via spills and leaks of hazardous liquids from construction camps.	Soil / Water bodies / Ground water	L	M	L	M	MOD	M/F	SMALL	MED	POSS	M
Hydrology	C	Flooding caused by blocking existing drainage structures.	Nearby communities	M	M	M	-	MOD	M/F	SMALL	MED	POSS	M
	O	Flooding caused by poorly designed drainage structures.	Nearby communities	M	M	M	-	MOD	LT	SMALL	MED	POSS	M
	C	Water contamination from construction camps, etc.	Nearby communities / Water bodies	M	M	L	M	MOD	M/F	INTER	MED	POSS	M
	C	Excessive water extraction affecting local water supplies.	Nearby communities / Aquatic wildlife	L	L	L	L	MIN	H/F	SMALL	MED	UNLIKE	L
	O	Ground water supply degraded by new tunnels.	Nearby communities	M	M	L	-	MOD	LT	SMALL	MED	POSS	M
Flora & Fauna	C	Degradation of habitat caused during site clearing.	Terrestrial wildlife	M	H	L	-	MOD	L/F	SMALL	LOW	DEF	L
	C	Tree cutting.	Terrestrial wildlife	H	H	L	M	MAJ	ST	SMALL	MED	DEF	M
	O	Blocking migration	Terrestrial	L	H	L	-	MOD	MT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
		routes of animals.	wildlife										
Infrastructure and Transport	C	Damage to access roads caused by construction vehicles.	Nearby communities / Road Users	M	L	M	-	MOD	MT	INTER	MED	POSS	M
	C	Traffic delays due to road works.	Nearby communities / Road Users	M	M	M	-	MOD	H/F	SMALL	MED	DEF	M
	C	Limited accessibility to properties as road works block access.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	POSS	M
	C	Temporary disruption to utilities while they are removed to make way for construction works.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	DEF	M
Land Use	C	Loss of land and property due to the new road.	Nearby communities	H	H	H	-	MAJ	MT	SMALL	MED	DEF	M
	C	Disruption to businesses caused by reduced access to the business.	Nearby communities	M	H	H	-	MAJ	H/F	SMALL	HIGH	POSS	H
	O	Reduced income for businesses no longer located by the road.	Nearby communities	M	H	H	-	MAJ	MT	SMALL	MED	POSS	M
	O	Induced changes.	Nearby communities	M	M	L	-	MIN	LT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Waste	C	Pollution from hazardous waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Pollution from inert waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Tunnel and embankment spoil	Communities /	H	H	H	M	MAJ	ST	INTER	MED	DEF	M
OHS / Community Health and Safety	C	Accidents and injuries during the construction phase.	Communities / Contractors staff	H	H	H	H	MAJ	H/F	INTER	HIGH	POSS	H
	C	STD's contracted and spread by workers.	Nearby communities / Contractors staff	M	H	L	-	MOD	L/F	INTER	MED	POSS	M
Emergencies	C	Fires, explosions, etc, at site.	Nearby communities / Contractors staff	M	H	L	M	MOD	S/T	SMALL	LOW	POSS	L
PCR	C	Damage to PCR caused during construction.	PCR site and its users	M	M	L	-	MOD	H/F	SMALL	MED	POSS	M
	O	Effects to PCR in terms of elevated noise, dust, etc.	PCR site and its users	M	M	L	-	MOD	MT	SMALL	MED	UNLIKE	L

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Noise	C	Elevated noise levels from construction equipment.	Contractors staff / Nearby communities	H	H	L	H	MAJ	H/F	SMALL	HIGH	DEF	H
	O	Elevated noise levels from vehicles using the road.	Nearby communities	H	H	M	H	MAJ	M/T	SMALL	MED	DEF	M
Vibration	C	Damage to properties caused during blasting and piling.	Nearby communities	M	H	M	H	MAJ	M/F	SMALL	MED	POSS	M
	O	Damage to properties from vehicle movement vibration.	Nearby communities	L	H	M	L	MOD	MT	SMALL	MED	UNLIKE	L

G.5 Physical Resources

G.5.1 Air quality

Potential Air Quality Impacts

The potential impacts of the Project to air quality are described as follows:

Design and Pre-construction Phase

The road rehabilitation works are generally intermittent and not permanent in a specific site, the works move along the Project road as work progresses and as such air quality impacts will be short term in specific locations. However, fugitive emissions will be emitted on a longer-term basis from stationary sources such as asphalt plants. These sites can however be selected prior to construction and be placed in an area where it can cause the least impact on human and ecologic receptors.

Construction Phase

During construction, air quality is likely to be degraded by a range of operational activities including:

- Exhaust emissions from the operation of construction machinery (e.g. Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x) and Carbon Monoxide (CO));
- Open burning of waste materials; and
- Dust generated from haul roads, unpaved roads, exposed soils and material stock-piles.

Dust is the major air quality problem from construction sites. Dust is a problem for a variety of reasons, as outlined below:

- Inconvenience to local people. For example, people may have to re-wash laundry that has been put outdoors to dry, and wash windows, curtains and vehicles. Dust can contaminate meat hanging up in open-air butchers and other food that is exposed to it in homes, shops and open-air restaurants, giving food a gritty texture.
- Health and safety problems. Dust may affect health by irritating eyes and worsening the health of people with asthma. Dust can reduce visibility for drivers on roads. It can also be blown for long distances by the wind.
- Crop damage. Even low concentrations of dust can affect plant and fruit growth as far away as one kilometer from a construction site. Plant growth is particularly susceptible to dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing run-off.
- Impact on ecology. Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight and suffocating fish. It may also affect plant growth and change the species of plants growing in an area. Dust may also damage trees and other vegetation planted as part of the construction contract.
- Damage to plant and equipment. Within the construction site, dust can cause mechanical or electrical problems in sensitive equipment such as computers. It can also increase abrasion of moving parts in equipment and clogging of air filters.

Operational Phase

The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_x; hydrocarbons (HC); SO₂; carbon dioxide (CO₂); and particulate matter (PM). These compounds can damage health and/or the environment. The concentration of pollutants generated by vehicles depends on factors such as the number, type and speed of vehicles. The effect of air pollution on local people depends on the distance between them and the road, wind direction, topography and other factors. The main direct effects are in the area closest to the road as the rapid dispersion and dilution of exhaust gases quickly reduces their concentrations to levels at which risks are minimal.

The impacts associated with air quality in the operational phase of the Project have been assessed using an air dispersion model. The findings of which are presented below.

The impacts associated with air quality in the operational phase of the Project have been assessed using an air dispersion model. The findings of which are presented below.

Pollutants Modeled - The pollutants kept into considerations are the ones characterizing the emissions from vehicles: NO₂, NO_x, PM₁₀, PM_{2.5}, CO, SO₂ e C₆H₆. The below indicates the limits taken into consideration.

Table 73: Pollutants Modeled & Reference Limits

	MPC/guideline values/limits	Average period	CO, µg/m3	NO ₂ , µg/m3	SO ₂ , µg/m3	PM10, µg/m3	PM 2.5, µg/m3	TSP, µg/m3
1	National limit – max.permiss. one time (volley) concentration (MPC), µg/m ³	24 h	3000	40	50	n/a	n/a	150
		30 min	5000	200	500	n/a	n/a	500
2	IFC/WHO (updated 2016) – guideline value, µg/m3	1 year	n/a	40	50	20	10	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	20	50	25	120
		1h	30000	200	n/a	n/a	n/a	n/a
		30 min	60000	n/a	n/a	n/a	n/a	n/a
		10 min	100000	n/a	500	n/a	n/a	n/a
3	EU limit, µg/m3	1 year	n/a	40	n/a	40	25	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	125	n/a	n/a	n/a
		1h	n/a	200	350	n/a	n/a	n/a

Time frame of the model - The modelling has been developed for each of the below scenarios:

- Scenario year 2019
- Scenario year 2034.

The number of vehicles has been divided in 24 hours according to the provided traffic flow; the results of the modelling are represented into values of concentration/time (hourly levels) for the considered pollutants in correspondence of the selected receptors.

Spatial domain and receptors - The model takes into consideration an area far larger than the road strips and has been enlarged according to the morphology, the distribution of settlements and potential receptors for a total of about 20 square kilometres. The domain is a rectangle having dimensions of 6 km x 3.5 km; calculations have been carried out on the basis of progressive advancements for the road. Five main receptors have been inserted at the north and south of the road. They have been used for the considerations in terms of respect or excess of allowable limits.

Results - The results of the modelling are organized as follows:

- Scenario 2019 (probable start of road service).
- Scenario 2034.

The values of the concentration of pollutants are calculated in correspondence of the five selected receptors. The average yearly values and the values considered of reference by the present day legislation are put into evidence together to verify the threshold of acceptability. It must be noted that the values only refer to the traffic in the new road, and do not consider any other external source.

Table 74: Average yearly contribution of the road traffic to the background (concentration in $\mu\text{g}/\text{m}^3$) 2019

Receptors	PM10	PM2.5	NO2	NOX	CO	SO2	C6H6
Tseva Public School	0,03	0,02	0,49	1,00	0,16	-	0,001
Dzirula Public School	0,04	0,03	0,50	1,36	0,27	0,001	0,001
Shrova Public School	0,07	0,06	2,01	3,57	0,48	0,001	0,002
Ubisa Monastery	0,07	0,05	1,28	2,83	0,48	0,001	0,002

Table 75: Average yearly contribution of the road traffic to the background (concentration in $\mu\text{g}/\text{m}^3$) 2034

Receptors	PM10	PM2.5	NO2	NOX	CO	SO2	C6H6
Tseva Public School	0,04	0,04	0,54	1,22	0,22	0,001	0,001
Dzirula Public School	0,06	0,06	0,57	1,70	0,38	0,001	0,002
Shrova Public School	0,09	0,09	2,09	4,18	0,67	0,001	0,003
Ubisa Monastery	0,09	0,09	1,38	3,46	0,67	0,001	0,003

The above values represent the contribution of the traffic to the background values in the year 2019 when the road is expected to enter in full service.

Scenario for the interval years 2019 to 2034 - The following estimations have been calculated according to Table 74, which reports the estimated increments/year of the

average monthly concentration for the expected traffic increments. When background values are available they are considered into the calculations.

The average resulting values are presented in the below Table 76 which shows the increments, the background and the final expected values.

Table 76: PM₁₀ (µg/m³) Comparison of expected values at 2019, background and limits

Receptor	Δ estimated increment 2019 (aver.) PM ₁₀	Background level	Total	Limits (year)
Tseva Public School	0,03	11,6	11,63	40,0
Dzirula Public School	0,04	11,6	11,64	40,0
Shrova Public School	0,07	11,6	11,67	40,0
Ubisa Monastery	0,07	11,6	11,67	40,0

The data analysis confirms that the emission of PM₁₀ generated by the traffic, at 2019, is very limited and even taking into account the background levels will not exceed the allowable limits. It must be taken into account that the largest part of the traffic generating the background will be diverted into the new road, for that the above scenario has to be considered very conservative.

The application of increment of emissions determined by the expected increase of traffic, permitted to develop the following tables (Table 77 to Table 83) where the yearly increment of pollution for the considered pollutants is put into evidence. This data is also mapped for NO₂, SO₂, CO and PM₁₀ in Figure 78 to Figure 97.

Table 77: Yearly scenario 2019 to 2034 for PM₁₀ (including background at 2019)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	11,63	11,64	11,67	11,67
2034	11,64	11,66	11,69	11,69

Table 78: Yearly scenario 2019 to 2034 for NO₂ (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	0,49	0,50	2,01	1,28
2034	0,54	0,57	2,09	1,38

Table 79: Yearly scenario 2019 to 2034 for CO (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	0,16	0,27	0,48	0,48
2034	0,22	0,38	0,67	0,67

Table 80: Yearly scenario 2019 to 2034 for PM2.5 (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	0,02	0,03	0,06	0,05
2034	0,04	0,06	0,09	0,09

Table 81: Yearly scenario 2019 to 2034 for SO₂ (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	1,00	1,36	3,57	2,83
2034	1,22	1,70	4,18	3,46

Table 82: Yearly scenario 2019 to 2034 for C6H6 (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	0,00	0,001	0,001	0,001
2034	0,001	0,001	0,001	0,001

Table 83: Yearly scenario 2019 to 2034 for C6H6 (No background)

year	Tseva Public School	Dzirula Public School	Shrova Public School	Ubisa Monastery
2019	0,001	0,001	0,002	0,002
2034	0,001	0,002	0,003	0,003

Figure 78: NO₂, 2019



Figure 79: NO₂, 2019

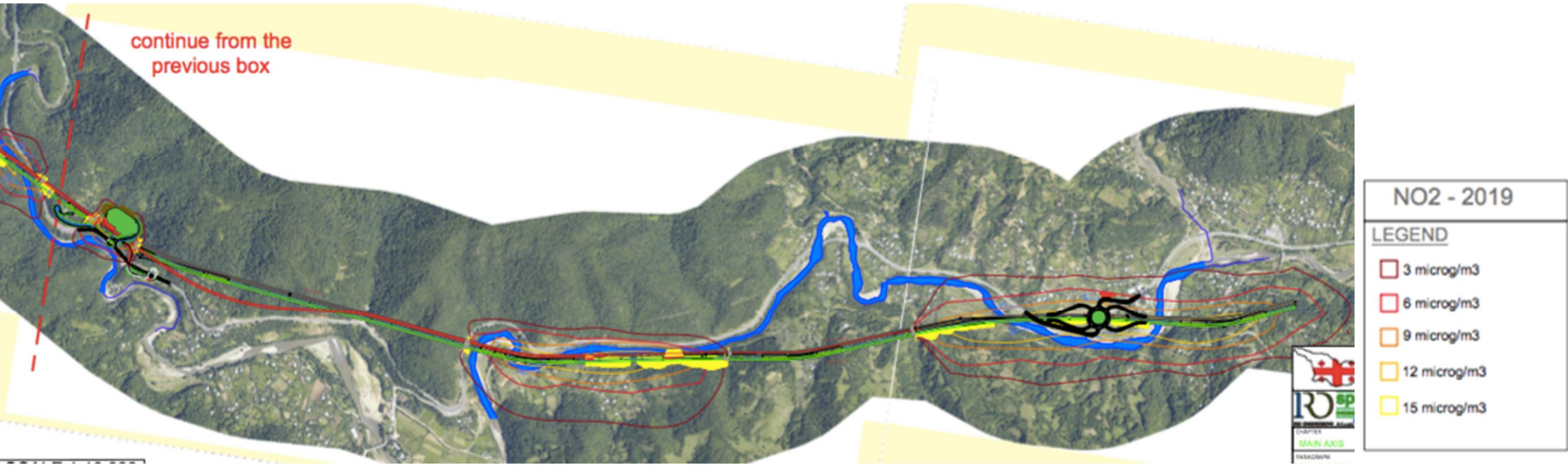


Figure 80: NO₂, 2034

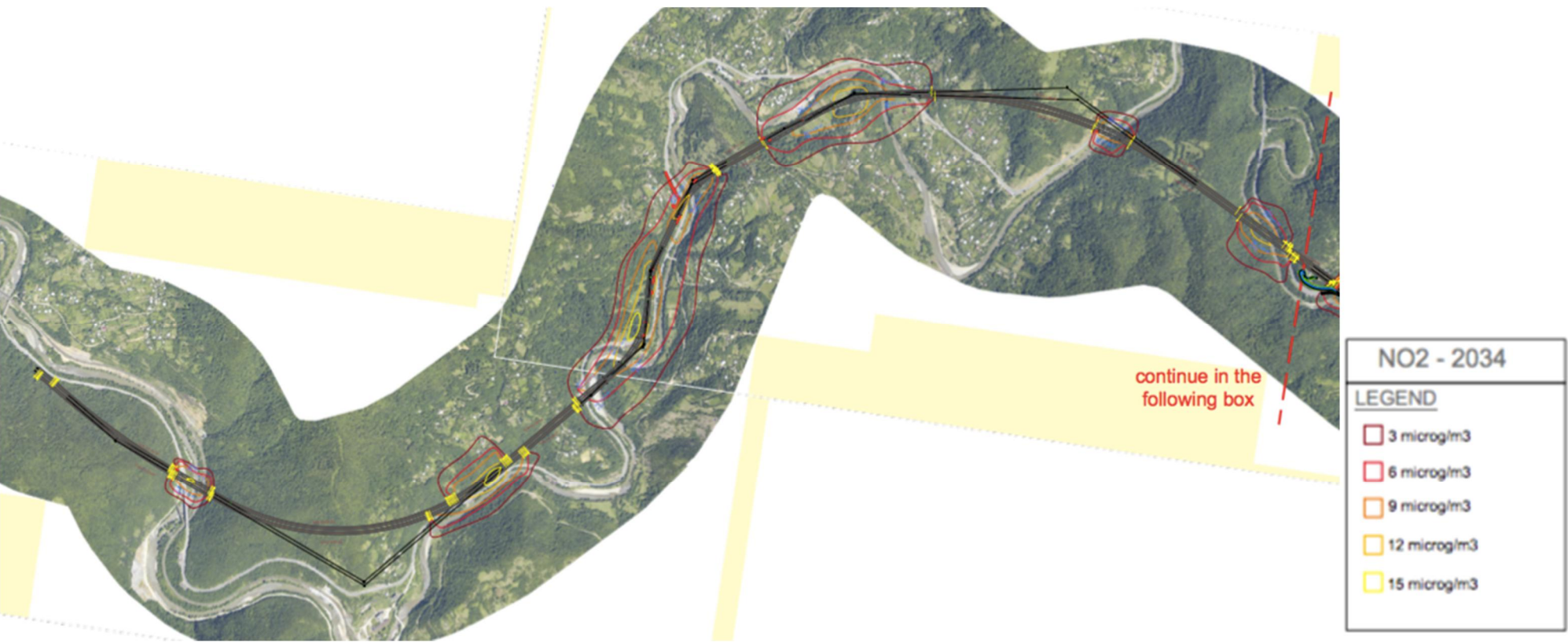


Figure 81: NO₂, 2034

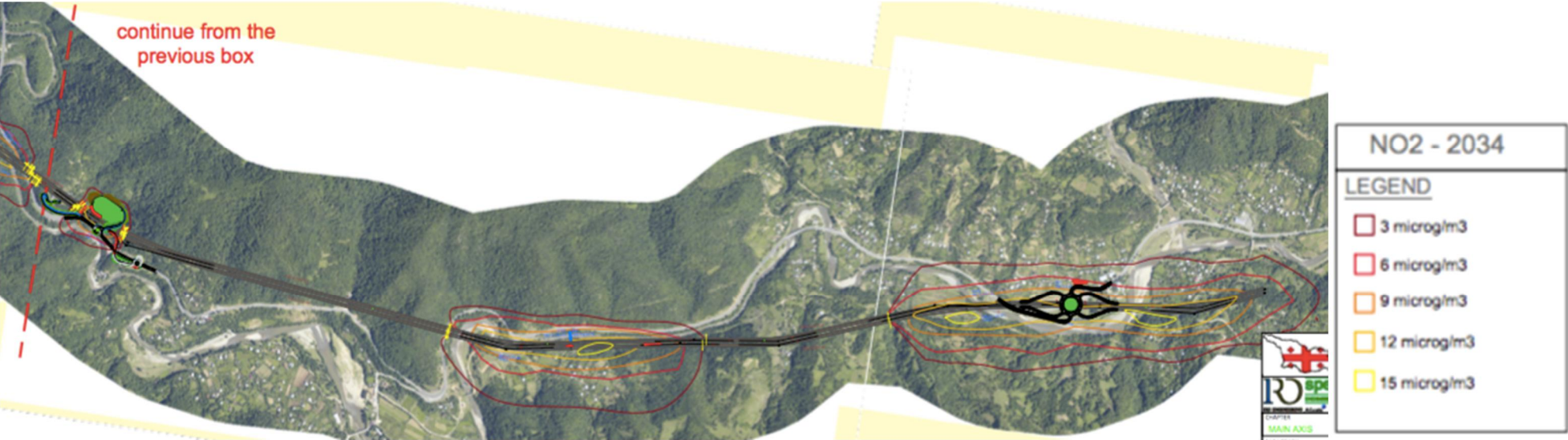


Figure 82: PM10, 2019



Figure 83: PM10, 2019

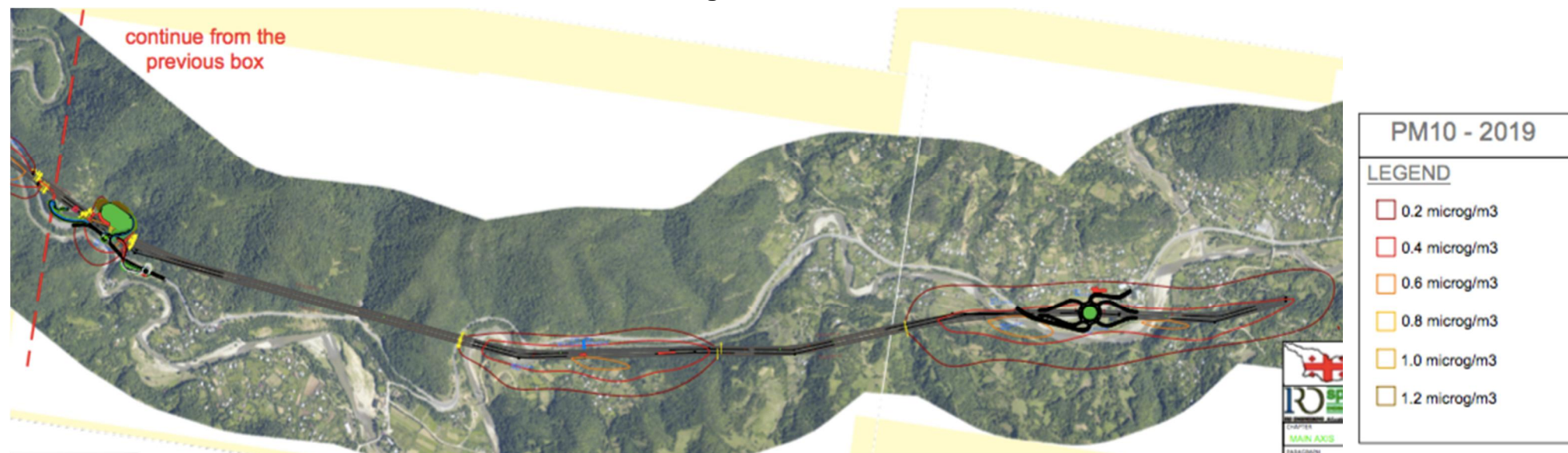


Figure 84: PM10, 2034



Figure 85: PM10, 2034

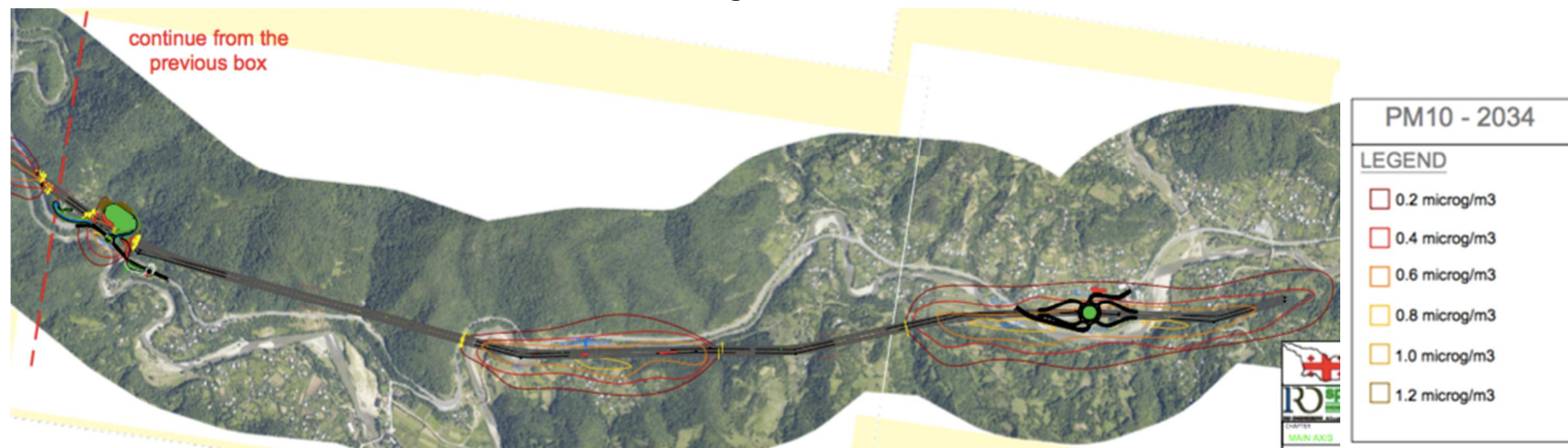


Figure 86: PM2.5, 2019

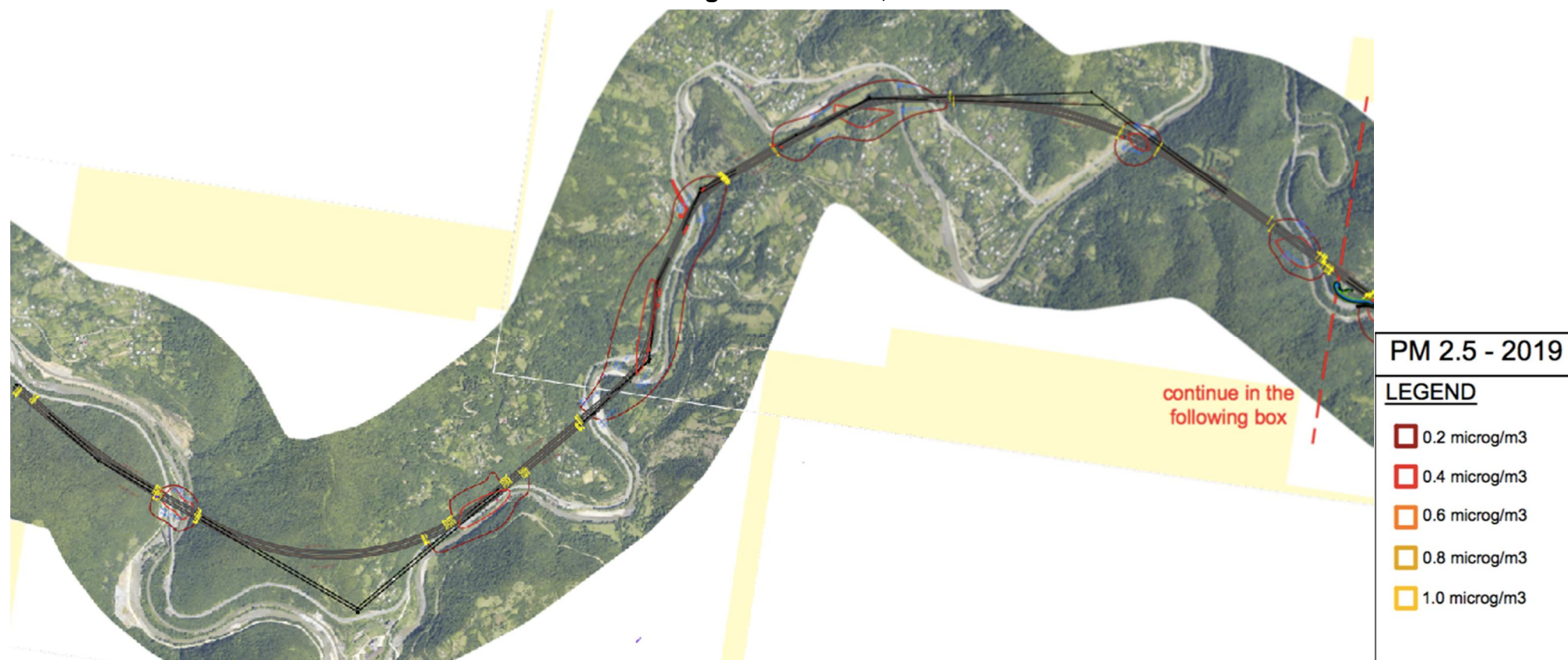


Figure 87: PM2.5, 2019

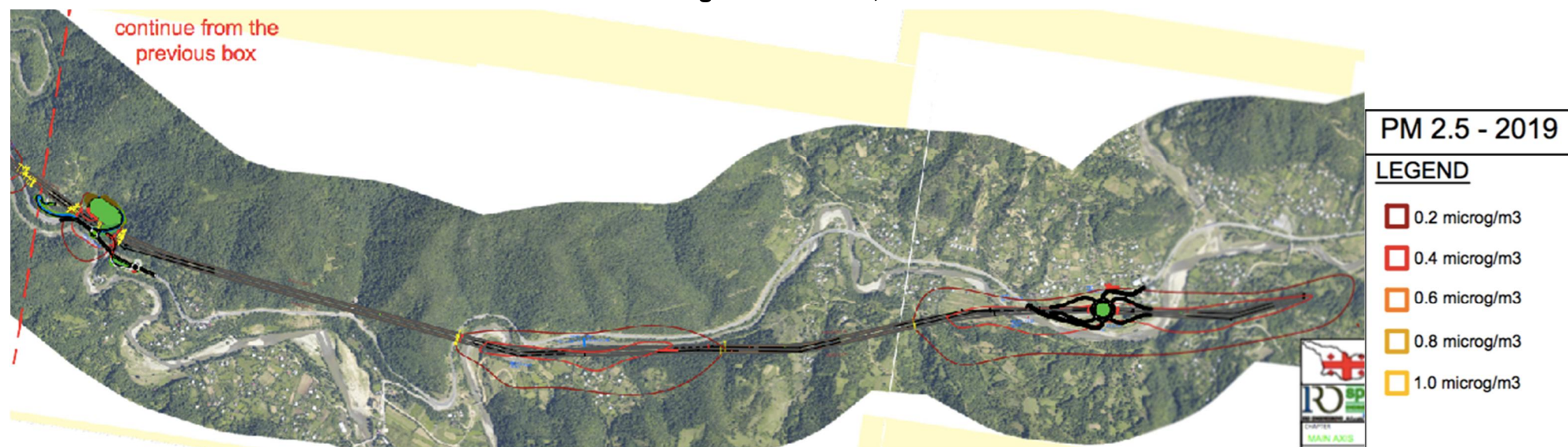


Figure 88: PM2.5, 2034

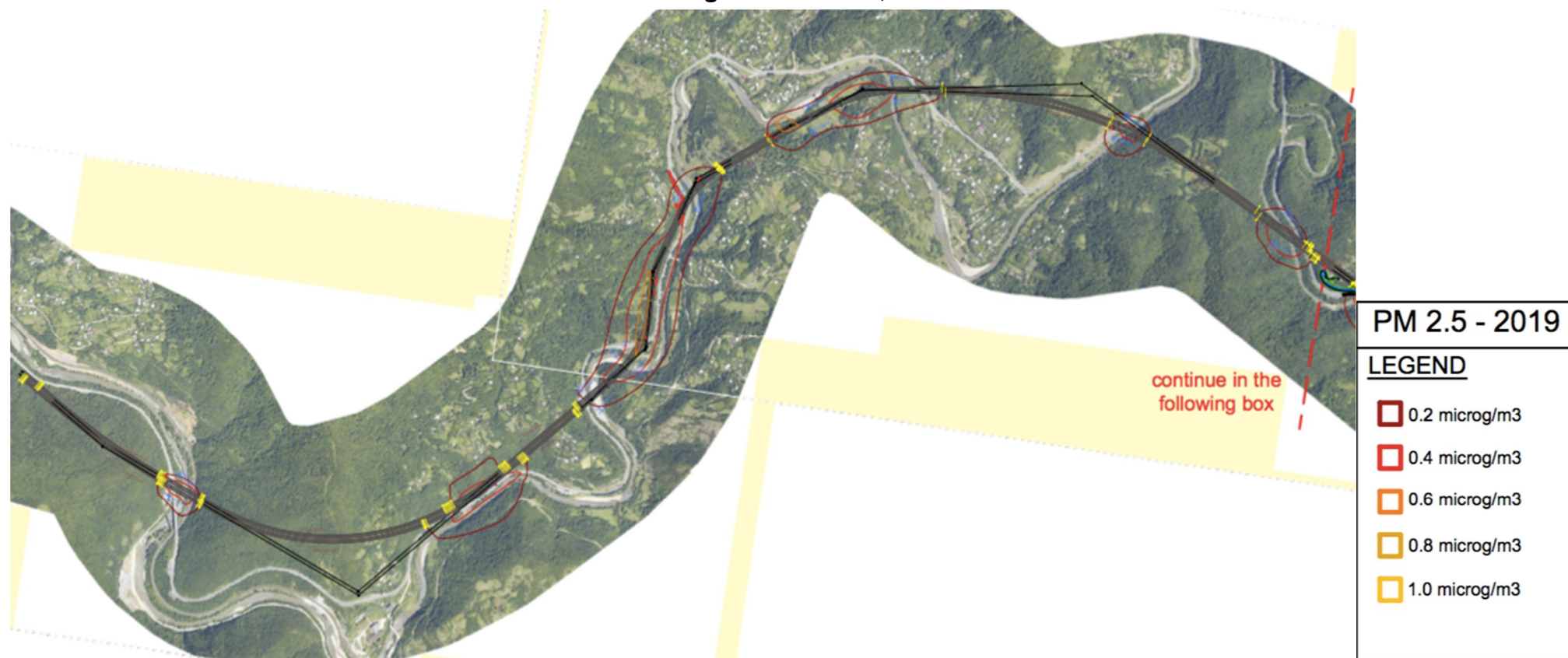


Figure 89: PM_{2.5}, 2034

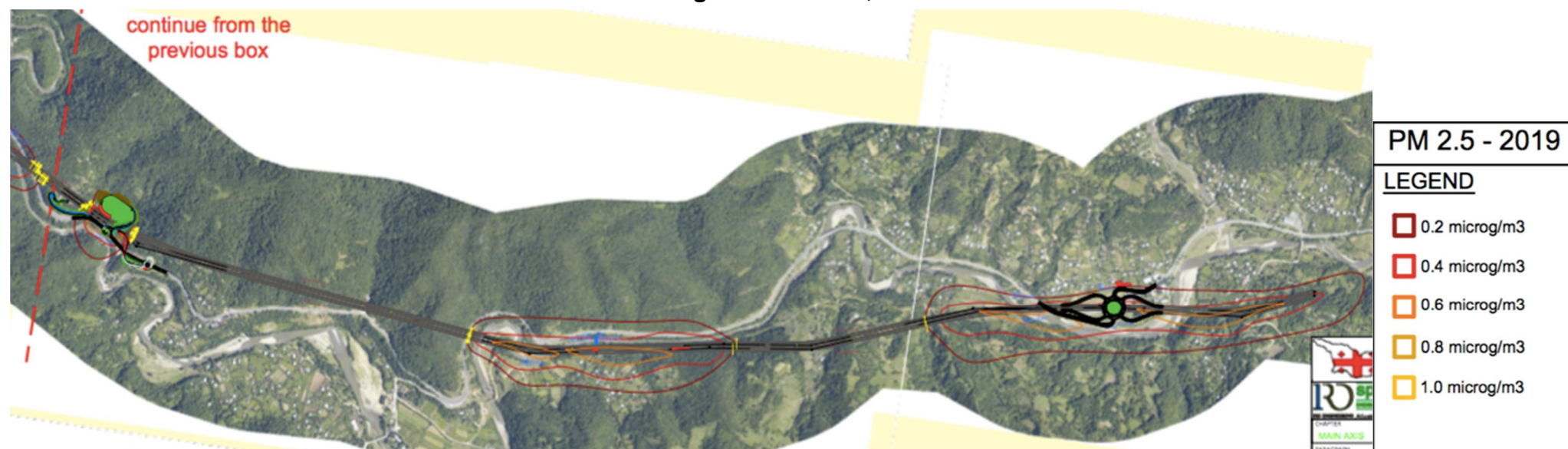


Figure 90: SO₂, 2019



Figure 91: SO₂, 2019



Figure 92: SO₂, 2034



Figure 93: SO₂, 2034

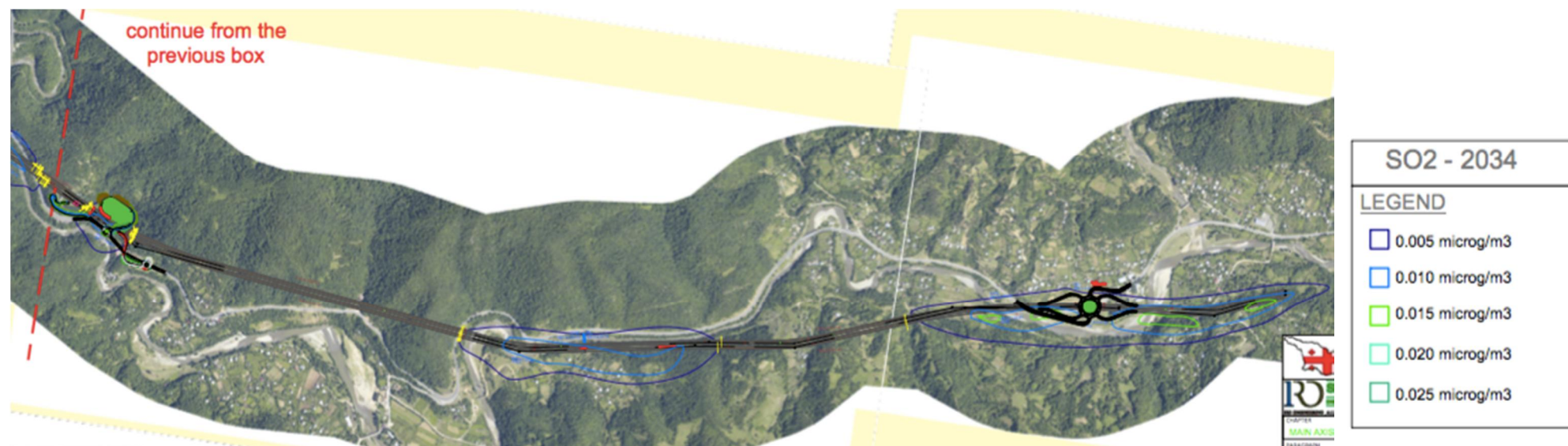


Figure 94: CO, 2019

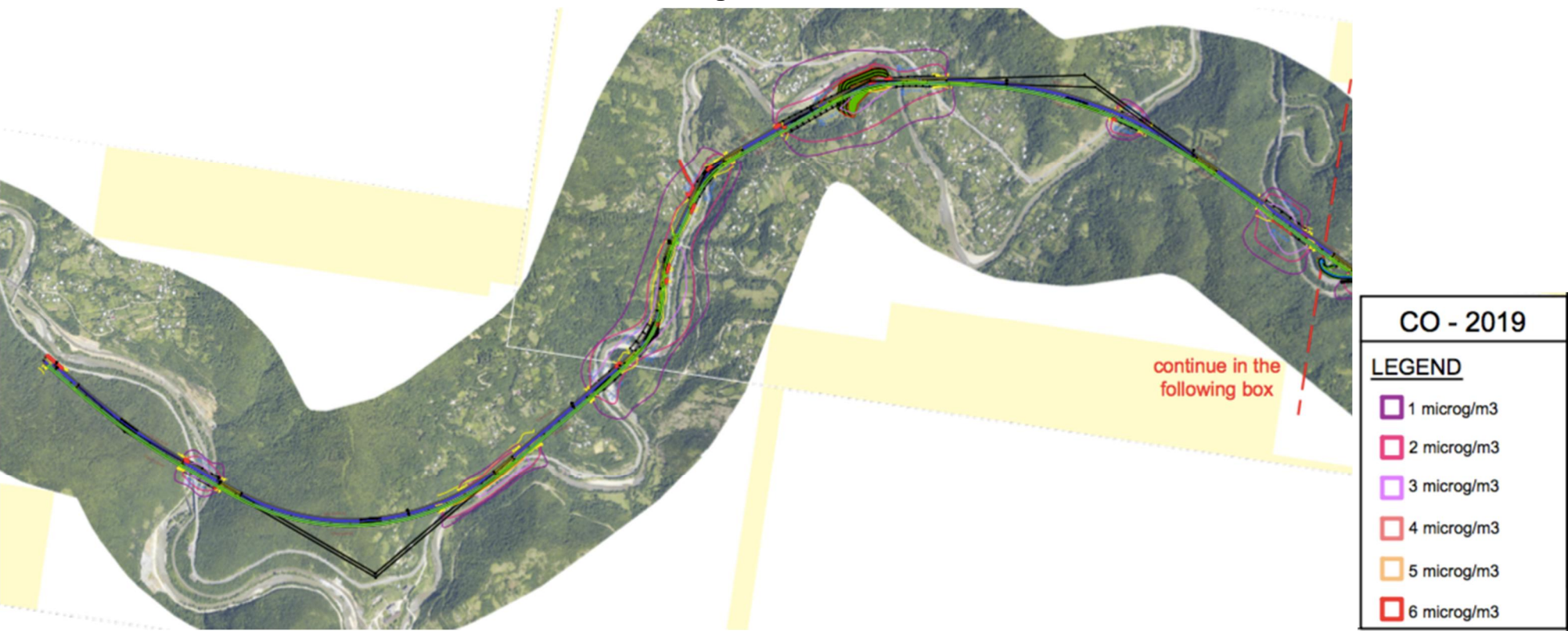


Figure 95: CO, 2019

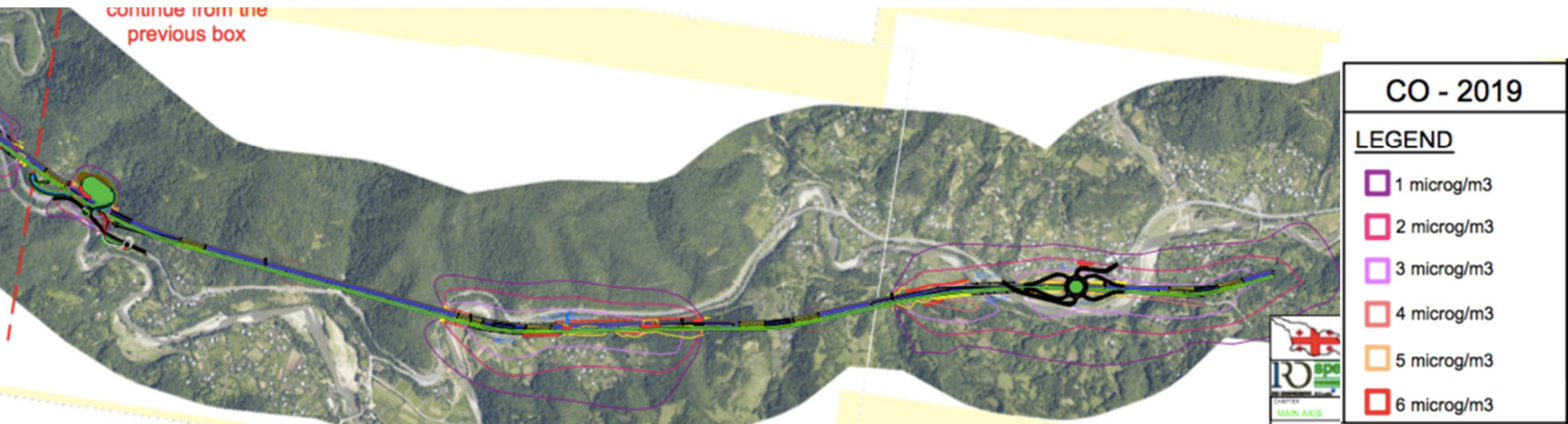
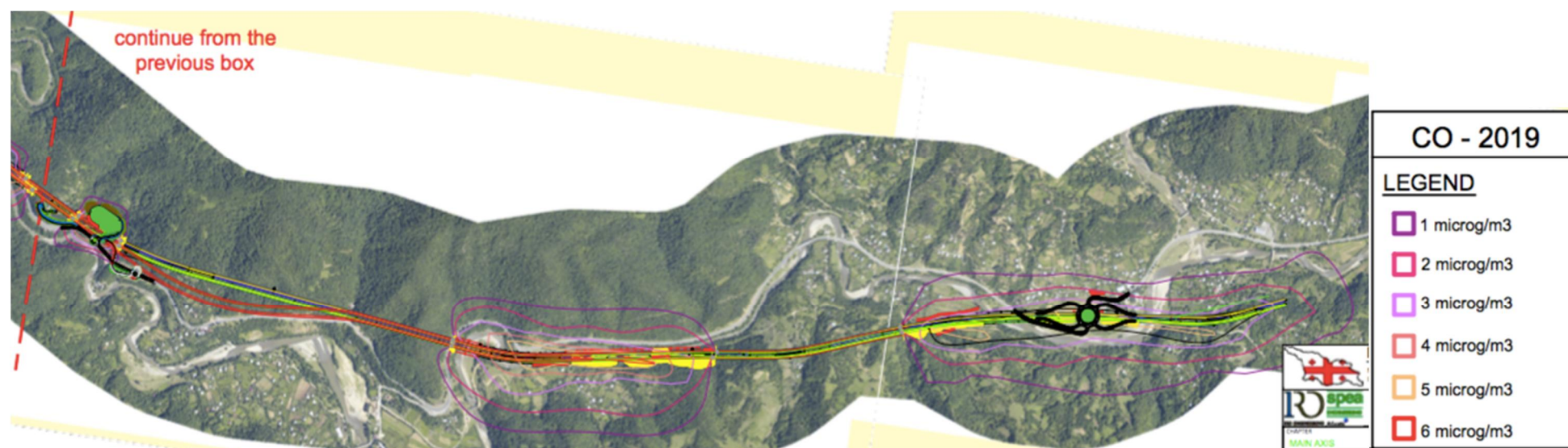


Figure 96: CO, 2034



Figure 97: CO, 2034



The analysis of the impact on operational phase air quality determined by the traffic on the new road suggests that there are no negative impacts on the environment. In addition to the fact that the maximum allowable limits are not surpassed, it must be taken into account that the road provides benefits in term of vehicular emission due to the smoother drive and optimized alignment.

The emissions of vehicles on a highway are lower than vehicles driving a urban type road as the existing one where the frequent bends, inclination and traffic congestions do not allow a fluid drive. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher.

The new road will have a positive impact on the air quality in term of reduced emissions compared to a similar flow of traffic along the existing one; it can also be pointed out that no air quality limits will be exceeded even considering that the composition of the fleet of vehicles is maintained. The higher values are recorded to the south of the road due to the main wind directions and morphology, these values are anyhow lower than the limits.

Management & Mitigation Actions

Pre-construction Phase

Locations for rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, MoEPA and the RD during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan (TMP).

To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc). The locations of these facilities will be indicated within the Contractors SEMP. Baseline air quality monitoring will also be undertaken by the Contractor during the pre-construction phase as described below under the recommended monitoring.

To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan, submitted to the Engineer as part of the SEMP. The plan will detail the actions to be taken to minimize dust generation (e.g. spraying un-surfaced roads with water (including the types of equipment, sources of water, locations for watering and schedule), covering stock-piles, etc) and will identify the type, age and standard of equipment to be used and will also provide details of the air quality monitoring program for baseline and routine monitoring. The Plan will also include contingencies for the accidental release of toxic air pollutants.

Construction Phase

The Contractor will be responsible, through compliance with this EMP and his SEMP, for the following;

- Exhaust emissions - No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. Construction equipment will be maintained to a good

standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.

- Open burning of waste materials - No burning of debris or other materials will occur on the Site without permission of the Engineer.
- Dust generated from haul roads, unpaved roads, material stock piles, etc:
- The Contractor will ensure that material stockpiles will be located in sheltered areas and be covered with tarpaulins or other such suitable covering to prevent material becoming airborne.
- All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins, or other acceptable type cover (which will be properly secured) to prevent debris and/or materials from falling from or being blown off the vehicle(s).
- Hard surfaces will be required in construction areas with regular movements of vehicles.
- Effective use of water sprays will be implemented (e.g., 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 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy). All water used for controlling dust will be free of odor and pollution.
- Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community.

In addition, any new concrete batching plant, rock crushing facility and asphalt mixing plant will be the subject of separate environmental application under the responsibility of the Contractor. The Engineer will ensure that no such facility becomes operational without the required permits.

The Contractor is also responsible for the preparation of a Health and Safety Plan. The Plan, required as part of the SEMP, will include contingencies for the accidental release of toxic air pollutants.

Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered:

- Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine maintenance programmes.
- Drivers should be instructed on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.
- Implement a regular vehicle maintenance and repair program.

Operational Phase

Ensure continued maintenance of tunnel ventilation system.

Residual Impact – *If the mitigation measures suggested are implemented during the construction phase the residual impacts of the Project will be low. No residual impacts anticipated during the operational phase of the Project*

G.5.3 Climate Change

Potential Impacts Caused by the Project

Greenhouse Gas (GHGs) Emissions – The Greenhouse Gas (GHG) emissions resulting from road construction have been estimated to be 2.14 ktCO₂/km for a 26m wide road. Including operational and maintenance issues over a 40 year period this figure rises to 3.94 ktCO₂/km. Given a road length of 13.0 km, this would result in around 50,826 tCO₂ of GHG emissions from the construction and O&M phases of the Project over a 40 year period.

Table 84: Estimated Energy Consumption, CO₂ Emissions and GHG Emissions for a Concrete Pavement 13 m wide.

Phase	Energy Consumption, TJ/km (26m pavement)	CO ₂ Emissions ktCO ₂ /km (26m pavement)	All GHG Emissions ktCO ₂ /km (26m pavement)
Construction	11.51 (23.02)	1.00 (2.00)	1.07 (2.14)
Maintenance – 40 years	2.99 (5.98)	0.19 (0.38)	0.20 (0.40)
Operation – 40 years	12.60 (25.20)	0.66 (1.32)	0.70 (1.40)
Total	27.09 (54.18)	1.85 (3.70)	1.97 (3.94)

Source: IEA ETSAP – Technology Brief T14 –August 2011

GHG emissions from traffic using the road have been calculated using the traffic forecasts presented in **Section B**. The existing road traffic is estimated to generate around 259 tons of CO₂ per day, or 94,661 tons of CO₂ per annum. A decrease of 13% of GHG emissions can be achieved when driving at 90 km/h as opposed to transient driving at 60 km/h. If we apply this condition to the traffic forecasts in 2037 a figure of approximately 186,000 tons of CO₂ would be generated by traffic using the road per year. However, this figure could reduce dramatically over the coming years as the performance of cars increase including the use of electric cars running of renewable energy.

Potential Impacts Upon the Project

The following section is extracted from the Climate Risk and Vulnerability Assessment & Independent Proof Check prepared by the ADB in April 2018.

Components at High- and Moderate-Risk from Climate Impacts

Bridges – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. This may lead to increased scouring and riverbank erosion. In addition, the bridge deck drainage capacity may be overwhelmed and create unsafe driving conditions.

By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. Water level and flow fluctuations may lead to changes in sub-surface conditions that could affect foundation settlement and pier bearing capacity.

By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which may impact bridge structure and bridge deck paving material.

The expected changes in temperatures will stress the bridge deck paving material, which is expected to be a BM. The increase in maximum air temperatures may soften the BM, and the likelihood of shorter winters will reduce the service life of the BM mixture due to abrasion and wear.

In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. The ambient heat generated from these may also affect bridge structures and materials, bridge deck conditions, and may also create unsafe driving conditions.

Tunnels – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. This may affect overflow drainage capacity and create unsafe driving conditions.

By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent. While droughty conditions are projected to occur more frequently, it is possible that an additional increase of at least 2% in relative air humidity may occur due to changes on the frequency of extreme rainfall events. This may impact tunnel waterproofing, tunnel lining and ambient air temperatures within the tunnels.

In addition, an increase in the number, duration and extent of wildfires in the surrounding hill slopes is expected. The ambient heat generated from the wildfires may affect conditions within the tunnels, and may also create unsafe driving conditions.

An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. An increase in debris flows along the road corridor is likely. These may impact access to the tunnels.

Cut Sections

By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Changes to ground water levels and flows may also lead to changes in sub-surface conditions.

By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which will lead to an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas.

An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. An increase in debris flows and drainage obstructions is likely.

Surface Water Management - By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Intense and long-

duration rainfall can be regarded as the most critical loading condition. The frequency of such events is projected to increase, which may create loads that exceed the original design parameters.

By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. This will likely increase the debris load near drainage channels and openings. Because of changing climatic conditions, projected debris loads, changing land use patterns, and uncertainties in hydrologic estimates, culvert size and capacity should be expansive.

An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. An increase in debris flows and drainage obstructions is likely.

Components at Low-Risk from Climate Impacts

Road Surface - Nearly all climate parameters affect the road surface. Even under normal climate change conditions, rigid pavements suffer from thermal-expansion stresses.

Thermal-expansion stresses, such as scaling, D-cracking, pumping, faulting, curling, corner cracking and 'punch-outs, are the primary concern due to air temperatures, including absolute yearly maximal and the number of heat days. Curling deformation, resulting in thermal-expansion stresses in the concrete slab, is a characteristic phenomenon under environmental and repeated vehicle loads. Distortion of the slab, due to both upward and downward curling, may occur when the top surface of the slab is cooler than the base course, and also when there is a higher temperature on the top surface, leading to separation of the base course from the concrete. Distress of the pavement in the form of joint deterioration, or cracking, also contributes to void formation by allowing moisture infiltration. The combination of distress and layer voids will further reduce the pavement load carrying capacity. Changes in the capacity of the base course, or subgrade, as a second-order response may also add new stresses to the road surface.

While an overall increase in temperature is projected, these are not expected to severely impact the road surface since the projected temperatures are within the German Pavement Design Guideline (RStO 12) reference temperature range (-20°–50°C) used in the pavement design.

The increase in the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C), and the increase in the number, duration and extent of wildfires on the surrounding slopes, may require second level responses.

Interchanges and Access Roads - There is insufficient information to properly assess climate risks to the interchanges, and the approach and connecting roads.

The majority of climate parameters affect asphalt surfaces, though the increase in the number of hot days and nights is of particular concern. As asphalt surfaces have a short design life and can be replaced relatively easily, they are not considered a medium- or high-risk component. Changes in air and ground temperatures may also

affect the subgrade of the approach and connecting roads, but not to an extent that would result in medium- or high-risk component.

Road Embankment and Road Base - Most climate events affect the road embankment to some degree. The climate load includes changing ground water levels, that can induce consolidation settlement; ground temperature; ground water regimes; snow cover; and surface vegetation that can reduce their service life. By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. Increasing temperatures and changes in precipitation patterns may impact ground and surface water flows, leading to consolidation settlement.

By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, may accelerate soil warming, and in some soil types, creating soil heave.

In contrast to the road embankment, the road base is not directly exposed to the atmosphere, and therefore is less impacted by short-term climate events. Changes in the road base capacity would mostly result from loss in strength or formation of voids due to internal erosion, especially if the road surface is cracked.

Changes in surface and ground water levels and their impact on the road base and the road embankment, as a second-order response to changes in precipitation levels are difficult to predict, but should be considered.

Management & Mitigation Actions

A number of recommendations were made as part of the climate risk assessment. The following table provides those recommendations along with the responses of the Detailed Design Consultant.

Table 85: Climate Change Recommendations and Responses

Recommendation	Detailed Design Consultant Reply
Bridges	
A review of the bridge pier design parameters in light of the potential changes in in soil conditions, with implications for foundation settlement, should be undertaken prior to finalization of the Design Reports.	All piers are designed in order to avoid settlements on the long run and plinths are generally in the floodplain. Plinths in the flowing section of the river, whenever unavoidable, are founded on piles and with the upper face below the riverbed level, as per best practice; the risk of foundations being exposed is consequently minimum. Intervention of protection of the plinths in the floodplain in case of future river bed changes is quite simple and not expensive, so we suggest to monitor this aspect and act accordingly just in case. Recommendations for the Employer will be included in the "Recommendations for the management of the highway" document, in order to give an instrument of monitoring and managing the maintenance.
The recurrence interval for the bridge drainage system should be upgraded to a 50-year recurrence interval, and the drainage calculations revisited, to	The shown value "30 years" at paragraph 4.5 of the Design Report is a typo mistake, indeed as you can check the discharge per unit area considered is that effectively used for all other

Recommendation	Detailed Design Consultant Reply
ensure concurrency with the other elements of the drainage system.	drainage elements. i.e. 50 years (50,5 m3/s/km2).
As part of road maintenance and key indicator monitoring, bridge deck retrofitting trigger levels – to recognize the point at which impacts are beginning to be experienced at specific locations – should be developed for initiation of management responses.	Bridge deck retrofitting trigger levels will be included in the "Recommendation for the management of the highway" document
Tunnels	
Verify that the parameters for the waterproofing and ventilation systems include potentially higher humidity values.	Waterproofing inside a tunnel is designed to prevent water circulating in the rocks from entering the tunnel, and, if properly executed, it should not be considered as a main humidity values rise driver. The humidity values are not a problem for these tunnels since they are unidirectional, so they do not affect the ventilation system or the smoke.
A 50-year recurrence interval for the tunnel drainage system should be used for consistency with other drainage system parameters, and all design calculations reviewed.	Highway platform drainage inside tunnels is designed to manage possible accidental losses of hazardous liquids from trucks as a consequence of an accident. In fact this is a close system, with "no-fire-inlet" manholes to avoid the spread of the flame and a storage tank at the lower portal. Tank that won't discharge on the rivers but will be emptied by means of pumps. Having neither direct precipitation nor runoff inflow in the tunnel, the relevant drainage is not an issue and it is not correlated to any specific hydrological return period.
The potential for higher levels of channel obstruction should be explicitly integrated into the drainage system design, due to increased mass movement and erosion activities.	See above. Moreover, at each portal there is a drainage system collecting water coming both from the platform and from the slope and discharging it in the river, by means of pipes or culverts, before entering the tunnel. In any case sediments are not expected to enter in a significant amount the tunnel drainage system.
The design of the tunnel portals and wing walls should be reviewed for suitability for higher levels of mass movement and erosion activities.	All the slopes at the portal, when not covered with material coming from excavation (slope 7 on 4), are protected with net, dimensioned case by case, based on the geotechnical conditions.
Cut Sections	
A decrease in the cut slope gradient, and a concurrent increase in the overall slope buffer area, is recommended.	The choice of the cut slope is a compromise between the geotechnical constraints and the occupation of land. Reducing the slope of the cuts in many cases will cause larger road footprint (often more than a hundred meters), which would not be acceptable for its landscaping and resettlement impacts and for the volumes of spoil material generated. In any case the geotechnical verification (not present in the draft) have been carried out with conservative safety coefficient.
Increased use of hydro seeding on all the cut slopes, not just their upper most area, is recommended.	The steepness of the slope (almost vertical) and the presence of rock don't allow the use of hydro seeding. This would more be the case of a "vertical garden", which is not a technology practiced in Georgia. That's why the designer's choice was the more industrial, but effective steel

Recommendation	Detailed Design Consultant Reply
	net protection.
Surface Water Management Structures	
A consistent 50-year recurrence interval for the road drainage system should be used throughout the design, and all design calculations reviewed.	50 years return period is used as clearly stated in the design documents (check paragraphs 4.1, 4.2, 4.3 and 4.4; statement at paragraph 4.5 about the 30 years RP is, again, only a typo mistake).
Assumptions and calculations for areas with high degree of mass movement and high potential for channel obstruction should be explicitly integrated into the drainage system design.	Mass movements are mostly unpredictable, as well as the yearly amount of debris flow. We only can suggest to the Employer to monitor these phenomena and to act accordingly, in case of event. Monitor of mass movement will be included in the "Recommendation for the management of the highway" document.
Use of box culverts, which are better at managing debris flows and related obstructions than pipe-based systems, is recommended.	Indeed, only box culverts are adopted all along the motorway for hill slope water (see table 3.7.1. of the hydraulic report). Further, given that a design solution with external ditches has been chosen for both embankment/fill and cut section, the motorway platform always lies higher than external ditches, so that drainage pipes are not expected to convey significant debris flow.

Given the above, no mitigation or management measures are required other than ensuring the items outlined above are included in the "Recommendations for the management of the highway" document.

Residual Impact – *Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road. The Detailed Design Consultant have considered the recommendations of the climate risk assessment and will add them to the "Recommendation for the management of the highway" document where applicable. No other actions are considered necessary to address climate change issues.*

G.5.4 Soils

Potential Impacts

Potential impacts to soils include:

- Loss of Topsoil - Several impacts to topsoil may occur during the construction phase, including; removal of top soil for construction outside the ROW; compaction of topsoil; loss of top soil by wind and □water erosion and covering of top soil by project works.
- Erosion - It is possible, that without adequate protection measures soil erosion could occur on road embankments and bridge embankments. It is also possible, that stockpiles of soil located close to surface waters could infiltrate the water courses during heavy rainfall and cause siltation of the rivers.
- Borrow Pits – No borrow pits are required under this Project as the quality and quantity of spoil material from tunnels and other cuts is suitable for construction purposes.
- Induced Changes - It is possible that construction of the new road could induce development along the corridor to some extent, but in general the purpose of the

Project is to improve the existing E-60 corridor to provide safer and quicker journey times which will help facilitate the movement of people and goods locally and regionally. It is considered unlikely that significant new commercial, industrial or residential developments would arise along this portion of the corridor as a result of the Project that in turn may lead to conversion of agricultural land or other impacts to productive soils.

- Contamination Due to Spills or Hazardous Materials - Potential soil contamination is a possibility resulting from poorly managed fuels, oils and other hazardous liquids used during the project works.
- Demolition of Petrol Stations – Three petrol stations were noted within the Project corridor:
 - Petrol Station 1 KM0.1
 - Petrol Station 2 KM9.9
 - Petrol Station 3 KM12.2

All of these petrol stations will need to be demolished to make way for the new alignment. Petrol stations 2 and 3 are located beneath the new alignment below bridges and as such structural demolition will be limited to above ground structures thereby eliminating the requirement for any significant excavation of soils and the removal of any underground storage tanks (UST). Any above ground storage tanks (AST) will need to be removed as hazardous waste. Partial excavation of soils from the area around the petrol stations will be required to construct bridge piers. The petrol station at KM0.1 will need to be demolished in its entirety and it is likely that any AST/UST at this site will need to be removed.

Contaminated soils and water may be encountered around fuel dispensers, piping, and tanks during excavation. Depending on the type and concentration of contaminants present, small quantities of soils or liquids may need to be managed as a hazardous waste.

Management & Mitigation Actions

Pre-construction phase

Demolition of Petrol Stations - Removal operations of any USTs, ASTs, and connected piping should include the following procedures recommended by the WBG¹⁹:

- Residual fuel should be removed from the tank and all associated pipes and managed as a hazardous waste;
- Before commencing tank removal operations the tanks should be inerted so as to remove the risk of explosion. Proven inerting methods include; hydrophobic foam fill, nitrogen foam fill, nitrogen gas purging, water fill, dry ice, combustion of gas, and cleaning-degassing;
- All vent pipes and risers associated with the tank should be dismantled and/or capped-off and clearly labelled;
- Tank dismantling should be carried out off-site, if the facility is currently used to store fuel and there is not sufficient space to carry out the dismantling work safely;
- If tanks and piping are left in situ, recommended closure methods should include cleaning and removing contents, inerting, and filling with sand and cement slurry, hydrophobic foams, or foamed concrete.

¹⁹ Environmental Health and Safety Guidelines for Retail Petroleum Networks

- Any observed contaminated soils around the excavated area shall be removed as hazardous waste and sent for disposal at a licensed facility.

Construction Phase

Potential adverse impacts will be avoided or otherwise mitigated by ensuring the Contractor complies with the following:

- Erosion - During construction, the Contractor will be responsible for ensuing material that is less susceptible to erosion will be selected for placement around bridges and culverts. In addition, he will ensure re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local grasses and shrubs; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion.
- Topsoil – To reduce impacts to topsoil the following measures will be employed by the Contractor; locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion; construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil; rip ground surface prior to the spreading of topsoil; and remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the ROW, as much as possible, to avoid soil compaction and damage to privately owned land. If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.
- Contamination Due to Spills or Hazardous Materials. The Contractor, with oversight from the Engineer, will ensure that:
 - All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund).
 - The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills, there will be no vehicle maintenance activities on open ground.
 - Filling and refueling will be strictly controlled and subject to formal procedures. Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of by a licensed contractor.
 - All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
 - The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils.
 - No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding.
 - Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils.
 - No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing.
 - Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils.

Residual Impact - If the mitigation measures suggested are implemented, the residual impacts of the Project will be low. The erosion protection measures outlined
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above will prevent impacts occurring into the operational phase of the Project.

G.5.5 Hydrology

Potential Impacts

Pre-construction Phase

The following potential impacts to hydrological conditions exist within the Project corridor:

- Drainage & Flooding - Inadequate assessment of the hydrological conditions in the Project Area and poor design could result in damage to Project structures, including bridges and culverts. This in turn would result in several impacts including cost to rebuild the structures, potential flooding of agricultural land and property and impacts to surface water quality.
- Construction Camps – Improper siting and design of construction camps can have negative impacts to hydrology, both surface and groundwater, through improper disposal of liquid waste and spills of hazardous liquids.

The span of the bridges is designed to avoid, as far as possible, the presence of foundation piles in the riverbed. That said, it is important to point out that the intervention is located in a complicated orography (a narrow valley with a central stream) and that the geometric standards of the route have imposed strong constraints that oblige to pass over the river, to have no greater environmental impact on forests or populated areas.

Construction Phase

Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the biodiversity of the rivers. Excavation of river bed materials will be required during the construction of the bridge piers. Surface water monitoring did not indicate any elevated levels of contamination in the groundwater of both the Dzirula or the Kvirila rivers as such it is considered highly unlikely that the river bed silt is contaminated by manganese or any other pollutant and will therefore not need to be disposed of as hazardous waste. No other pollution of riverbed sedimentation is anticipated as a result of the construction activities in the river.

Hazardous Liquids - From the construction activities, there will be significant use of fuel and lubricant and other hazardous liquids such as paints. Without standardized materials handling and storage protocol in place, spills and contamination of groundwater and soils is possible. Other impacts to groundwater could occur from the washing out of concrete mixers onto bare soils and a lack of oil and grease interceptor tanks in camp drainage systems.

Water Use – Technical water may be sourced from the Dzirula and Kvirila rivers. The required amounts, potentially 200 m³ per day (0.002 m³/s) are insignificant given the flow rates of these major rivers. (The lowest flow in the Dzirula is during August with a flow of approximately 3.445 m³/s).

Tunnel Construction – Impacts associated with tunnel construction are discussed under **Section G.7.5** below.

No fisheries have been identified within the Project area, or residents that rely on fishing as a livelihood. As such no impacts to livelihoods or fisheries or activities downstream are anticipated. Recreational fishing was noted in the Dzirula river during site visits. Impacts to recreational fishing are anticipated to be short term and minor.

Operational Phase

In rare circumstances there could be a major spill of oil / fuel from tanker trucks. Such spills could impact significantly on the Dzirula and Rikotula rivers given the proximity of the road to these surface water courses in many locations along the alignment.

Drainage of run-off from bridge decks could flow directly to the rivers if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

Management & Mitigation Actions

Pre-construction Phase

Drainage and Flooding - Consideration in the design phase has been given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges.

It is also strongly recommended that the RD considers including the use of oil separators within the road drainage system to capture any spills of oil / fuel and also to filter hydrocarbon run-off from the road in general.

Bridges - All bridges will be designed for the life expectancy of 100 years. The design loading and design of all structural components will conform to the bridge design standards provided in the Employer's Special Requirements. Bridge designs will ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. The bridges shall be designed with dry paths under the bridge on either side of the streams to facilitate movements of people, livestock and wildlife, the latter primarily at night when people are not around. The bridge run-off waters will lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off. The bridge design and layout must also be aesthetically pleasing and in harmony with the existing environment. Finally, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to confirm the fish spawning period in relation to the bridge construction works to ensure that all works are scheduled to take place periods least likely to affect the fish spawning period.

Construction Camps – In the first instance, no construction camp, permanent or temporary, will be located within 500 meters of any river, or irrigation channel (not including drainage channels) identified in this report, including the Dzirula and any of its tributaries. The Contractor will also be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including

latrines, holding areas, septic tanks, etc. The Contractor will ensure the following conditions are met within the Plan:

- Wastewater arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a way that will cause neither pollution nor nuisance.
- There will be no direct discharge of sanitary or wash water to surface water, including the surface water courses identified in this report, including the Dzirula and its tributaries. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- Liquid material storage containment areas will not drain directly to surface water (including wetlands).
- Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained (including spill kits) across the Contractors construction camp and ancillary facilities, e.g. asphalt plant.
- Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters.
- Discharge of sediment-laden construction water directly into surface watercourses or wetlands will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- Spill cleanup equipment will be maintained on site. The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
- Fueling operations will occur only within containment areas.
- All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
- Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
- All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
- The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
- Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
- Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal. Disposal of such was will be undertaken by a waste management company contracted by the Contractor. The waste management company must have the required licenses to transport and dispose of hazardous waste before any such waste is removed from the site. The Contractor will keep copies of the company's licenses and provide waste transfer manifests at his camp site for routine inspection by the Engineer.

Site plans will be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 100 meters away from any surface water course. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.

Construction Phase

Construction Camps and Storage Areas – The Engineer will undertake regular monitoring of the Contractors construction camp and storage areas to ensure compliance with the SEMP and the Contractors Construction Camp Site Plan.

Site plans will be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 100 meters away from any surface water course. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.

Bridge Construction - Concerning bridge construction works, the Contractor will:

- Divert the water flow near the bridge piers.
- Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams.
- Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.
- Carry out bridge construction works without interrupting the traffic on the Project Road with the provision of suitable diversions.
- Ensure no waste materials are dumped in the river, including re-enforced concrete debris.
- Place generators more than 20 meters from the river.
- Ensure that no concrete waste is dumped in the river.
- Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment.
- Ensure that no hazardous liquids are placed within 10 meters of the river.
- Provide portable toilets at bridge construction sites to prevent defecation by workers into the river.
- Ensure that workers are provided with correct PPE including harnesses.
- During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river.
- Provide areas where concrete mixers can wash out leftover concrete without polluting the environment. This may be in the form of a lined settling pond at each bridge site. Drivers will be informed of these locations and the requirements to use these settling ponds on a routine basis by the Engineer. Dried waste from the settling ponds can be used as backfill for culverts, etc.

Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. Should any operation being performed by the Contractor interrupt existing irrigation systems, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

Tunnel Construction - Mitigation associated with tunnel construction are discussed under **Section G.7.5** below.

Operational Phase

During the operational phase of the Project, the RD will be responsible for monitoring drainage along the road to ensure that it does result in increased run-off and flooding. The RD will be responsible for rectifying this issue if it occurs.

During routine maintenance, the Contractor shall:

- Perform maintenance paving of the road sections and bridge decks only in dry weather to prevent runoff contamination.
- Use staging techniques to reduce the spread of paving materials during the repair of potholes and worn pavement. These can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines.
- Comply with mitigation measures defined for water protection during construction.
- Remove all waste, material, machinery and tool from the area after completion of works.
- Reinststate disturbed areas – if the case.

Residual Impact - *If the mitigation measures suggested are implemented, there will be no significant residual impacts. It is noted that the Project requires interceptor tanks for bridge run-off and this could also be applied to the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.*

G.5.6 Natural Hazards

Potential Impacts

Potential flood events are discussed above under **Section G.5.5 - Hydrology**) and increased precipitation is discussed above under **Section G.5.3 Climate Change**.

As noted in **Section F**, generally, landslides do not affect the project alignment and where they have been identified realignment of a tunnel has occurred and engineering measures have been incorporated to ensure these landslides to not affect the road.

The project is located in a seismically active area. The Detailed Design Consultants have experience of designing roads in seismically active areas and have ensured that all designs are compliant with the relevant seismic standards of the GoG.

Management & Mitigation Actions

None required.

Residual Impacts – *None anticipated*

G.6 Ecological Resources

G.6.1 Flora & Fauna

Potential Impacts

The main concerns for impacts on ecological receptors are disturbances caused by site clearance/preparation, the spread of invasive species and contamination of feeding, breeding and resting habitats. Another concern is poaching due to a lack of regulation.

Site Clearance - The main effects of site clearance/preparation and movement of equipment include loss of habitat. The ecological receptors most affected include those that have limited mobility such as terrestrial flora, reptiles and amphibians. Loss of habitat can also affect more mobile species which lose breeding, nesting and feeding sites. The spread of invasive plant species is facilitated by disturbances such as site clearance and this results in a risk to the native, endemic and relict flora.

The removal of vegetation, including up-rooting of shrubs and cutting of trees, will result in loss of plants, contributing to a decline in their numbers, as well as loss of habitat for species of mammals, birds, insects and herpetofauna that they provide. Fauna with limited mobility, such as reptiles, are at a greater risk of direct mortality due to Project- related activities such as movement of equipment.

Site clearance/preparation and movement of equipment results in the removal of top soil which can negative influence several soil functions which are relevant in nature and environmental protection, e.g. carbon storage, and a decrease in biological activity.

Reptiles and amphibians have limited ranges and are unable to travel long distances unlike birds and mammals. As a result any individuals found within the Project area are at risk of either being killed by Project-related activities, or having suitable habitat destroyed and perishing as a result of their inability to re-locate.

Loss of habitat results in the loss of breeding, feeding and nesting sites for all species including highly mobile ones.

A number of trees will need to be cut within the Project area, both on private land and within State Forest Fund areas. Other trees (potentially including Georgian red-listed species) are located adjacent to the boundary of the site and may be damaged accidentally by construction works.

The Project road has been designed in such a way that will be no significant fragmentation of habitat. The majority of the roads alignment traverses either bridges or tunnels, meaning that wildlife can pass above the road, or under it to access the Rikotula and Dzirula rivers.

Pollution and Waste Generation - Pollution and improper disposal of waste, generated during construction activities, poses a threat to surrounding fauna. The ecological receptors at risk are not only those that have limited mobility but also more mobile receptors, such as fish and bird fauna which pass through the Project area. Improper waste disposal can result in dumping on vegetation and contamination of soil which can result spread of contaminants into the ecosystem. Water bodies can also be contaminated. Both land and water pollution can result in contamination of

the food chain. Pollution of water channels can put at risk both aquatic and terrestrial ecosystems. Pollution from noise and dust from construction activities will result in presently suitable habitat nearby becoming uninhabitable. It can also cause loss of suitable foraging and breeding sites.

Pollution of the Dzirula and Rikotula rivers can result in contamination of sites that may currently be suitable habitat for feeding and breeding of fish species.

Work Sites in and around Rivers – A number of bridges will be constructed across the Dzirula and Rikotula rivers. Works involve the construction of bridge abutments and bridge piers which in many instances will be undertaken in the river itself or on the river banks. Temporary impacts on fish may result from sedimentation and water turbidity in the immediate vicinity of the construction work area (especially around the bridge construction zones), and the potential for minor introduction of pollutants from construction operations.

Light Pollution - Light pollution may have impact on bats. Since these species are nocturnal light may disrupt bat commuting routes or deter bats from feeding areas. Besides the light may cause delay in emerging from the roosts in the evening and reduce foraging ability. On the other hand light can be beneficial for insectivorous species, since light attracts insects. However, it can also make them more vulnerable to predation by nocturnal birds such as owls.

Lack of Regulation - Staff involved on-site, such as workers and site managers, can engage in poaching and illegal exploitation of wildlife. This can result in the targeting of species of conservation importance including those currently under legal protection from hunting and exploitation.

Impacts on Ecosystems – Ecosystems can be divided into terrestrial and aquatic ecosystems.

- The impact on terrestrial ecosystems will be limited, with the main one being due to loss of habitat from construction of the Project.
- The spread of invasive species, however, if not prevented, will have an impact on the terrestrial ecosystem, especially on the composition of native flora. Under disturbed conditions invasive species will be able out-compete native flora and alter the plant community composition permanently. □
- Irresponsible waste disposal will result in impacts on both terrestrial and aquatic ecosystems. Dumping on soil will reduce soil quality and inhibit biological activity, whilst dumping in water bodies will reduce water quality, which will impact the aquatic ecosystem. Contamination of both ecosystems will result in adverse impacts on the food chain for both terrestrial and aquatic organisms.

Impacts on Wildlife Habitat - Impacts on wildlife habitat include habitat loss and pollution from noise, dust and irresponsible dumping of waste.

- Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife. □ Impacts to habitat were unavoidable given the constraints of the Project corridor and the need to design a safe road to a modern standard. It is estimated that approximately 33 hectares can be classified as natural habitat within the Project buffer – all of the land in this area will be cleared for construction works. Almost all of these areas comprise the State Forest Fund areas that will be de-listed as per the national requirements outlined in this report. Approximately 19 hectares of SFF will be de-listed, including 9,709 trees over 8cm in diameter.

- Construction activities will result in generation of noise and dust which will drive wildlife away from areas surrounding the Project site.
- Improper waste disposal will result in pollution which will contaminate soil and water resulting in a reduction in quality of habitat available for wildlife. □

Protected Species - The following species IUCN Red-list Species (Vulnerable (VU), Near Threatened (NT), Endangered (EN), Critical (CR)) and Georgian Red list species have been identified that are, or may be present within the Project area:

- *Testudo graeca* Linnaeus - Mediterranean turtle (IUCN / GRL – VU)
- *Emys orbicularis* - European Pond Turtle (IUCN – NT)
- *Sciurus anomalus* Gmelin – *Caucasian Squirrel* (GRL – VU)
- *Lutra lutra* Linnaeus – *Eurasian Otter* (GRL – VU)

Site clearance activities, pollution and waste generation can have significant negative impacts to these species. However, review of the habitat along the alignment indicates it is not optimum for existence of the Caucasian squirrel. Therefore construction and subsequent presence (operation) of the highway is not anticipated to change the population trend.

Mitigation and Management Measures

General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management□Plan. If any of these trees are identified the contractor will be required to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

Cutting of Trees on Private Land - Compensation shall be paid to all affected tree owners as per the Project LARP.

Cutting of Trees in State Forest Fund Land – An inventory of the species to be de-listed has been prepared as part of this EIA and is provided in full as part of **Appendix F**.

A total of 9,709 trees over 8cm in diameter have been identified in State Forest Fund areas. Of these, 657 are Georgian Red-listed species greater than 8cm in diameter. The trees cut in these areas will need to follow the procedures for de-listing, cutting and removal as described below.

The RD is responsible for supplying the inventory of the species to be de-listed to the National Forest Agency in writing in order to complete the de-listing process. The RD shall also apply to the MoEPA in writing regarding the identified Red-List species in the project area so that they may also be de-listed from the SFF.

Compensation payments for the tree cutting in SFF areas will be paid to the Government as follows:

1. User (RD) shall pay onetime payment for the use of forest land during implementation of land activities. The payment shall be paid according to Table 2

- of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use taking into account the area of used land.
2. User (RD) shall pay compensation for cutting the trees according to the Table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
 3. In case of cutting the red list trees the user (RD) shall pay compensation four times as great than the amount shown in the table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
 4. The payment shall be made before beginning of forest usage.

The National Forest Agency provides free service for special marking and issuing timber origin certificate for transportation of timber resources. The timber resources obtained as a result of cutting of the trees from the SFF, shall be sorted out according to species by the Contractor and collected at the area indicated by National Forest Agency and transferred to the National Forest Agency by the Contractor to a specified state property land plot.

Habitat – No compensation in the form of re-planting, or habitat restoration is required under the SFF resolution unless specified by the MoEPA in the Conclusion of Ecological Expertise. However, given the extent of vegetation clearance associated with the Project and the impact on habitat it is recommended that a program of tree re-planting undertaken in addition to the SFF monetary compensation measures.

As noted above, 9,709 trees over 8cm in diameter will be de-listed and felled in SFF areas. Tree replanting on a basis of 1:3 should be undertaken, meaning that 30,000 seedlings will be replanted as part of the Project. The Contractor will coordinate with MoEPA and the National Forest Agency to identify a site, or sites, within the Project area where the trees can be re-planted (including the spoil disposal site in Boriti). Where practical trees should be replanted as close to their original location as possible as a 'restoration' measure. The Contractor shall also coordinate with MoEPA and the National Forest Agency to determine the composition of species to be replanted and to ensure they include the Georgian Red-list species identified in the SFF inventory.

The Contractor shall include this information as part of his Clearance, Re-vegetation and Restoration Management Plan. The plan shall clearly identify the approved locations for tree-replanting and restoration, the species and numbers to re-plant and the schedule for re-planting and maintenance. The plan will be submitted to MoEPA and the National Forest Agency for comment before submission to the Engineer for approval.

Plant maintenance will be carried out for at least two years in the plantation areas. The Contractor will be responsible for the maintenance of these areas. If the maintenance period extends after the completion of the Contractors contract period the RD will be responsible for contracting an operator to maintain the trees for the remaining period. During the Construction phase the Engineer will undertake monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% the Contractor will re-plant on a 1:1 basis to compensate for losses. The Contractor will be responsible for paying for any compensational re-planting.

IUCN / GRL Species - Mitigation Measures are proposed in Table 86 below.

Table 86: IUCN / GRL Species Mitigation Measures

Species	Mitigation
<p>Lutra lutra Linnaeus – Eurasian Otter</p>	<p>Prior to the start of construction in river beds, or close to river embankments (within 10 meters), the Contractor shall undertake a site survey (using a local ecologist) to ensure that there are no otter holts in these areas. If holts are found in these areas the Contractor will prepare a method statement for the management of these areas which will be sent to the Engineer for review and approval. The method statement should included at least the following measures:</p> <ul style="list-style-type: none"> • Marking the areas where otters are registered. • Implementation of works so to retains otter habitats in the water body and bank where feasible. • Constructing artificial holts to replace those that will be damaged or removed. • Implementation of works at daylight to allow a separation of human activity from the main peaks of otter activity (dawn/dusk). • Implementation of pollution prevention measures (soil and water) such as - arrangement of temporary surface water run-off control system consisting of settling ponds and drainage ditches, as well as other measures for soil, water, vegetation/flora and fauna impact mitigation listed in the EIA. • Avoiding significant change in lighting. This can be achieved by retaining the bank-side vegetation. In case necessary, additional planting along the bank-top to provide further screening to reduce light impact. Note: This will also work during operation. In addition to planting, to reduce impact during operation of the road location of the poles on design and construction stage should be selected so to be at a distance from the riverbed. • Arranging barriers in the sensitive areas to avoid accidental road kills (using otter-proof fences to stop otters getting into development sites) Note: The otter fence shall consist of a post, mesh and wire and ply board. The posts shall be ≥ 1.5m high, spaced at 2m intervals. Netting shall be mounted onto the supporting wire (welded wire mesh (2.0mm wire)) – gauge 50x50mm and 2000mm wide. The mesh shall be buried to 300mm and at top turned out at 45 degrees to the outrigger line. This mesh will thus be resistant to animal activity from the river side. On the upper slope side of the fence 10mm ply boards (1500 wide) shall be nailed to the support posts to provide damage protection and screening. • Tool-box briefings to contractors prior to those works commencing. • If live otters are encountered contractor is to cease work and contact the ecologist who will then liaise with the appropriate regulatory officers to discuss the encounter and how best to proceed from that point. • Mitigation relating to noise, air quality and water pollution are addressed under their specific headings within this section of the report.
<p>Sciurus anomalus Gmelin – Caucasian Squirrel</p>	<p>Although squirrels are not anticipated to be found in the Project area, as a precaution measure the construction contractor must be aware of the need to follow requirements listed below:</p> <ul style="list-style-type: none"> • Checking all mature trees scheduled removal and other potential nest areas for the presence of dreys . (Survey must be done shortly before operations to locate active dreys). • Before commencing of works, obtaining evidence that the drey (if any) is no longer in use. • Felling and removal of trees in a manner that minimises the likelihood of killing adult squirrels.

	<ul style="list-style-type: none"> • Implementation of works in the period when likelihood of encountering dependent young is the least. • Max preservation of vegetation - keeping to the boundaries of the RoW and worksites; fencing of sensitive areas bordering the RoW to reduce the risk of impact and land take required for vehicular movements and construction works. • Adoption of best practices to avoid light pollution, emissions/dust, ensure compliance with good waste management practices. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • As mentioned above, presence of squirrel in the project impact zone has not been observed. Given that the forest zones are mainly bypassed by means of the tunnels and that a part of the road coincides with existing road sections, the new infrastructure will not cause fragmentation.
Testudo graeca Linnaeus - Mediterranean turtle	If turtles are found within the work site, individuals must be removed to a safe distance (not less than 50m) from the works area. Eggs/hatchlings must be placed in a box (Note: sand substrata in the box must be provided) and moved to suitable nearby habitat where a nest will be created.
Emys orbicularis - European Pond Turtle	

Other Fauna - Table 87 below provides mitigation measures for other species

Table 87: Other Species Mitigation Measures

Species	Mitigation
Fish	<ul style="list-style-type: none"> • Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat. • Use of sites designated for dumping will also prevent contamination of the aquatic food chain. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project. • The Contractor shall consult with the MoEPA to determine when works in rivers should be suspended in order to limit impacts to fish spawning periods. In addition, mitigation measures outlined in Section G.5.5 – Hydrology, will reduce the potential for impacts in surface waters.
Reptiles & Amphibians (herpetofauna)	<ul style="list-style-type: none"> • Re-plantation will result in some habitat restoration. Reptile and amphibian species that will re-locate may return once planted vegetation is established. • Any herpetofauna species observed during construction activities should be re-located with assistance from a biodiversity expert to ensure proper handling. • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife.

	<ul style="list-style-type: none"> • Use of sites designated for dumping will also result in prevention of contamination of the food chain. • Noise pollution should be minimized to reduce the disturbance to herpetofauna species as far as possible. • Dust pollution should be minimized to reduce disturbance to herpetofauna species as far as possible. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project.
Birds	<ul style="list-style-type: none"> • Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna in and around the Study Area • Noise pollution should be minimized to reduce the disturbance to birds as far as possible • Dust pollution should be minimized to reduce disturbance to birds as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

In addition to the above species specific measures, the following shall apply:

- Site Surveys – Prior to the clearing of vegetation at any site (and prior to works in existing tunnels and at bridge sites) the Contractor will undertake site surveys of the area to be cleared using national biodiversity specialists. Depending upon the results of the surveys the following shall apply:
 - Re-location of any specimens found during the surveys will be provided with the help of biodiversity experts to ensure proper handling. This is especially important for species of conservation importance. The practice will provide the best possible chance of survival for wildlife. The Biodiversity experts shall devise effective relocation plans, taking species-specific factors into consideration, to maximize the chances of success. □
 - If herpetofauna species are observed in the Project area during the surveys, they should be removed to other suitable habitat, with the help of biodiversity experts to ensure proper handling. Herpetofauna species are most at risk because of their limited ability to re-locate. These species are at higher risk because of their limited ranges.
 - If bird nests are observed during the site surveys (and also during construction), they should be carefully removed and placed in suitable habitat, with the help of biodiversity experts to ensure proper handling. An expert can help identify the species the nests belong to. If it is a species of conservation importance, special care should be taken. This will reduce the risk of mortality faced by them as a result of Project-related activities. □
 - If roosting sites for bat species are identified, first priority needs to be given to protecting the roosting sites. Since the majority of roosts are used only on seasonal basis, the most common/effective method of avoiding the impact is planning of works for less sensitive period of time. Optimum time for implementation of works in the area where hibernation roosts are found is May-October. However, in the absence of this option, biodiversity experts should be consulted and if required the bats should be re-located with the help of experts to ensure proper handling and development of a

plan for relocation that maximizes chances of its success. Research into relocation of bats is limited with documented success of relocations even more so. It is recommended that the following characteristics be taken into consideration for the species being relocated, to both assess feasibility and develop an effective relocation protocol:

- Dispersal from the release site.
- Size of the founder group.
- Habitat quality at the release site.
- Disease transmission.
- Anthropogenic effects on the founder population.
- Post-release monitoring.

Bat boxes can be considered as mitigation measure. However, it should be taken into account preferences – for instance Lesser horseshoe bat can not use bat boxes whereas Common pipistrelle can use tree crevice-type box with 25-35 crevices and or tree hollow-type box (note: the latter type is rarely used as maternity roost).

- Bridges should be designed with dry paths under the bridge on either side of the streams to facilitate movements of livestock and wildlife, the latter primarily at night when people are not around.
- Poaching of wildlife shall be strictly prohibited.
- The Contractor will be responsible for providing training sessions to his workers relating to environmental protection (including the ban on poaching).
- Ensure that lower wattage lamps are used in street-lights which direct light downwards to reduce glare.
- Waste should be disposed without dumping on vegetation or allowing it to contaminate waterways. This will prevent contamination of habitat and the spread of pollution through the food chain. □
- Noise and dust pollution should be managed using the specific noise and air quality mitigation measures outlined in this EIA.

Operational Phase

During the operational phase of the Project, the RD shall:

- Register and analyze road kills. Develop additional mitigation measures if found to be necessary.
- During maintenance works strictly comply with wildlife/vegetation impact mitigation measures set for construction stage.
- Prohibit poaching (ensure that tunnel operator staff is aware of the ban).

Residual Impacts – *If the mitigation measures suggested are implemented, there will be no significant residual impacts.*

G.6.2 Forests and Protected areas

Potential Impacts

No protected areas or forest reserves are located within the Project area, or within the vicinity of section F3. No induced impacts are anticipated.

Management & Mitigation Actions

Despite the fact no protected areas or forest reserves are located within the vicinity of the Project road and it is unlikely that haul routes would traverse such areas, it is

still considered prudent to include a condition within this EIA that no construction activities, including camps, haul routes, etc will be allowed within, or through protected areas, or reserves.

Residual Impacts – None anticipated

G.7 Economic Development

G.7.1 Transportation Facilities & Utilities

Potential Impacts

Transportation Facilities

Construction Phase

Two of the main impacts resulting from Project works will be short term road diversions and some temporary blocking of access to properties during the construction phase.

In some locations closure of access roads will be needed and may occur for periods between one and two hours and as such is not a significant issue as long as the local population are given notice of the delays and suitable detours are provided. Longer-term road closures maybe required while the new road is constructed across existing roads. This issue is discussed above under section **B.13 – Temporary Roads**.

Blocking of access to properties will be temporary while structures, such as side drains and culverts, are constructed, however alternative access to properties will be provided at all times by the Contractor.

The new alignment also crosses above and adjacent to the existing railway line KM 12.0. The bridge works above the railway line (BRI 3.1.11-AT/TA) may cause specific issues due to its close proximity to railway. Specific attention needs to be paid by construction workers in this area to ensure that they are not involved with an accident on the line. In addition, the Contractor needs to take care to ensure that any construction equipment interferes with passing trains. Special care will also need to be undertaken when excavating the tunnel portal in this area to avoid rock falling on the tracks. Vibration from bridge piling may also affect the railways tracks.

Operational Phase

The road has been designed in a way so that it has relatively little impact upon the existing road, or other local roads due to the fact that it is a new alignment often passing through tunnels and over bridges. Where the new alignment does interfere with the existing road, new local roads have been designed (see Figure 98 to Figure 101) along with several interchanges to ensure that access to the existing road remains open.

Notwithstanding the above, the potential beneficial impacts to transport are significant. The road, when complete, will offer reduced travel times to major urban areas, smoother ride (resulting in less vehicle maintenance and less damage to perishable goods) and safer driving conditions. In addition, the traffic volumes on the existing road will reduce significantly resulting in less accidents on the existing road.

Utilities

Medium and low voltage power lines, water supply and gas pipes are located within the Project corridor. It is possible that these utilities will need to be temporarily removed during construction.

Mitigation and Management Actions

Transportation

Pre-construction Phase

To mitigate the potential impacts the Contractor will:

- Submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP. The TMP shall include plans of haul routes and access roads used for construction traffic which will be strictly adhered to with oversight from the Engineer;
- As part of his TMP, the Contractor shall provide haul routes to spoil disposal sites which, as far as is practical, avoid populated areas.

The volume of construction traffic is considered to be intensive truck traffic and will need to be managed both in terms of surface damage. A road condition survey of all roads included in the Contractors TMP will be conducted by the Engineer prior to construction in order to gauge any damage to the road as a result of the intensive heavy traffic during the construction phase. Before completion of the Project the Engineer shall repeat the survey to determine which, if any roads need to be repaired by the Contractor.

Construction Phase

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;
- Allow for adequate traffic flow around construction areas via diversions or temporary access roads;
- If temporary access roads are to be constructed with a gravel surface they shall be routinely watered by the Contractor during dry weather to reduce dust impacts; and
- Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control.
- Access roads for batching plants, etc, should be maintained during the construction phase and rehabilitated at the end of construction.

To prevent potential environmental, health and safety issues arising whilst working in the area above the railway line at KM12.0, the Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in these areas. The statement shall address issues relating to:

- Restrictions relating to blasting;
- Excavation of the tunnel portal;
- Vibration impacts on tracks;
- Working above live tracks; and
- Coordination with GR.

Utilities

Construction Phase

During construction all gas supply and electricity networks in the Project area shall be kept operational, particularly during the winter months. Some lines and pipes may require temporary relocation during the construction phase and as such the Contractor will be responsible for liaising with the relevant utilities operators to ensure they remain operational. Should utilities need relocating in a different location the Contractor will consult with the relevant utilities and local community to ensure that there is no change in supply as a result of these changes.

Residual Impacts - *If the mitigation measures suggested are implemented, the residual impacts of the Project will be low. As noted above, the Project road has been designed in such a way that access to the existing road will be more or less maintained into the operational phase of the Project (with the exception of the start of the road which overlaps with the existing E-60) and where the new road crosses local roads new roads will be constructed.*

G.7.2 Land use

Potential Impacts

The Project road passes through a rural landscape for most of its extent and also through numerous tunnels. However, a number of private properties and land parcels will be impacted many of which are used for agricultural purposes.

Although the existing road will remain open for almost its entire extent and interchanges will be constructed to access the existing road from the new alignment, it is likely that a number of roadside market traders will be impacted by the reduced traffic levels on the existing road, including the pottery and ceramics traders around Shrosha.

Mitigation and Management Actions

Under EIB Guidelines the Employer must prepare the Land Acquisition and Resettlement Plan (the LARP). The Employer will implement the plan and acquire the land before the commencement of the construction works at any part of the site.

As part of the Project a new road side market area will be constructed. The market area, located between bridges BRI-3.0.07 AT/TA and BRI-3.0.08 AT/TA, is intended for any market stall holders along the existing alignment including the pottery and ceramics traders at Shrosha.

G.7.3 Waste Management

Potential Impacts

General Construction Waste - Road construction will inevitably generate solid and liquid waste products including:

- Inert waste – for example, concrete, metal, wood and plastics.
- Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, and bitumen.

In addition, uncontrolled discharges of sewage and 'grey water' (e.g. from washrooms and canteens) from construction sites and worker's camps may also cause odors and pollute local water resources. As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor.

The main construction waste produced will waste concrete (solid and sludge) and possible asphalt, depending upon how much can be re-used as sub-base material. Table 88 indicates the main types of waste and an estimate of volumes (based on similar road construction projects).

Table 88: Waste Types and Estimated Volumes

#	Waste Type	Hazardous	Estimated Volume
1	Concrete	No	200 m ³
2	Asphalt	No	Currently unknown
3	Bituminous Mixtures	Yes	1 t
4	Wood	No	10 t
5	Uncontaminated Metal	No	5 t
6	Uncontaminated Plastic	No	1 t
7	Contaminated metal (paint tins, etc.)	Yes	2 t
8	Contaminated plastic (oil containers)	Yes	3 t
9	Domestic waste (food stuffs)	No	5 t
10	Domestic Waste (non-foodstuff)	No	40 t
11	Sewage Water	Yes	150 m ³
12	Tyres	Yes	150 t
13	Hazardous liquid waste	Yes	20 m ³
14	Hazardous solid waste	Yes	10 t

It is noted that the waste management situation in Georgia is still developing, and that the waste management facilities in the Project area have been closed. Accordingly, the Contractor needs to ensure that waste materials are disposed of in a manner that does not cause pollution to the environmental or result in potential health impacts.

Tunnel and Other Spoil Material – A large volume of spoil material will be generated from the tunneling works. Estimates provided by the Detailed Design Consultant indicate that the following amounts of spoil material will be generated:

- Tunnels - 1,510,000 m³
- Tunnel Portals – 278,000 m³
- Local Roads / interchanges / bridges - 400,000 m³
- Cut in side slopes - 1,247,000 m³

Where practical the spoil will be re-used as embankment material at the Project site. Estimates indicate that approximately 516,000 m³ can be re-used as embankment material, which would leave approximately 2,919,000 m³ as static balance.

Mitigation and Management Actions

To ensure waste management is adequately controlled during both the construction and operational phase of the Project, the Contractor shall be responsible for ensuring that the waste hierarchy is followed including prevention, minimization, reuse and recycling. Specifically the Contractor will be responsible for the following measures:

1. Waste Management Plan (WMP) – The WMP shall include items relating to the safe handling and management of:

- Domestic waste
- Food waste
- Recycled Waste
- Plastic
- Metals
- Wood
- Construction Waste
- Hazardous Waste
- Liquid Waste

2. Recycling and Reuse – Where possible, surplus materials will be reused or recycled – this should include asphalt, concrete, wood, plastic, metal and glass. A plan for the recycling of materials should be included in the WMP. As noted above, around 338,000 m³ of spoil material will be re-used for embankments thereby eliminating the requirement for the use of borrow pits and quarries under the Project.

3. Storage of Hazardous Wastes – Oils, fuels and chemicals are substances which are hazardous to human health. They need to be stored properly in correctly labeled containers, both within the construction camp and also at construction areas. Oil and fuel should be stored in tanks with lined bunds to contain spillage (the bund should be able to contain at least 110% of the volume of the largest storage tank within the bund).

4. Waste Disposal – Waste, both hazardous and non-hazardous, shall be collected and disposed of by a licensed waste management contractor. The Contractor will keep copies of the waste management company's licenses on file at his site office. The Contractor shall also keep a record of the waste volumes and types removed from the site and the waste transfer notes provided by the waste management contractor. Licensed hazardous waste management contractors in Georgia include:

- “Mersi” Ltd. (Environmental Impact Permit No. 00054, date of issue: 7.11.2006). The company receives hydrocarbons by pyrolyzing the used tires and other rubber waste.
- “Frontera East Georgia” Ltd. (Environmental Impact Permit No. 00040, date of issue: 5.9.2006). The company cleans the soils polluted with oil or oil slug and disposes the inert material waste and various chemicals in safe conditions. □
- “Nasadgomari” Ltd. (Environmental Impact Permit No. 00059, date of issue: 1.24.2007). The company owns the bio-remediation grounds, where the soils polluted with oil hydrocarbons are delivered and processed with special technology. The process envisages processing the polluted ground with mineral fertilizers and (artificial) introduction of microorganisms in the soils. □
- “Sanitary” Ltd. (Environmental Impact Permit No. 00136, date of issue: 11.17.2008). The company has a permit for temporal storage of hazardous waste. The types of waste for temporal storage are: used technical oils, oil paraffin, solid waste polluted with oil (plastic, uniforms, rugs), used adsorbents, used batteries, used luminescence/fluorescent bulbs, used antifreeze and paint waste/boxes. It is planned to export hazardous waste to the European countries (Germany, Holland) for final disposal or destruction with certain intervals (once a year presumably). If it is possible (provided there are proper technologies) the waste can be handed down to the contractor with the relevant permit to treat or make it harmless. □

- “Big Been” Ltd. (Environmental Impact Permit No. 00134, date of issue: 2.13.2015). The company makes packaging materials by secondary processing of polyethylene and polypropylene waste. The plant receives the waste from different industrial objects under the relevant agreement. □
- “Sarini” Ltd. (Environmental Impact Permit No. 00102, date of issue: 08.1.2014). The company undertakes management/incineration of toxic and hazardous waste. □
- “Georgian International Energy Company” Ltd. (Environmental Impact Permit Number – Conclusion, date of issue: 9.13.2010). The company has a landfill cell for asbestos and glass-fiber construction materials.

Waste Spoil Material – A screening exercise has been undertaken to identify suitable disposal locations for the 2,919,000 m³ of spoil material (see **Section C**). A potential site has been identified close to Boriti, however, it is noted that the Contractor does have the choice to select other spoil locations.

In any case, this area will not have problems in terms of acquisition land and few problems in terms of impacts, as already said, so it is strongly recommended, mostly because of its dimensions which allow to envisage disposal of spoil material coming both from F3 and F2. For this reason the Contractor shall develop a preliminary design of the area, considering it divided in two different lots, with different accesses, each of one able to accept at least 2,5 million cubic meters and carry out an EIA procedure as shown below, getting the approval of MoEPA for the entire location. Once received approval he will develop the detailed design of his own lot, getting approval of the Engineer.

If the Contractor intends to use this site there are several actions he must follow:

1. The Georgian EIA regulation states that the spoil storage areas shall be agreed with the local municipality and MoEPA.
2. As soon as agreements are provided MoEPA will request an EIA for the Project.
3. The Contractor will prepare and submit an EIA to MoEPA for review and approval.
4. In addition to the EIA, the Contractor shall prepare a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan. This plan shall be prepared in accordance with regulation N 424 on Approval the Rules for Removal, Storage and Use of Topsoil and Re-cultivation.
5. The plan will indicate:
 - a. The location of disposal area (layout, coordinates, etc.).
 - b. Agreement with the landowner.
 - c. Category of the land.
 - d. Distance from the surface water source.
 - e. Provide information on route of spoil transportation and means of transport (including routes avoiding, where possible, sensitive receptors).
 - f. Schedule of the timing of material transport (excluding night-time transport on local roads (but not the existing E-60) between 10pm and 6am).
 - g. Any necessary improvements to local roads to cater for the increased level and types of trucks using the roads.
 - h. The scheme of dumping.
 - i. The maximum height of disposed soil and anti erosion measures.
 - j. Describe re-cultivation of disposal area.
 - k. Provide coordinates of the spoil area.
 - l. Provide profile drawings of the spoil area.

- m. Provide time stamped photographs of the pre-disposal site conditions.
6. The Plan will also be provided to the RD and the Engineer as part of his SEMP. No spoil storage will be allowed until the RD and the Engineer have approved the plan and all licenses and approvals have been received from MoEPA.

If the Contractor wished to use an alternative site he will be responsible for following the same procedures above. No spoil storage will be allowed until the RD and the Engineer have approved the plan and all necessary permits and approvals have been received from MoEPA.

6. Liquid Waste – The issue of liquid waste, including concrete sludge, camp run-off water, vehicle washing water, batching plant wastewater, etc., is discussed above under item **G.5.5 – Hydrology** and **G.7.4 Construction Camps**.

Operational Phase

The RD shall:

- Install waste collection bins in technical buildings area.
- Use garbage bins fitted with lids to avoid scattering around and attraction of scavengers.
- Segregate hazardous, non-hazardous and reusable waste streams.
- Manage and dispose hazardous waste according to the type and the class of hazard. Note: for hazardous waste removal licensed company must be contracted.
- Until removal (temporarily) waste must be stored within secure facilities with weatherproof flooring and roofing.
- Dispose garbage according to agreement with licensed waste management contractors.

Residual Impacts - If the mitigation measures suggested are implemented, the residual impacts of the Project will not be significant.
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G.7.4 Construction Camps & Batching Plants

Potential Impacts

Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities. Specific issues may arise as a result of the following:

Design and Siting - Improper siting and design of construction camps can have negative impacts to hydrology through inappropriate disposal of liquid waste and spills of hazardous liquids. Poor management of sanitary waste and accidental spills of hazardous liquids from construction camps can also have negative impacts on ground and surface water. Rock crushing plants and concrete batching plants can also have impacts on sensitive receptors located downwind of the sites if the plants are too close to the urban areas.

Concrete Batching Plants - Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. The main sources of wastewater

at batching plants are; contaminated storm water runoff, dust control sprinklers, the agitator washout station, the agitator charging station, the slumping station, and cleaning and washing areas. These substances can adversely affect the environment by:

- Increasing water pH.
- Increasing the turbidity of waterways (turbidity is a measure of the cloudiness of a suspension).

Asphalt Plants – Several impacts are associated with asphalt plants:

- Emissions – including dust from the transport and handling of aggregates and emissions from the combustion process in the dryer.
- Noise - Noise occurs at different places in the process for examples in the conveyor belts, dryer and mixer drum, internal and external traffic. The noise is estimated to be in the range of 90 to 100 dBA (Leq) at a few metres from the equipment.
- Storage of Bitumen – Drums of bitumen will be stored safely and securely to prevent accidents and pollution.
- Storage and Use of Hazardous Materials – Some materials used during asphalt production, such as Kraton, can be explosive or a fire hazard. These materials need to be stored and managed appropriately.
- Health and Safety - Asphalt Plants can be very dangerous, accidents may occur at any time. Hence it is important to have a proper policy for the Health and Safety Issues.
- Vehicle Movement – a large number of trucks will be required to transport the hot asphalt from the plant to the work site, this may be a distance of up to 25 kilometers.

Mitigation and Management Actions

Construction Camps – Prior to commencement of works, the contractor must identify the location of the camp, with approval from the Engineer, and then agree on/receive a permit for its use from the state or the land owner. No construction camp will be located within one kilometer of an urban area and at least 50 m from any surface water course.

The Contractor will be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, etc. The Contractor will ensure the following conditions are met within the Plan:

- Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors.
- There will be no direct discharge of sanitary or wash water to surface water.
- In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site wastewater treatment facilities. For sites servicing a small number of employees (less than 150), septic tanks may be used. For larger sites, liquid wastes will as a minimum receive primary treatment in anaerobic tank or pond preceded by a bar screen to remove large solid objects (e.g. sticks, rags). Primary treatment (also referred to as clarification, sedimentation or settling) is the process where wastewater is allowed to settle for a period (around 2 hours) in a settling tank. This leads to separation of a liquid effluent which includes oils and grease and a liquid-solid

sludge. Primary treatment leads to reduction in suspended solids, biological oxygen demand and removal of floating material (e.g. faeces). There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies.

- Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis.
- Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- Liquid material storage containment areas will not drain directly to surface water.
- Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly.
- Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area.
- Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities.
- Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- 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.
- Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
 - Fueling operations will occur only within containment areas.
 - All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
 - Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
 - All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
 - The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
 - Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
 - Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste.

If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. The Engineer will undertake regular monitoring of the construction camps to ensure compliance with the SEMP and the Construction Camp Site Plan.

The Contractor will be responsible to maintain and cleanup campsites and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period.

The Contractor will also ensure that potable water for construction camps and workers meets the necessary water quality standards of the GoG. If groundwater is to be used it will be tested weekly to ensure that the water quality meets the GoG drinking water standards specified in **Section D**.

Concrete Batching Plants – The following measures will be followed to limit the potential for pollution from batching plants:

- To limit impacts from dust, the following conditions will apply:
 - Batching plants will be located downwind of urban areas and not within one kilometer of any urban area.
 - The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.
 - Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker.
 - Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile.
 - The hopper or bunker will be fitted with water sprays, which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition.
 - Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed.
 - Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.
 - Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed.
 - Conveyor belts will be fitted with belt cleaners on the return side of the belt.
 - Weigh hoppers at front-end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile.
 - Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight.
 - Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.
 - Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector.
 - Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere.

- An inspection of all dust control components will be performed routinely – for example, at least weekly.
- All contaminated storm water and process wastewater will be collected and retained on site.
- All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues.
- Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications:
 - The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain.
 - Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling.
 - An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).
 - Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.
 - Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.
 - Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity. This will restore the system's storage capacity, ready to deal with wastewater generated by the next rainfall event. Uses for recycling tank water include concrete batching, spraying over stockpiles for dust control and washing out agitators.

Asphalt Plants – the following measures will be applied by the Contractor:

- Emissions & Noise:
 - Asphalt plants will be located downwind of urban areas and not within one kilometer of any urban area.
 - Adequate Personal Protective Equipment (PPE) will be provided to staff working in areas of high noise and emissions.
- Storage and Use of Hazardous Materials (including bitumen):
 - Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS).
 - Copies of MSDS will be kept on site with all hazardous materials.
 - The Contractor will keep a log of the type and volume of all hazardous wastes on site.
 - The Contractor will keep a plan of site indicating where all hazardous materials are stored.
- Vehicle Movement:
 - The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant.
- Health and Safety:
 - To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full-body protection.
 - All transportation, handling and storage of bitumen will be handled safely by experienced personnel.

- The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates.
- Ear-muffs will be provided those working on the plant.
- First Aid kit will be available on site for the workers in case of emergency.
- The MSDS for each chemical product will be made accessible onsite and displayed.

Temporary Storage Areas – The Contractor will be responsible for preparing a method statement for the opening, operation and reinstatement of any temporary storage area he uses. The method statement shall be prepared and submitted to the Engineer for approval before any such site can be used. Many of these sites will be located close to rivers, and as such the Contractor will ensure that the method statements include specific measures to ensure no pollution of the rivers, including banning of the storage of hazardous liquids in these areas. The method statement shall also clearing illustrate the conditions of the site prior to its clearing and use, so that it can be fully re-instated to its former conditions. The method statement shall also indicate what type of vegetation has been cleared at the site, and where this has occurred, the Contractor shall be responsible for replanting of any trees cut in these areas on a 1:3 basis.

Residual Impacts - *If the mitigation measures suggested are implemented, the residual impacts of the Project will not be significant as long as reinstatement plans are followed correctly.*

G.7.6 Tunnels

Potential Impacts

The main typical environmental problems linked to the construction of underground works are listed below:

- Triggering of surface settlements, structures collapses and slope instabilities
- Drying up of springs and groundwater alterations
- Storage and use of excavated materials (Addressed in **Section G.7.3 – Waste Management** above).
- Noise & vibration (Addressed in **Section G.8.6 – Noise and Vibration** below).
- Pollution of groundwater, mainly after the realization of stabilization works by injections.

Surface Settlements & Slope Instabilities - The opening of underground works can lead to a deformation of the soils and rocks around the excavation area in some instances. Such deformations may trigger sudden collapses, subsidence and sinking that can damage both the work under construction and pre-existing nearby structures. The extent of settlements depends on the following elements:

- Excavation technique.
- Dimension and geometry of the excavation.
- Type of excavated material.

Analysis undertaken by the Design Consultants have indicated that settlement of less than 5mm will occur above the tunnels in the F3 section. The analysis indicates that settlement will not impact upon structures above these tunnels and structural damage is not to be expected unless some unforeseen situation occurs or unless the Contractor doesn't work properly. It is however possible that cosmetic damage could occur such as small cracks in plaster in wall joints.

Dewatering - A key aspect of dewatering systems for tunnel and shaft construction is that they will generate water from pumped wells or from sumps and drains within the tunnel. Some of this water, particularly from sumps, will be 'dirty water' and will require some form of treatment (most commonly to remove suspended solids) before it can be disposed of. Some of the water may be 'clean water' (particularly from dewatering wells or tunnel drains) that may require little or no treatment.

Drying up of Springs and Groundwater – Tunnels located below the water table can seep into excavations that are below the water table, which can result in groundwater drawdown around the structures during construction and operation. This in turn may impact upon water levels in wells and natural springs (or artesian wells). Drawdown can also potentially impact the flow of rivers, although in the case of the Dzirula and Rikotula rivers this is not likely to be significant due to their high discharge rates. These phenomena can persist even after the tunnel construction if the final alignment is not completely waterproof.

Site visits were undertaken in the Project area by the LCF to determine what the status of ground water use was in the local community. The results of the site visits indicated that few groundwater wells are located in the Project area and that most water is supplied to homes and businesses through a piped system which transfers groundwater from several kilometers away further up in the mountains. Accordingly, it appears that tunnel construction is unlikely to have any significant impacts on the local community in terms of groundwater depletion.

Mitigation and Management Actions

Drying up of Springs and Groundwater – Although site visits have indicated that there are few wells in the Project area and that most of the community receive water from a piped network it is still considered prudent to monitor the status of groundwater drawdown during the construction phase.

The Contractor will be responsible for the development of a ground water management plan for each tunnel which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works. The plan shall include a map of all ground water wells within the Project area that maybe affected by each tunnel.

The Plan shall include routine monitoring of the groundwater levels in wells against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the construction works are finished. The Contractor shall continue to monitor the water levels in the affected wells for a period of 12 months after construction is completed at the tunnel sites. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties, this may include for example, increasing the depth of their wells, or piped water from another location, which, as noted above, appears to be a fairly effective option.

Dewatering – The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be

undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase.

Residual Impacts - *If the mitigation measures suggested are implemented, the majority of residual impacts of the Project will not be significant.*

It is possible that the construction of tunnels could deplete groundwater and affect groundwater users. If this is the case affected villagers will be supplied with an alternative source of potable water if this occurs.

G.8 Social and Cultural Aspects

G.8.1 Employment Creation, Skills Enhancement and Local Business Opportunities

Potential Impacts

The Project is expected to generate positive impacts on the local economy and livelihoods in terms of employment and skills enhancement and local business opportunities through the procurement of goods and services.

Positive impacts will be primarily associated with the construction phase and therefore temporary in nature. The termination of construction contracts will occur once construction activities are completed. Workers who have relocated to the area for the Project are likely to leave the area in search of other opportunities, especially if they are permanent employees of Contractors and subcontractors.

Those who have worked on the Project will have an advantage when seeking alternative jobs on similar projects due to the experience and any training received through this Project.

The construction phase will last approximately 24 months and it is expected that approximately 400 direct employment opportunities will be available during the peak of construction. The breakdown of skills required during the construction phase will be as follows:

- Skilled labour: 58%;
- Semi-skilled labour: 20%; and
- Unskilled labour: 22%.

Local procurement is going to benefit the hospitality and service industries primarily, such as accommodation, catering, cleaning, transport and security services. Local businesses will benefit during the construction phase as there will be increased spending within the area by the wage labor who will have improved buying power while employed by the Project.

According to the Project social survey, it is envisaged that in the long term, the Project will bring more opportunities into the whole area. First of all to the agricultural traditional sector whose products will easily reach the main market places like Tbilisi and Kutaisi, Batumi and Poti. It is also expected a seasonal adjustment of the tourism period stretching and increasing the presence of visitors all along the year encouraging moreover the week end holidays visits. This in turn could possibly curb the emigration toward the main town and cities through the creation of stable and

well remunerated jobs. It can also be said that the realization of the Project complies with the integrated geo-tourism development approach outlined in the Strategic Environmental Cultural Heritage and Social Assessment contained in the ITDS (Imereti Tourist Development Project – funded by the World Bank) comprising multi-sectoral interventions, managed vertical investments, coordinated elaboration of tourist circuits and destination sites, targeted support to cost efficient and environment-friendly tourist packages, and protection of local communities and cultural heritage through promotion of responsible tourism.

Notwithstanding the above, during the operational phase of the Project diversion of traffic from the existing road to the new alignment may affect some roadside business in the Project areas including small roadside shops and restaurants, including the market area in Shorsha. The level of trade with road users will fall, but they will still be able to provide their services to the local community.

Mitigation and Management Actions

As part of the Project a new road side market area will be constructed. The new market area, located between bridges BRI-3.0.07 AT/TA and BRI-3.0.08 AT/TA, has been created for market stall holders along the existing alignment to relocate to this area, including the pottery and ceramics traders at Shrosha.

In addition, access to the existing road will be provided by two interchanges in section F3 allowing road users to visit restaurants along the old alignment which is unaffected by the new alignment.

G.8.2 Community Health and Safety

Potential Impacts

The presence of the Project could affect the health, safety and security of the communities in the area of influence as a result of worker-community interactions, immigration to the area, increased incomes in the local community that may be used for drugs, alcohol and prostitution, the risk of injury associated with construction and operational activities, increased pressure on health care resources and changes to the environment.

Construction Phase Impacts

Potential impacts due to the proposed construction can be identified as follows:

- Workforce, Jobseekers and Social Conflict. In some instances the local population may not be able to provide the necessary skilled workers for the Project. In such cases workers from other regions, or other countries may be employed by the Contractor. This could lead to social tensions and potential conflict if these workers are not aware of local customs and practices. An increase in disposable income within the Project area (among Project workers, both local and external) may also result in a change in spending habits and behavior resulting in increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations, which poses a threat to community health and safety.
- Pressure on Social Infrastructure and Services. During the construction phase workers will be accommodated on-site and as such there will be no pressure on local housing stock. In addition, the Contractor will also have his own on-site medical facilities. Any serious injuries will be treated in Zestaphoni.

- Road Safety. Construction of the Project Road will require a large amount of vehicle movements, locally and regionally. These may result in an increase in the total number of road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles. This is especially relevant around the first intersection close to Boriti public school.
- Air quality and noise. Potential air and noise issues and their impacts to the local population are discussed above under items **G.5.1 – Air Quality**, **Item G.7.4 – Construction Camps and Batching Plants** and **Item G.8.6 – Noise**.
- Blasting - Depending in the rock type and explosive strength, rocks can go up to 50 m and can potentially damage structures. For the above reason, surface blasting or blasting near the mouth of the tunnel is not recommended.
- Access – Construction activities have the potential to temporarily disrupt access to home, businesses and access roads.

Operational Phase Impacts

Road Safety. The road has been designed in such a way that locals will not need to cross the new alignment on foot, as they do with the existing road. Access will be maintained to the existing road and people will be able to pass beneath bridges or above tunnels. Accidents involving collisions between pedestrians and vehicles are therefore likely to be rare. The geometry of the new road, improved drainage and two-lanes will also provide safer driving conditions for road users, although as traffic volumes increase the total number of vehicle accidents may increase, especially as average speeds are likely to increase.

The intersection at the start of the Project road is located adjacent to Boriti public school. Once the Project road becomes operational less traffic will pass outside of the school entrance which will have positive road safety impacts.

Air Quality & Noise – These issues, including the impacts to Boriti public school, are discussed in detail under items **G.5.1 – Air Quality** and **Item G.8.6 – Noise**.

Access – The Project road has been designed specifically with the issue of access in mind. The design team have taken special consideration of this issue and where practical have avoided the existing alignment and other local roads. Two intersections have been included in the design which link directly to the existing road meaning that locals can continue to use the existing road to access their homes and businesses. Tourists can also easily exist the new road via the interchanges to access areas such as St Georges Monastery or the market at Shrosha.

However, several local roads will need to be replaced with alternative access routes. These routes are still being precisely defined, but Figure 98 to Figure 101 provides an indication of these areas and the route of the new local roads (the thick black line indicates the location of the new access roads).

Figure 98: New Access Roads (KM0.7)

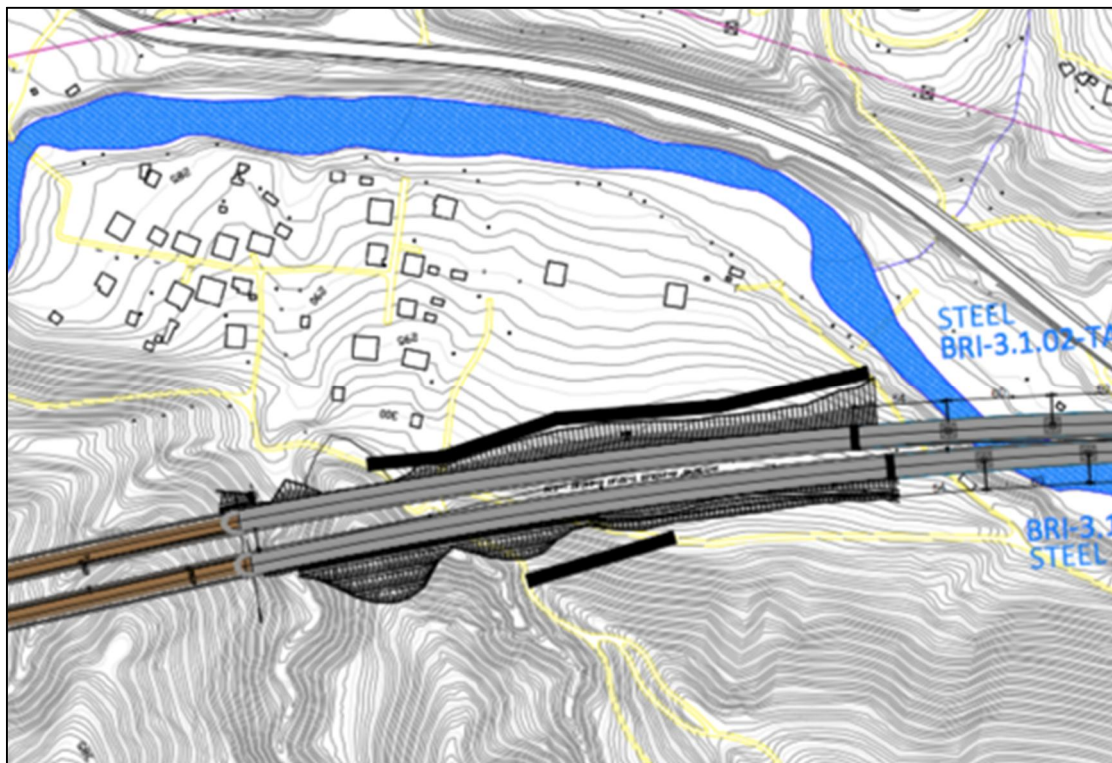


Figure 99: New Access Roads (KM2.6)

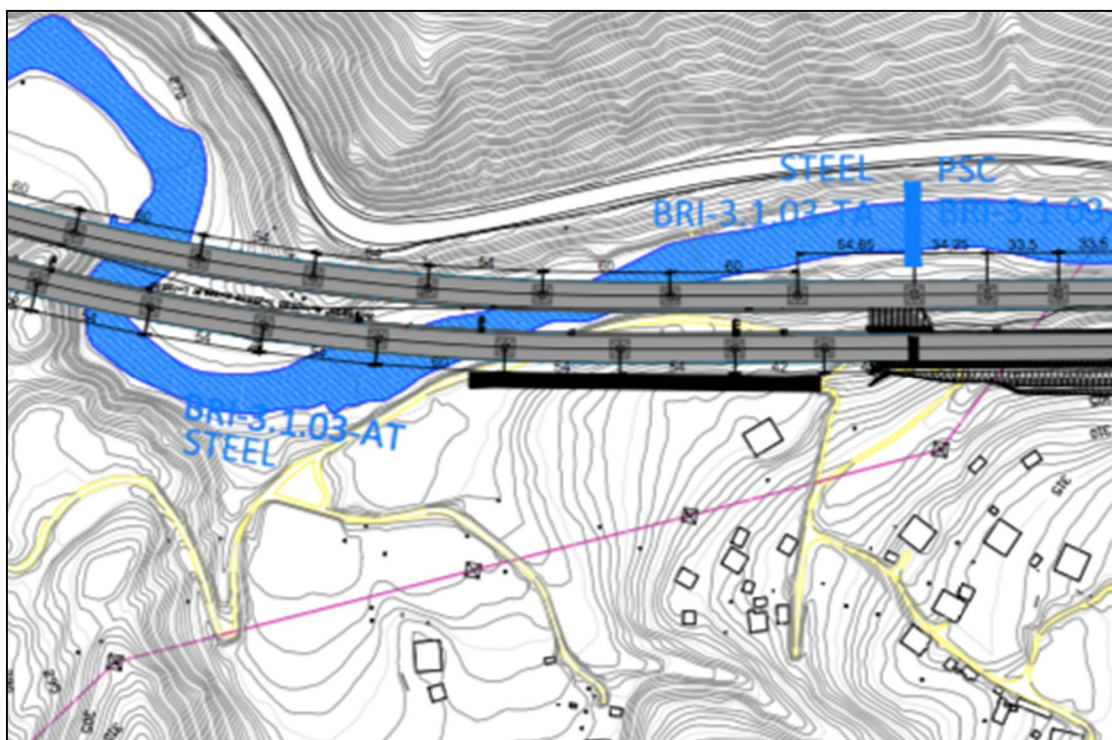


Figure 100: New Access Roads (KM5.1)

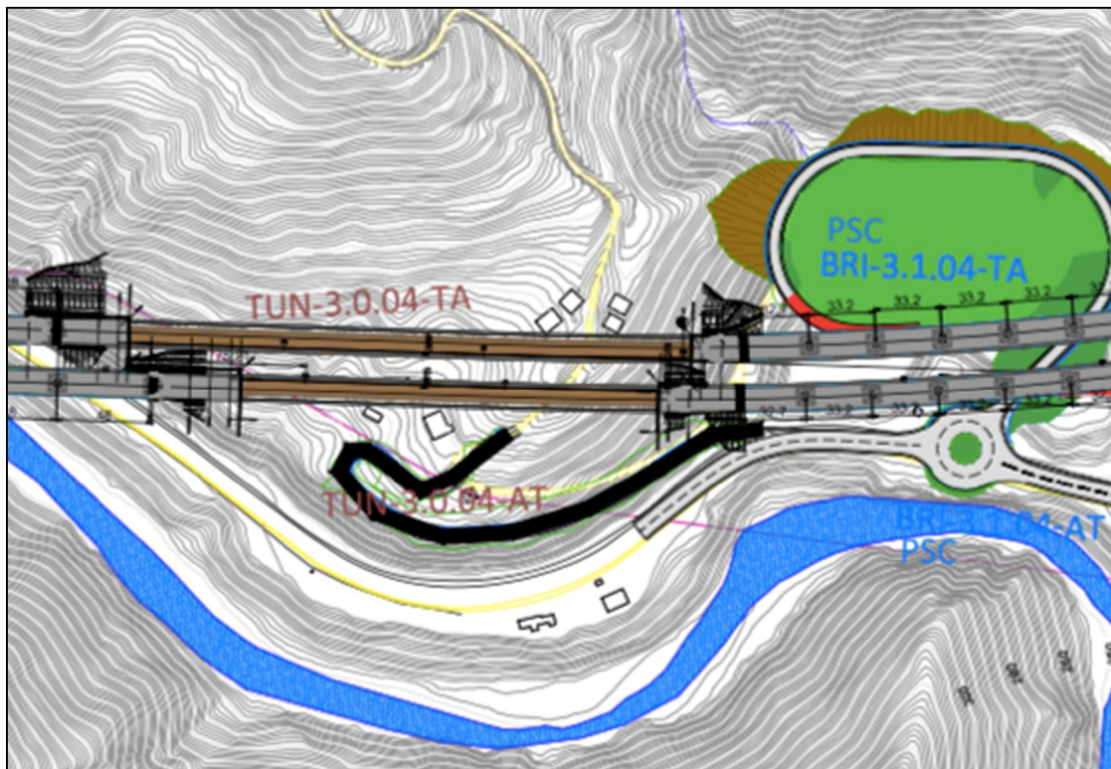
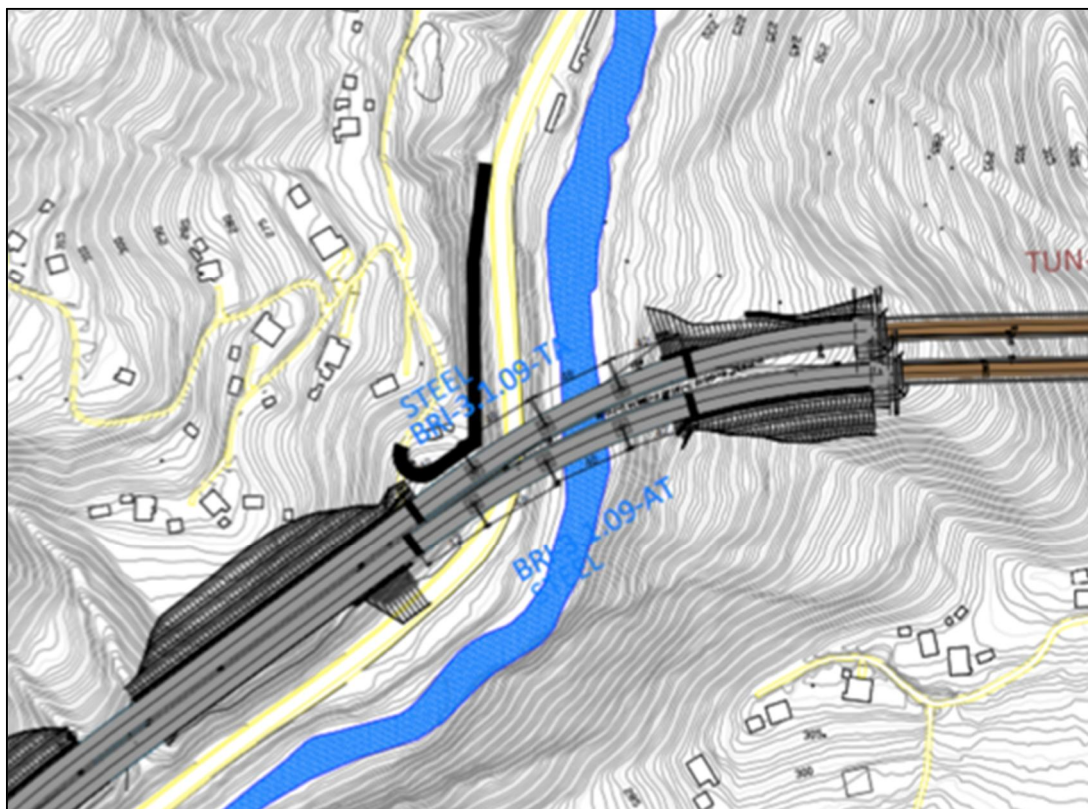


Figure 101: New Access Roads (KM8.7)



Mitigation and Management Actions

Pre-construction Phase

Prior to start of site works residents, business representatives in the project area, local authorities and other stakeholders, including NGOs, who are likely to be affected by the project or are interested in the project) shall be informed on the construction schedule and activities, potential environmental impacts and mitigation measures through public meetings at each affected community.

Construction Phase Mitigation

Mitigation measures to limit community health and safety impacts include:

Road Safety – The Contractor will be responsible for preparing a traffic management plan (TMP) for the construction phase of the Project. The TMP will include specific conditions for traffic management in Boriti and the first interchange. Special attention should be given in the TMP to Boriti public school, including speed restrictions for construction traffic outside the school (50 kph). In addition, School Safety Sessions will be completed by the Contractors Health and Safety (H&S) team and community liaison on 6-month basis throughout construction and an initial session prior to start of works to provide road safety awareness to children. During these sessions the school children shall also be provided with reflective badges to fit to clothing or school bags. Lastly, contraction traffic will not be allowed to park within 100 meters of the entrance of the schools.

Blasting - The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it.

Social Conflicts. The Contractor shall provide regular health and safety training to their workers which will include sessions on social and cultural awareness. The Contractor will also sub-contract an organization to develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behavior change issues around the transmission and infection of HIV/AIDS. In addition, the Contractor shall develop an induction program, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:

- Respect for local residents and customs;
- Zero tolerance of bribery or corruption;
- Zero tolerance of illegal activities by construction personnel including:
 - unlicensed prostitution;
 - illegal sale or purchase of alcohol;
 - sale, purchase or consumption of drugs; and
 - illegal gambling or fighting.
- No alcohol and drugs policy during working time or at times that will affect ability to work; and
- Description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal.

- Project security guards shall not to violate the safety of local residents or other individuals involved in the project.

In addition, the Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period. The monthly meetings will be held in the villages along the alignment and will provide a forum for locals to discuss specific issues, such as noise and dust, with the Contractor before making complaints formal through the Grievance Redress Mechanism. The minutes of meetings shall be recorded and a list of participants prepared (including signatures). Photos of each event shall be taken (with timestamps). The Contractor shall prepare a short monthly summary of the meetings including all of the above information and submit it for review to the Engineer and RD within a week of the meeting.

Residual Impacts – *The main residual risks associated with the Project on the local community relate to noise which are discussed below. From the perspective of the schools, they should benefit from decreased traffic volumes on the existing road which will lead to increased road safety in the areas outside of the school.*

G.8.3 Workers' Rights & Occupational Health and Safety

Occupational Health and Safety - Accidents are common during a project of this size and scale. Accidents can occur if workers are not adequately trained or qualified for the job or if they have incorrect safety equipment and clothing.

Sexually Transmitted Diseases – See **Section G.8.2** above for impacts and mitigation relating to STDs.

Worker Rights - Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions. These issues need to be considered not only for workers who are directly employed by the Project but also sub-contractors.

Potential Impacts

The Project is expected create more than 400 direct employment opportunities during the peak of the construction period, which will be approximately 30 months in duration. The majority of workers will be engaged by the Contractor and will consist of a semi-skilled to skilled workforce.

The expected impacts on worker rights and H&S as a result of construction, activities and Project operation are as follows:

- Risk to workers H&S due to hazardous construction activities; and
- Violation of workers' rights.

Construction activities will involve the operation of heavy equipment and trucks, working at height, construction traffic, use of electric devices, handling of hazardous materials and other hazardous activities. Due to the nature of the activities being undertaken during construction, worker H&S is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours.

Mitigation and Management Actions

An OHS Plan will be prepared by the Contractor to manage worker safety. The Plan will include the following items:

- Safety Training Program. A Safety Training Program is required and will consist of:
 - Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site.
 - Periodic Safety Training Courses: Period safety course will be conducted not less than once every six months. All Contractor (and any sub-contractor) employees will be required to participate in relevant training courses appropriate to the nature, scale and duration of the subcontract works. Training courses for all workmen on the Site and at all levels of supervision and management. A list of training participants names and time-stamped photographic evidence of the training will be provided by the Contractor to the Engineer for his records.
 - Safety Meetings. Regular safety meetings will be conducted on a monthly basis. The Engineer will be notified of all safety meetings in advance. The Engineer may attend in person or by representative at his discretion. The minutes of all safety meetings will be taken and sent to the Engineer within seven (7) days of the meeting and will include a list of participants names and time-stamped photographic evidence of the training.
 - Safety Inspections. The Contractor will regularly inspect, test and maintain all safety equipment (including firefighting equipment), scaffolds, guardrails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment. Lights and signs will be kept clear of obstructions and legible to read. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be repaired or replaced immediately by the Contractor.
 - Personal Protective Clothing (PPE) – Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers.
- All construction plant and equipment used on or around the Site will be fitted with appropriate safety devices. These will include but not be limited to:
 - Effective safety catches for crane hooks and other lifting devices, and
 - Functioning automatic warning devices and, where applicable, an up-to-date test certificate, for cranes and hoists.
- Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE must be worn by workers.
- Portable toilet facilities for workers at road work sites will be provided.
- Fencing on all areas of excavation greater than 2 m deep will be installed along with warning signs.
- Ensure sufficient fresh air supply to confined work spaces.
- Keep air inlet filters clean and free of dust and microorganisms.
- Ensure reversing signals are installed on all construction vehicles.
- Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Note: fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.
- Mark the areas where risk of injuries from falling objects exist with rope or

flagging to minimize risks and injuries.

- Provide spotters. Employ flag persons to control traffic when construction equipment is entering or leaving the work area.

In addition, all Project sub-contractors will be supplied with copies of the SEMP. Provisions will be incorporated into all sub-contracts to ensure the compliance with the SEMP at all tiers of the sub-contracting. All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective sub-contract unless the Engineers approval to the contrary is given in writing. In the event of the Engineers approval being given, the Engineer, without prejudice to their other duties and responsibilities, will ensure, as far as is practically possible, that employees of sub-contractors of all tiers are conversant with appropriate parts of the SEMP. To implement the above items the Contractor will designate a qualified environmental, health and safety personnel.

Residual Impacts - If the mitigation measures suggested are implemented residual impacts will be negligible.

G.8.4 Emergency Response Planning

Potential Impacts

Emergency situations may arise during the construction phase of the Project, for example, fires and explosions (through poor management and storage of fuels and chemicals).

Mitigation and Management Actions

Construction Phase

The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to:

- Containment of hazardous materials;
- Oil and fuel spills;
- Fire, gas leaks and explosions;
- Work-site accidents; and
- Earthquake and other natural hazards.

The plan will detail the process for handling, and subsequently reporting, emergencies, and specify the organizational structure (including responsibilities of nominated personnel). The plan will be submitted to the Engineer for approval. Implementation of the plan will be monitored by the Engineer. Any emergencies, and how they were handled, will be reported in monthly progress reports by the Contractor to the Engineer. The Engineer will also provide periodic monitoring of the Contractors works throughout construction to ensure the ERP is implemented effectively.

Residual Impacts - If the mitigation measures suggested are implemented residual impacts will be negligible.

G.8.5 Physical and Cultural Resources

Potential Impacts

As noted by **Section F.4.5** no physical cultural resources have been identified within the Project corridor that are likely to be significantly impacted by Project works with the exception of a religious monument around KM0.2. It is possible, given the rich cultural heritage of Georgia, that chance finds could occur during excavation works.

Mitigation and Management Actions

During the construction phase the monument will be fenced off to ensure that there is no encroachment into this area by construction workers or equipment.

In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines. A chance finds procedure shall also be developed by the Contractor. **Appendix E** provides a sample chance find procedure which the Contractor could adopt.

Residual Impacts - If the mitigation measures suggested are implemented residual impacts will be low.

G.8.6 Visual Impact

Potential Impacts

Visual impacts are the effects on people of the changes in available views through intrusion or obstruction and whether important opportunities to enjoy views may be improved or reduced. Visual impact to nearby receptors of the Project include:

- Degradation of aesthetic value of the area due to construction activities; and
- Permanent change in visual character due to proposed Project. □

The Project Area largely consists of valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations.

The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, and storing of material in stockpiles and dumping at the waste disposal areas.

However, When in place, the new alignment will change the landscape substantially. The elevated interchanges and retaining walls in some sections, along with areas of cut slopes will impact upon the view along the valley.

Many of the road users will be transport vehicles and people moving between urban centers such as Kutaisi and Tbilisi. The impact on them will be short term and limited to the travel time only. Besides, for some of the passengers the landscape may be not familiar, so for them the change will not be crucial. The main impacts will be to the local villagers and tourists, although this portion of the road is not specifically known for its tourist industry.

Management & Mitigation Measures

654. Tree re-planting, as indicated under **Item G.6.1 – Flora**, will go some way to restoring the natural landscape of the area. However, this will not alleviate all of the visual impacts associated with the elevated interchanges and bridges. Nonetheless, the following mitigation measures are required. □

- Undertake landscaping after the completion of the activities to match in with surrounding landscape; □ and
- Reinstatement vegetation according to plans.

Residual Impacts – Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go some way to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.

G.8.7 Noise & Vibration

Potential Impacts

Noise - Construction Phase

The potential noise related issue during construction of the project is disturbance to sensitive receptors in the Project area.

Noise levels within the Project area range depending upon the location. Baseline noise monitoring undertaken for this EIA indicates that noise levels range from 55 to 78 dBA adjacent to the existing road.

The noise during the construction phase depends on the stage of construction work and equipment used at the site. The construction activities generating significant levels of noise can be divided as follows:

- Site clearing and preparation;
- Excavation and tunnel construction;
- Bored piling and concrete placement; and
- Erection of bridges.

The main sources of noise and vibration during construction of the project are as follows:

- Construction machinery;
- Drilling activities;
- Blasting;
- Haulage and general vehicle movements;
- Concrete mixing and aggregate production systems; and
- Construction Camps / Ancillary Facilities.

The criteria for Determining Significance is the World Bank Group guidelines for noise require that the sound level in residential areas (and other sensitive receptors, such as schools and hospitals) should not exceed 55 dBA during the day and 45 dBA during the night. During construction period, it is possible that these standards will be exceeded for short duration during the day.

Construction noise levels at receptors would fluctuate depending on the type and number of equipment, their duration of use and the distance from receptor. In this analysis, first the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated. The peak noise levels of construction

equipment mainly used at a typical construction site, are shown in Table 89. The list includes all equipment except vehicles and some minor pieces of equipment.

Table 89: Typical Noise Levels from Construction Equipment

Equipment	Actual Max (dBA)	Usage Factor (%)
Roads – Preparation Stage		
Dozer	81.7	30
Excavator	80.7	30
Grader	85	30
Roller	80.0	15
Rock Drill	81.0	15
Dump Truck	76.5	30
Roads - Completion stage		
Compressor	77.2	30
Paver	77.2	30
Roller	80.0	15
Tractor	84.0	30
Concrete Mixer Truck	78.8	30
Tunnel Mouth		
Jackhammer	88.9	50
Tunnel		
Blasting	94.0	1
Bridge		
Boring Jack Power Unit	83.0	20

Source: Source: Batumi Bypass EIA. ADB 2017.

Using this data, the expected noise level, Leq(8-hr), is calculated. The predicted noise levels at 100 m from the source are shown in Table 90. It shows that the highest equivalent noise level for an 8-hour shift due to a single piece of equipment at a receptor, at a typical distance of 100 m from the source will be about 61 dB(A) during preparation stage. When more than one piece of equipment are working simultaneously, the noise level at the receptor will increase. The attenuation due to topographic factors could be up to 2 dB(A). Good maintenance of equipment with installation of noise mufflers may also reduce the noise.

Table 90: Predicted Noise Level for Construction Equipment (dBA)

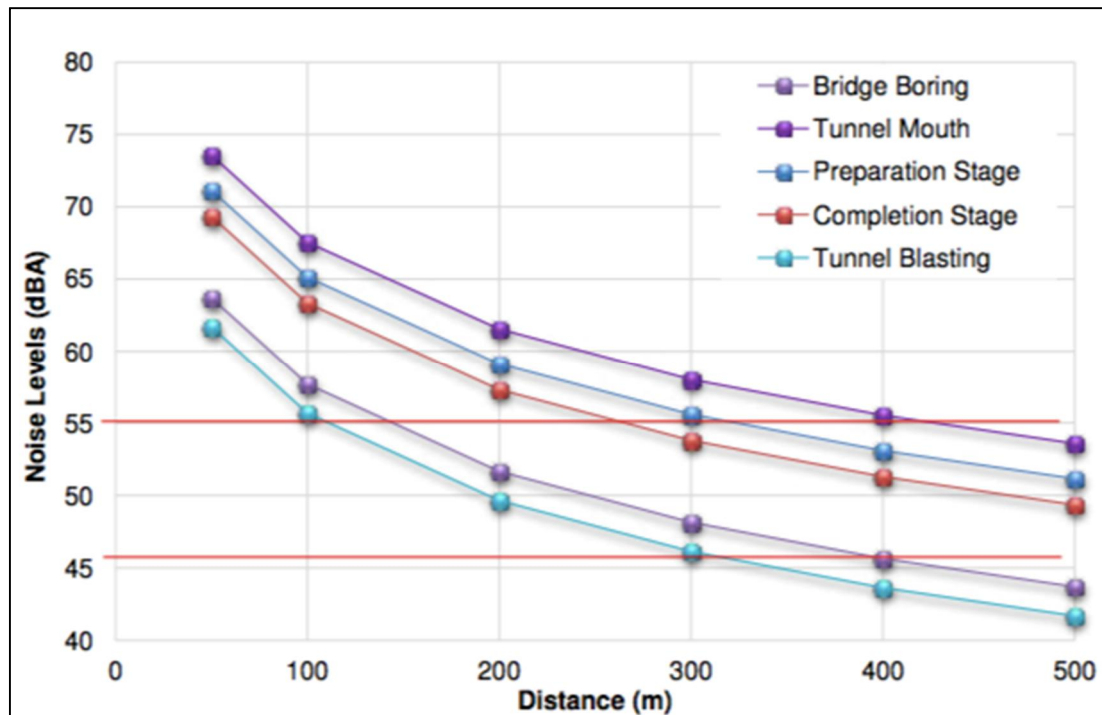
Equipment	Actual Max	Usage Factor (%)	Leq (dBA) at Various Distance					
			50m	100m	200m	300m	400m	500m
Road – Preparation Stage								
Dozer	81.7	30	64.2	58.1	52.1	48.6	46.1	44.2
Excavator	80.7	30	63.2	57.1	51.1	47.6	45.1	43.2
Grader	85	30	67.5	61.4	55.4	51.9	49.4	47.5
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Rock Drill	81.0	15	60.4	54.4	48.4	44.9	42.4	40.4
Dump Truck	76.5	30	59.0	52.9	46.9	43.4	40.9	39.0
Road – Completion Stage								
Compressor	77.2	30	60.2	54.1	48.1	44.6	42.1	40.2
Paver	77.2	30	59.7	53.6	47.6	44.1	41.6	39.7
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Tractor	84.0	30	66.5	60.4	54.4	50.9	48.4	46.5
Concrete Mixer Truck	78.8	30	61.3	55.2	49.2	45.7	43.2	41.3
Tunnel Mouth								

Equipment	Actual Max	Usage Factor (%)	Leq (dBA) at Various Distance					
			50m	100m	200m	300m	400m	500m
Jackhammer	88.9	50	73.6	67.6	61.5	58.0	55.0	53.6
Tunnel								
Blasting	94.0	1	61.7	55.7	49.6	46.1	43.6	41.7
Bridge								
Boring Jack Power Unit	83.0	20	63.7	57.7	51.7	48.1	45.6	43.7

For a more detailed impact assessment, the construction noise was calculated at distances starting from 50 m to 500 m to see the extent of spreading of noise and separately for surface, bridge and tunnel. The modeling results for construction noise are shown in Figure 102. Following assumptions were made during calculation:

- It was assumed that the equipment working simultaneously in preparation stage are; dozer, excavator, grader, road roller, rock drill and dumpers whereas in completion stage the equipment are; compressor, paver, road roller, tractor and concrete mixers. □ Blasting will not be used for excavation at the tunnel mouth and portal. □
- Boring is used for bridges whereas the jack hammer is used for tunnel mouth. □
- The estimated shielding was taken as 2 dBA. Shielding is the reduction in noise due to addition of mitigation measures like barriers and dirt mound. □

Figure 102: Construction Noise



It can be seen that all the construction activities detailed above cannot take place at nighttime (22:00pm to 7:00am) except the boring which is meeting the nighttime limit at 400 m distance.

The overall construction noise at a distance of 100 m exceeds the prescribed 55/45 dBA limit. However, the resultant noise levels at the receptors when the construction work is carried out at a distance of the 500 m from the receptor could be in the range

45- 55 dBA. As a worst case, when the baseline noise level is over 60 dBA like in some locations close to the existing road, there the increase may be still less than 3 dBA and thus barely noticeable. Note that the above statement is valid if there is a continuous non-fluctuating noise source. As the noise levels of construction equipment vary considerably, the community can easily notice the variation.

Noise - Operational Phase

The operational noise impacts have been assessed as part of a noise model, see **Section G.8.8** below.

Vibration - Construction Phase

Vibration from construction activities is a cause concern to the community. The effects of vibration varies and depends on the magnitude of the vibration source, the particular ground conditions between the source and receiver, presence of rocks or other large structures in the area. The intensity, duration, frequency and number of occurrences of a vibration all play an important role in both the annoyance levels caused and the strains induced in structures.

The effects of vibration can be assessed as:

- General annoyance, sleep disturbance, etc;
- Potential cosmetic damage to properties; and
- Potential structural damage to properties.

The sources of vibration can broadly divided into two parts:

1. Vibration Impact of Construction Activities on the Surface (General construction works including construction equipment movement, pile driving, compaction, hammering (hydraulic or pneumatic), operation of batching plant and generators, etc).; and
2. Vibration Impact of Tunnel Construction.

The propagation of vibration from construction activities are different in nature from the vibration from tunneling. The construction activities are undertaken essentially on ground surface and spreads basically as two-dimensional waves. In contrast, the tunneling is undertaken below the surface and spreads in three-dimension. For this reason, the impact of the two is assessed separately.

The Georgian Standards for vibration are provided in Table 21. The proposed criteria for damage to buildings are shown in Figure 106. These are derived from British Standard BS 6472 and are German Standards DIN 4150-3:1999.

Table 91: Criteria for Structural Damage Due to Vibration

No Damage Likely	PPV < 5 mm/s
Cosmetic Damage Risk	PPV 5 to 15 mm/s
Structural Damage Risk	PPV > 15 mm/s

Vibration Impact of Construction Activities on the Surface – Table 92 provides an indication of the approximate vibration levels that may be expected for various vibration sources.

Table 92: Approximate Vibration Levels for Various Sources ²⁰

Activity	Typical Levels of Ground Vibration
Vibratory Rollers	Up to 1.5 mm/s at distances of 25 m Higher levels could occur at closer distances; however, no damage would be expected for any building at distances greater than approximately 12 m (for a medium to heavy roller)
Hydraulic rock breakers (levels typical of a large rock breaker operating in hard sandstone)	4.50 mm/s at 5 m 1.30 mm/s at 10 m 0.4 mm/s at 20 m 0.10 mm/s at 50 m
Compactor	20 mm/s at distances of approximately 5 m, 2 mm/s at distances of 15m. at distances greater than 30 m, vibration is usually below 0.3 mm/s
Pile driving/removal	1 to 3 mm/s at distances of 25 m to 50 m depending on soil conditions and the energy of the pile driving hammer
Bulldozers	1 to 2 mm/s at distances of approximately 5 m. at distances greater than 20 m. vibration is usually below 0.32 mm/s
Air track drill	4 to 5 mm/s at a distance of approximately 5 m, and 1.5 mm/s at 10 m. at distances greater than 25 m, vibration is usually below 0.6 mm/s and at 50 m or more, vibration is usually below 0.1 mms
Truck traffic (smooth road surfaces)	0.01 to 0.2 mm/s at the footing of buildings located 10 to 20 m from a roadway
Truck traffic (over irregular surfaces)	0.1 to 2.0 mm/s at the footings of buildings located 10 m to 20 m from a roadway

These levels are well below the threshold of any possibility of damage to structures due to vibrations from typical construction activities related to roller, compactors, and movement of construction equipment.

The piling for the bridge piers are likely to generate relatively more vibrations which depends on soil condition. However, even under extreme conditions, the vibration is unlikely to exceed 10 mm/s beyond 25 m.

Vibration Impact of Tunnel Construction – Tunneling will be the main source of vibration impacts associated with the Project. In these tunnels (hard rock: porfirites) two tunneling techniques could potentially be used, blasting, or hydraulic hammering. Blasting is intermittent, with pauses between each blast to remove rock and set charges for the next blast. On the other hand hydraulic hammering is continuous causing uninterrupted vibration.

Vibration – Operational Phase

Highway traffic is not likely to have any measurable impact on the structures or on comfort. The Federal Highway Administration of the USA has determined that “All studies the highway agencies have done to assess the impact of operational traffic induced vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. In fact, normal living

²⁰ Northern Expressway Environmental Report: Noise and Vibration technical Paper. 2007.
http://www.southroad.sa.gov.au/__data/assets/file/0019/13780/Noise_and_Vibration_Technical_Paper.pdf

activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic.”²¹

Mitigation and Management Measures

Noise - Pre-construction Phase

Correct siting of construction camps and ancillary facilities will reduce the potential for elevated noise levels to affect sensitive receptors. Locating these facilities more than 500 meters from residential or sensitive receptors should mean that the noise generated by these facilities will be lower than IFC daytime and night-time guideline limits at this distance. Locating these facilities more than 1km downwind of sensitive receptors will further limit potential noise impacts.

Prior to the start of construction, and as part of his SEMP, the Contractor will develop a noise management plan that will include the mitigation measures outlined below for the construction phase.

Noise - Construction Phase

During the construction phase the Contractor will be responsible for the following:

- Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. 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 residential, nursery, or medical facilities, the Contractor's hours of working shall be limited to 8 AM to 6 PM.
- Use temporary noise barriers while working in sensitive locations in case exceedance of allowable limits is expected. Placing the barrier close to the source proves to be effective.
- Give notice as early as possible to sensitive receptors for periods of noisier works such as excavation. Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress.
- Within normal working hours, where it is reasonable to do so:
 - schedule noisy activities for less sensitive times.
 - provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise).
- The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times.
- All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair.
- Maintenance tools, machines and equipment so that they are in good conditions.

²¹

http://www.fhwa.dot.gov/Environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/polguide09.cfm

When some wrong is found, they must be fixed immediately in order to reduce noise from the equipment.

- Fit all pneumatic tools with an effective silencer on their air exhaust port.
- Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems must be followed.
- Turn off plant when not being used.
- All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the Engineer.
- Keep good conditions of trucks that use to transport construction materials so they cause no loud noise and control the truck speed, to be not exceeded 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways.
- Where possible, no truck associated with the work should be left standing with its engine operating in a street adjacent to a residential area.
- Provision of noise protection kits such as ear plug, earmuff, for workers who are working in the area with noise level is higher than 85 dB(A). It is designated as a regulation that workers must wear protection kits in case of working in a noisy area.

Noise - Operational Phase

Discussed below under **Section F.8.7 – Noise Model**.

Vibration Construction Phase

The following phased mitigation measures for construction induced vibration are recommended:

1. The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule. The TBP shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel and will include the results of all of the surveys undertaken (see below for survey requirements). The TBP will also include a vibration monitoring plan to monitoring vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:
 - a. Ensure that vibration levels in the communities are within the adopted criteria levels;
 - b. Maintain record of vibration to settle any potential conflicts; and
 - c. Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.Vibration data will be documented, reviewed, and preserved by the Contractor. It will be regularly shared with the Engineer, RD, EIB, MoEPA and the community as part of the monthly progress report.
2. A survey will be undertaken within a 250 meter corridor of tunnel TUN 3.0.01-AT/TA to determine the pre-blasting conditions of all buildings within the corridor. This tunnel is one of the most remote tunnels with a very low number of properties within 250 meters. The survey will be commissioned by the Contractor at his own charge and will identify and record any existing damage to the structures. The survey will cover the following aspects:
 - a. Overall condition of the structures, both exterior and interior;
 - b. Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches; and

- c. Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches.

The survey will be accompanied with consultations with the affected household to explain the extent and reason for the survey, confirm the findings of the survey (affected households shall sign the survey form saying they agree with the findings) and the process for reporting any grievances regarding vibration impacts. The households will be provided with materials that summarize the grievance redress process. If the households do not allow the survey they shall be informed by the Contractor that they will not be authorized in the future to claim any damage.

3. Tunneling shall then start from tunnel TUN 3.0.01-AT/TA at its eastern portal. In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to define damage risk zones in damage risk maps.
4. Using the damage risk map and the tunnel boring schedule, the Contractor in consultation with the RD and the Engineer, will identify the houses that are likely be affected in the entire Project corridor and the impact duration and schedule. As noted above, there is assumed no risk of structural damage for the houses, but the pressure of the blasting could cause some cosmetic damages, mainly relating to the breaking of windows. Before start of blasting, all residents shall be informed of the exact hour of the blasting and they will be invited to open the windows in order to avoid them breaking.
5. With respect to blasting the following are key recommended mitigation measures:
 - a. No blasting will be carried out within 100 m of the portal of any tunnel.
 - b. Blasting will be scheduled during the day only.
 - c. Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
6. Both during and after the tunnel excavation if any damage to properties is reported by the property owners the survey will be repeated to ascertain that the blasting is the cause of the damage comparing the damage with the previous survey. If this is the case, the Contractor will repair the damage and the cost will be on charge of the RD. If the Contractor has no previous survey to compare the cost of the repairs will be with him.
7. If the damages are significantly more than what expected, the Contractor shall change the method of blasting (decreasing the energy of blasting) or if this is ineffective, cease blasting and employ another less invasive method (rod header).
8. Regarding vibration nuisance it is strongly recommended that hydraulic hammering not be used in order to limit constant vibration nuisance. If the Contractor decides to use this method and substantial complaints are received from the community, the Contractor will be obliged to use an alternative technique.
9. In addition the following measures shall be applied relating to tunnel blasting;
 - a. No blasting will be carried out within 100 m of the portal of the tunnel;
 - b. Blasting will be scheduled during the day only; and
 - a-c. Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.

It is noted that only a few properties will potentially suffer cosmetic damage from bridge piling works. It is however recommended that the Engineer undertakes cosmetic condition surveys of all properties within 50 meters of bridge piles as per the vibration surveys recommended above for the tunnels. If there are any claims or

reports of damage the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate by the Contractor.

G.8.8 Noise Model

G.8.8.1 Environmental Noise Model

To assess the impacts of operational noise within the Project area a noise model has been prepared.

The Environmental noise model is based on a specific set of conditions for which the noise is being estimated, it will be a fixed representation or 'snapshot' of a physical environment of interest; in practice the physical environment of the area of interest is constantly and randomly changing; the model intend to represent the most typical or frequently occurring conditions as reconstructed by the input data. Modeling takes into consideration both worse scenario and the average conditions, the latter being a good representation in case of pretty constant traffic conditions. The key conditions for the development of a good noise model are:

- Knowledge of the noise source, or sources, for which associated environmental noise levels are of interest.
- The physical environment through which noise will transmit from the noise source(s) to the location or targets/region of interest. This includes the ground terrain, the built environment, and atmospheric conditions (e.g. wind, temperature, humidity).
- An approximation of the way in which sound will travel from the noise source(s) via the physical environment, to the receiver location or region of interest (building surface).

In complex scenarios, the environmental noise model is repetitiously calculated for the distribution of sound source (by using ray – tracing modeling), from the traffic to the receiver location. The total sound level at each position is then calculated by summing the contribution of each source and transmission path. The road will be considered as a linear source of noise, composed by a number of vehicles considered as single sources moving along a line. Application of these calculations to each point on a uniformly distributed grid enables a noise contour map to be developed to depict regions of equal estimated noise level and depict trends in the spatial pattern of the sound field:

Information considered in the development of the model Table 93 shows the requirements for specifying a noisy environment

Table 93: Factors in Acoustic Mapping

Stage	Minimum	Other elements to be considered
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The noise sources to be investigated	Number of sound sources; Total sound power output of each source; Directional characteristics of each source; Height of each source; Frequency characteristics of each source	Time variations of emissions for example, a worst-case assessment would imply the use of the highest possible value irrespective of how frequently it may occur, whilst an assessment which related to 'typical' conditions could necessitate the use of an averaged value or some typically recurring upper value. (In our case, impulsive noise from the source should be excluded)
The physical environment through which noise will transmit to the receivers	Separating distances between all relevant noise sources and receivers Reflecting/ obstructing structures; amount and type of vegetation Height(s) of receiver(s) (Obtained from Maps or field survey of buildings)	Ground terrain profile characteristics of the ground cover Meteorological conditions relevant to the intentions of the including wind direction and speed, temperature, and humidity, (not so relevant in our case due to the short distances from the source).

To estimate the way in which noise will travel from the noise sources to the receivers, a range of sound propagation methodologies may be employed. Methods vary widely in their complexity and the scope of applications for which they can offer meaningful predictions.

In our model a standard hemi-spherical spreading is considered; this method accounts for the reduction in sound intensity as a sound wave front spreads over a larger area, with the consequence of increasing the area of the spherical surface where the energy (sound pressure wave) is distributed.

To calculate the propagation the algorithm takes into account:

- The absorption associated with the propagation of noise through the atmosphere **(very low due to the short distance)**
- The change in noise level that occurs as a result of interactions between the sound wave travelling directly to the receiver and those reflected from the ground, buildings and accounting for influence of the ground cover type **(calculated from the 3D model of soil and buildings obtained by field survey).**
- The attenuation offered by obstacles that fully or partly obstruct line of sight between a source and a receiver location **(poor vegetation will not determine any attenuation).**
- The influence of atmospheric conditions that can change the direction of an advancing sound wave front by refracting the wave at points where there are significant changes in wind speed and/or temperature (not considered due to the short distance).
- The influence of reflecting surfaces which re-direct an advancing sound wave front (for the second row of buildings reflection/shielding will be the main factor of attenuation).

G.8.8.2 Variability

The noise sources considered in the model exhibit very large variability in space and time and during the construction phase also the background noise from the nearby existing road has to be considered. The following table gives examples of variations considered in the developed model.

Table 94: Examples of Components Variations

Component	Examples of component variations
Source	Background noise: Changing traffic sound e.g. hourly, daily, and seasonal changes in the general traffic flow volume and composition, as well short term (wet or dry) and long term (road surface degradation) changes in road conditions.
Transmission	Position dependent sound propagation, e.g. varying separation distances due to sound source movement, varying degrees of sound path screening according to source and receiver location, and localized regions affected by reflections (not of capital importance in our case due to linear modelization of traffic)

G.8.8.3

Algorithms for Outdoor Sound Propagation

The ability of mathematical algorithms to accurately represent sound propagation has been the focus of considerable researches, particularly given the role of noise prediction as an integral assessment tool in the fulfillment of the European Noise Directive (i.e. EU Directive 2002/49/EC, which requires member states to produce noise maps and action plans for urban areas and major transport infrastructures, including roads, railways and airports). As mentioned, the applied software fully complies with that and it is updated to the latest EU directives and norms. In particular the used Software SOUND PLAN VER. 7.2 considers the guidelines ISO 3891 e ISO 9613; the sound pressure has been calculated in accordance to the procedures stated in the model "Nouvelle Methode du Presion du Bruit - Routes 2008" and the following norms:

- Industrial Noise
 - ISO 9613 incl. VBUI (International, EC-Interim)
 - CONCAWE (International)
 - VDI 2714, VDI 2720 (Germany)
 - DIN 18005 (Germany)
 - ÖAL Richtlinie Nr. 28 (Austria)
 - BS 5228 (United Kingdom)
 - Nordic General Prediction Method (Scandinavia)
 - NORD 2000 (Scandinavia)
 - Ljud från vindkraftverk (Sweden)
 - Harmonoise, P2P calculation model (International)
 - NMPB08 - Industry (France)
 - CNOSSOS-EU (2014)
- Road Noise
 - NMPB-Routes-96 (France, EC-Interim)
 - RLS-90, VBUS (Germany)
 - DIN 18005 (Germany)
 - RVS 04.02.11 (Austria)
 - STL 86 (Switzerland)

- SonRoad (Switzerland)
- CRTN (United Kingdom)
- TemaNord 1996:525 (Scandinavia)
- Czech Method (Czech Republic)
- NMPB-Routes-08 (France)
- TNM (USA)
- CNOSSOS-EU (2014) Industrial Noise

G.8.8.4 Standards, regulations and guidance notes

The following standards, regulations and guidance notes have been considered as part of the model:

- ISO 9613-2, Acoustics — Attenuation of sound during propagation outdoors Part 2: General method of calculation.
- BS 4142, Method for rating industrial noise affecting mixed residential and industrial areas.
- BS 5228-2, Noise and vibration control on construction and open sites — Part 2: Guide to noise and vibration control legislation for construction and demolition including road construction and maintenance.
- BS 7445, Description and measurement of environmental noise.
- IPPC H3 Horizontal Noise Guidance. Part 1 'Regulation and Permitting' and Part 2 'Noise Assessment and Control'.
- Calculation of Road Traffic Noise 1988, Department of Transport, Welsh Office.
- Calculation of Railway Noise 1995. Department of Transport.
- The CAA Aircraft Noise Contour Model: ANCON Version 1. DORA Report 9120, Civil Aviation Authority 1992.
- PPG 24 Planning Policy Guidance: Planning and Noise. Department of the Environment 1994. TAN11 (Wales); PAN56 (Scotland).
- BS 9142: 2006 Assessment methods for environmental noise — Guide, 2003/01534 12 July 2006.

G.8.8.5 Simulation parameters

The modeling of the noise emissions and noise propagation from the new road takes into account that there are many houses very close to road side in certain sectors and others where urbanization is almost absent. The morphology, characterized by hills, and the presence of the river valley and riverbed plays a very important role mostly because this determine the distribution and type of vegetation which is acting as noise barrier and the absence of obstacles for the propagation across the valley.

To model noise, the design study of the new road design and detailed traffic forecasts immediately after construction and for the next 20/25 years have been taken into account.

Modelling of noise level was performed using 2037 traffic flow for Day and Night time as provided in the Engineering Design documents package with a difference between day and night of 70% for light vehicles and 30% for trucks (see Table 95).

Table 95: Daily average vehicles/day (working day) (2017 – 2037)

Year	Car	Mini Buses<15, PickUPs	Buses & Trucks	Trailers & > 3 axels	Total
	65,6%	17,0%	11,9%	5,5%	
2017	13,335	3,448	2,410	1,116	20,310
2018	14,002	3,621	2,521	1,167	21,311
2019	14,757	3,816	2,645	1,225	22,443
2020	15,636	4,043	2,790	1,292	23,761
2021	16,663	4,309	2,958	1,369	25,298
2022	17,753	4,591	3,135	1,452	26,930
2023	18,712	4,838	3,290	1,523	28,364
2024	19,722	5,100	3,453	1,599	29,874
2025	20,550	5,314	3,586	1,660	31,111
2026	21,414	5,537	3,724	1,724	32,399
2027	22,313	5,770	3,868	1,791	33,741
2028	23,172	5,992	4,010	1,856	35,030
2029	24,064	6,222	4,157	1,925	36,368
2030	24,858	6,428	4,288	1,985	37,559
2031	25,679	6,640	4,423	2,048	38,790
2032	26,526	6,859	4,563	2,112	40,060
2033	27,401	7,085	4,706	2,179	41,372
2034	28,306	7,319	4,855	2,247	42,727
2035	29,240	7,561	5,007	2,318	44,126
2036	30,205	7,810	5,165	2,391	45,571
2037	31,201	8,068	5,328	2,467	47,064

These traffic fluxes are for ultra-conservative scenario in which full load of the road in year 2037 will occur (peak hour at day and maximum expected load at night) and also for the present day vehicle levels. In reality, it can be said with high probability that vehicle levels in Georgia will change by 2037 with the consequence of having lower emissions than predicted in the project design documents and used in this modelling. This will result from:

- Technological improvement (new models, hybrids, electric cars have and will have less and less noise emissions and the share of these vehicles in the whole vehicle cars will be significant);
- Full amortization of the old vehicles; and
- Possibly also from national regulations to limit the use of old vehicles producing excessive air pollution (the same categories of vehicles happen to be responsible for high noise emissions too).

G.8.8.6 Numeric model

The forecast of noise emissions on new urban road has been performed using SOUND PLAN VER. 7.2 ray tracing software. Noise sound pressure results on receiving point are based on method BNPM (Basic Noise Prediction Method) and on German regulation BNPM, which is based on DIN 18005.

G.8.8.7 Receptors to be investigated

In order to investigate noise levels in operation field and close to buildings, many receiving points have been ideally set in correspondence of building facades, at proper distance and height according to Georgian and international standard regulations. The model can evaluate not only general noise level in the area but also noise levels close to buildings, in position suggested by international

regulations about residential buildings. Due to the absence of tall buildings, maximum height is four floors, and their distance from the source, there is no need to make a multi level computation at different heights.

G.8.8.8 Traffic forecasts

Currently last 5 year statistic data is available from Roads Department of Georgia for the main roads; data includes seasonal measurements during the year, specifically in April, July and October from these measurements Annual Average Daily Traffic (AADT) is derived.

According to German regulation BNPM, the vehicle fluxes must be divided in light and heavy means; accordingly the reported data has been divided assigning the class of light vehicles to cars and minibuses, the class of heavy vehicles to buses trucks and trailers. The traffic flux per day at 2017 is shown in Table 96.

Table 96: Traffic Flux Per Day, 2017

Year	Car	Mini Buses<15, PickUPs	Buses & Trucks	Trailers & > 3 axles	Total
2017	13335	3448	2410	1116	20310

This data has been collected in a period of 8 hours in the day reference period, so the average hour flux can be considered 2,540 vehicles per hour. Due to unstable patterns it was considered more reasonable to calculate Compound Annual Growth Rate (CAGR) to apply first year growth rate separately for Passenger and Freight Vehicles based on last few year traffic history. The compound annual growth rate is calculated by taking the root ^{nth} of the total percentage growth rate, where “n” is the number of years in the period being considered.

For the reasons above described, in our model as future traffic flux the traffic forecast values at 20 years from now data was the input data; in other words the traffic values after a period of about 18 years after road construction. The future vehicle flux used in calculations is 47,064 total vehicles.

To investigate the worst traffic condition for noise levels, this flux, according to BNPM method, has been evenly spread on road lanes, the average per day has been divided in a period of 8 hours, obtaining the above average flux per hour, 5,883 vehicles/hour with about 16% of heavy vehicles; speed has been set to 80 Km/h.

As far as regards the night reference time, considering the absence of any directly measured data and lacking of a study as detailed as daytime one, a vehicles flux of 70% of the daytime for cars and 30% for buses trucks and trailers has been chosen (see Table 97). The assumption is based on experience in European countries, and corrected by direct observation of traffic reduction during night time in the investigation area.

Table 97: Night Traffic

Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total

Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total
2017	9334,5	1034,4	723	334,8	11426,7
2018	9801,4	1086,3	756,3	350,1	11994,1
2019	10329,9	1144,8	793,5	367,5	12635,7
2020	10945,2	1212,9	837	387,6	13382,7
2021	11664,1	1292,7	887,4	410,7	14254,9
2022	12427,1	1377,3	940,5	435,6	15180,5
2023	13098,4	1451,4	987	456,9	15993,7
2024	13805,4	1530	1035,9	479,7	16851
2025	14385	1594,2	1075,8	498	17553
2026	14989,8	1661,1	1117,2	517,2	18285,3
2027	15619,1	1731	1160,4	537,3	19047,8
2028	16220,4	1797,6	1203	556,8	19777,8
2029	16844,8	1866,6	1247,1	577,5	20536
2030	17400,6	1928,4	1286,4	595,5	21210,9
2031	17975,3	1992	1326,9	614,4	21908,6
2032	18568,2	2057,7	1368,9	633,6	22628,4
2033	19180,7	2125,5	1411,8	653,7	23371,7
2034	19814,2	2195,7	1456,5	674,1	24140,5
2035	20468	2268,3	1502,1	695,4	24933,8
2036	21143,5	2343	1549,5	717,3	25753,3
2037	21840,7	2420,4	1598,4	740,1	26599,6

G.8.8.9 Modeling Results

The results of the noise model are presented below in a series of maps (Figure 104 to Figure 117). The Project road has been divided into two 'portions' to allow a better visual analysis of the maps. Figure 103 shows the approximate location of each 'portion'.

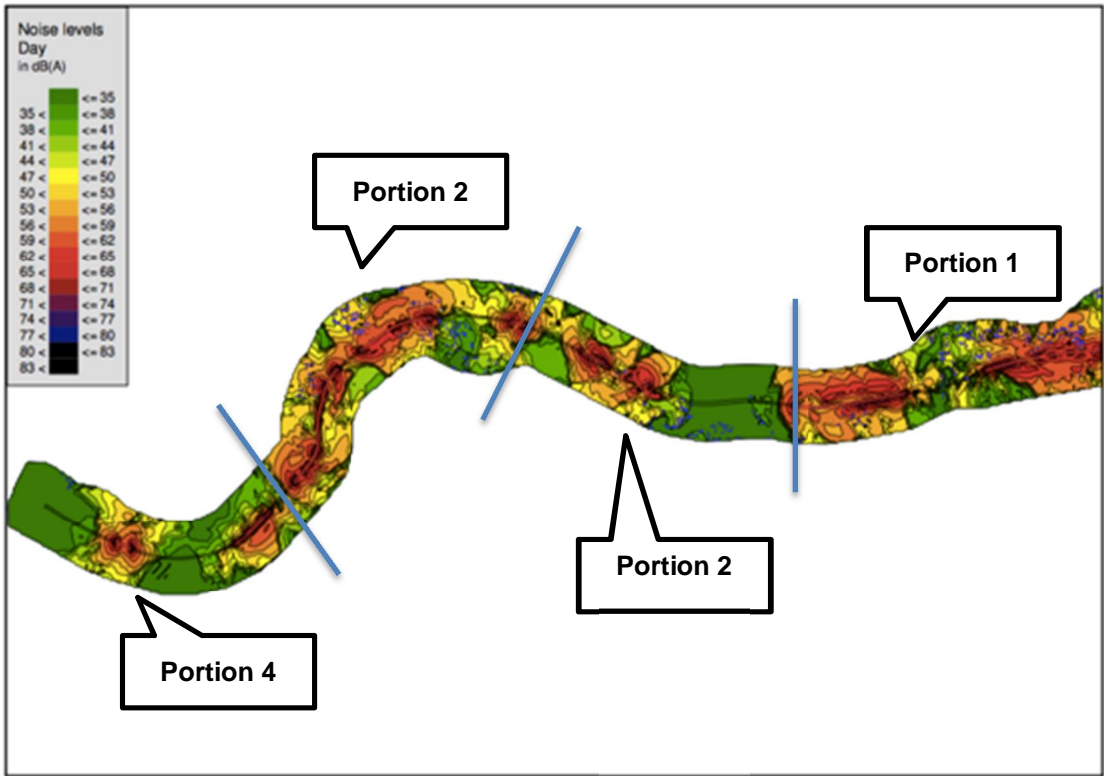
Each portion comprises a series of four maps with isolines representing the various predicted noise levels for:

1. Daytime noise – Without noise abatement
2. Daytime noise – With noise barrier
3. Nighttime noise – Without noise abatement
4. Nighttime noise – With noise barrier

The noise barrier has been developed based on a generic solid noise barrier type, with a height of 4 meters and is used only to illustrate the types of noise reduction that could be anticipated by employing such abatement measures.

Next to each map a table is provided indicating the predicted noise levels at each identified receptor within the Project corridor (100 meters each side of the road). The numbers highlighted in green indicate where they meet the IFC Guidelines limits for daytime and nighttime noise.

Figure 103: Approximate Location of Portion



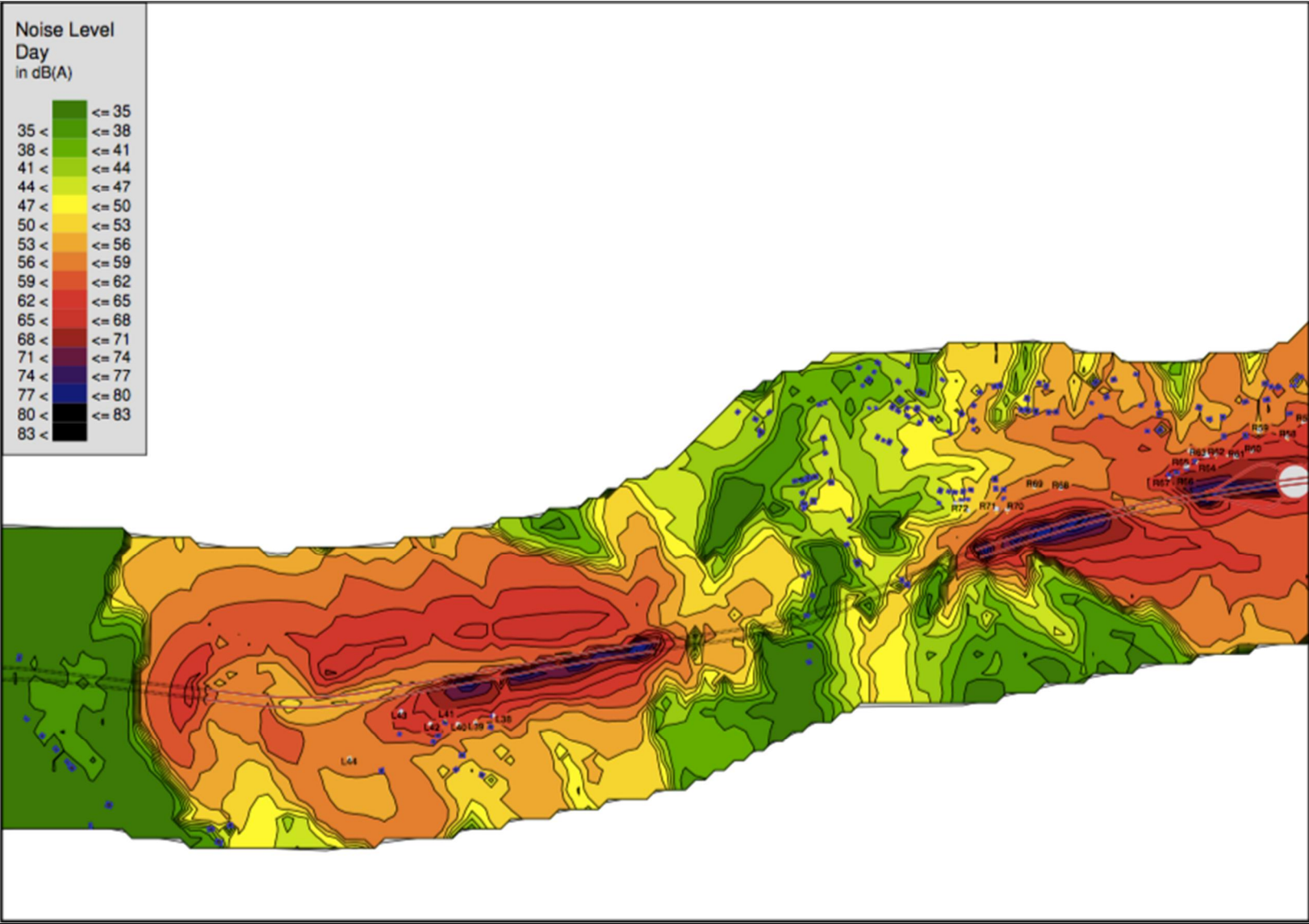


Figure 104: Predicted Noise Level, Daytime

dBA	Rec.
62.7	L38
59.2	L39
61.3	L40
64.2	L41
64.4	L42
63.6	L43
59.9	L44
71	R53
71.2	R54
64	R55
63.7	R56
64.3	R57
67.2	R58
65.1	R59
70.8	R60
71	R61
65.4	R62
66.5	R63
64.1	R64
64.7	R65
69.2	R66
66.3	R67
60.3	R68
58.6	R69
58.6	R70
56.9	R71
51.1	R72

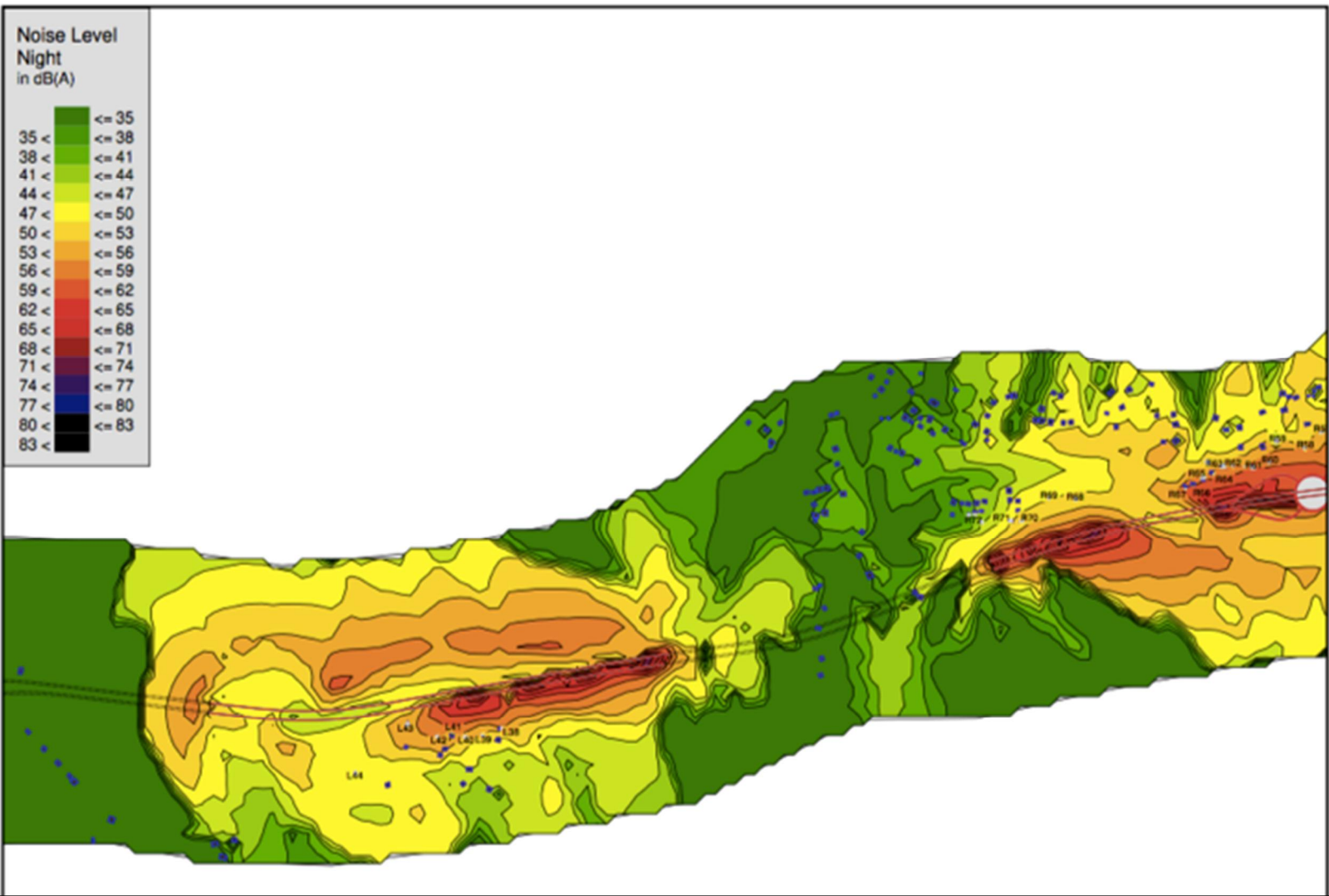
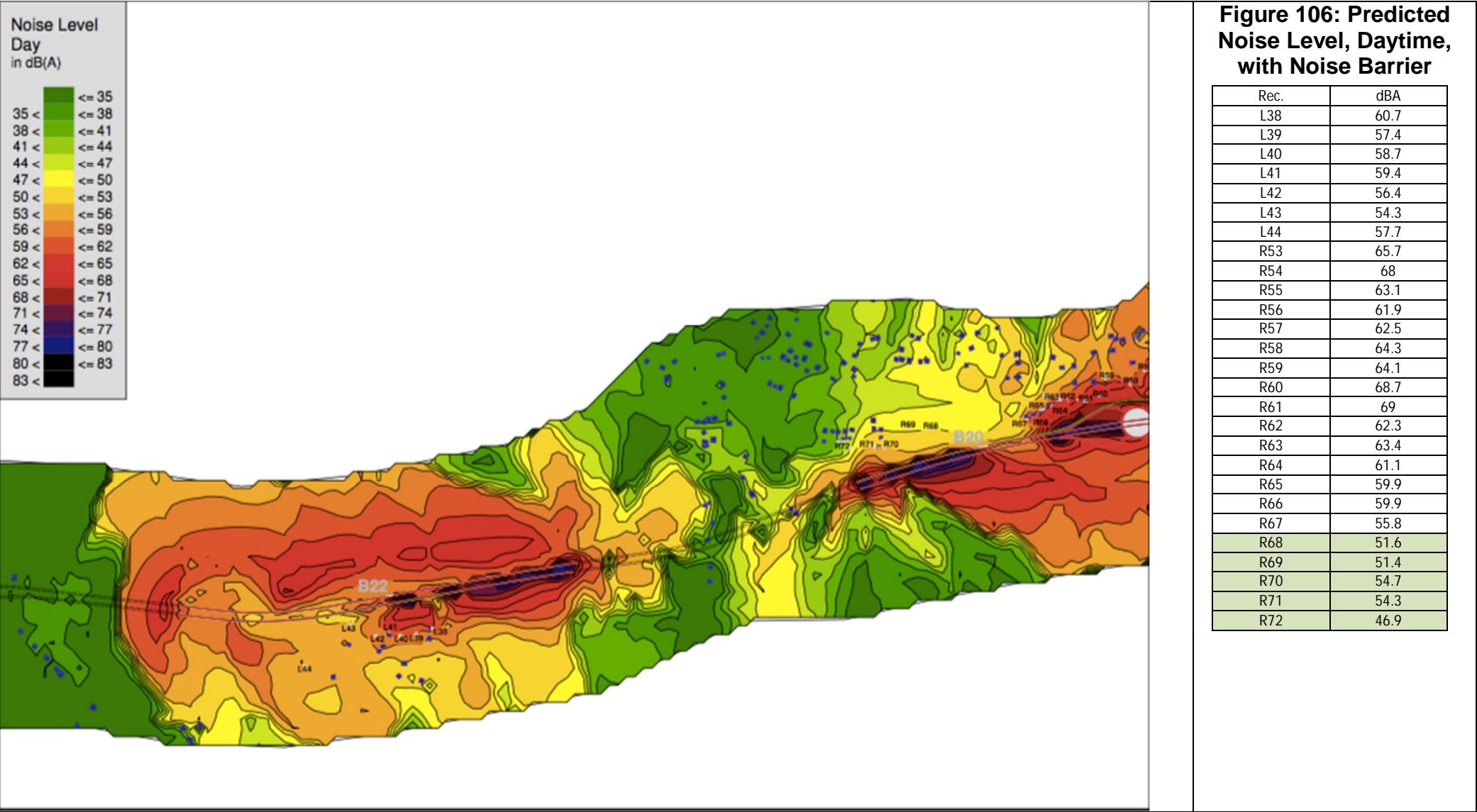
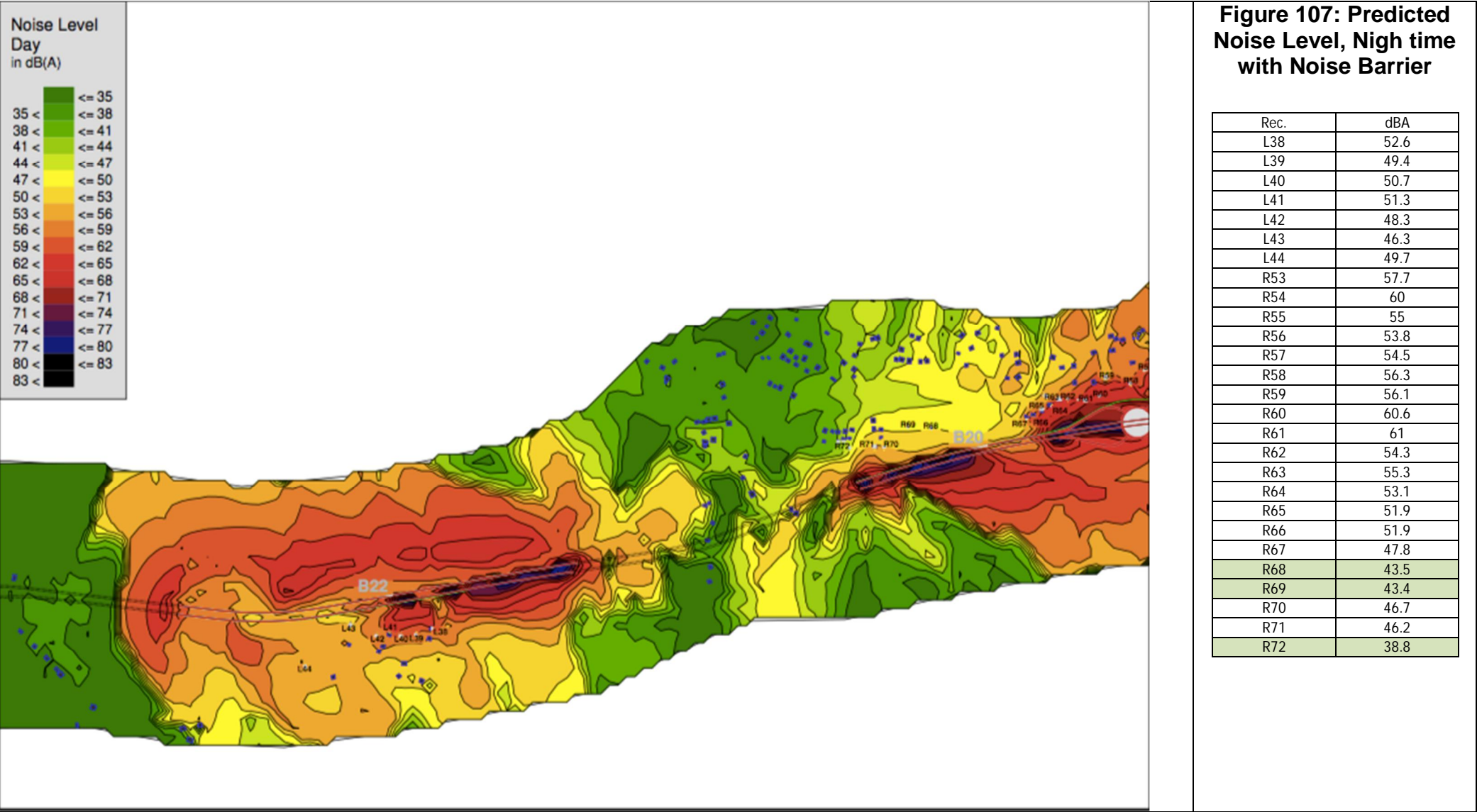


Figure 105: Predicted Noise Level, Night time

dBA	Rec.
54.7	L38
51.1	L39
53.2	L40
56.1	L41
56.3	L42
55.6	L43
51.8	L44
62.9	R53
63.2	R54
55.9	R55
55.6	R56
56.2	R57
59.1	R58
57.1	R59
62.8	R60
62.9	R61
57.3	R62
58.4	R63
56.1	R64
56.6	R65
61.2	R66
58.2	R67
52.2	R68
50.6	R69
50.6	R70
48.9	R71
43.1	R72





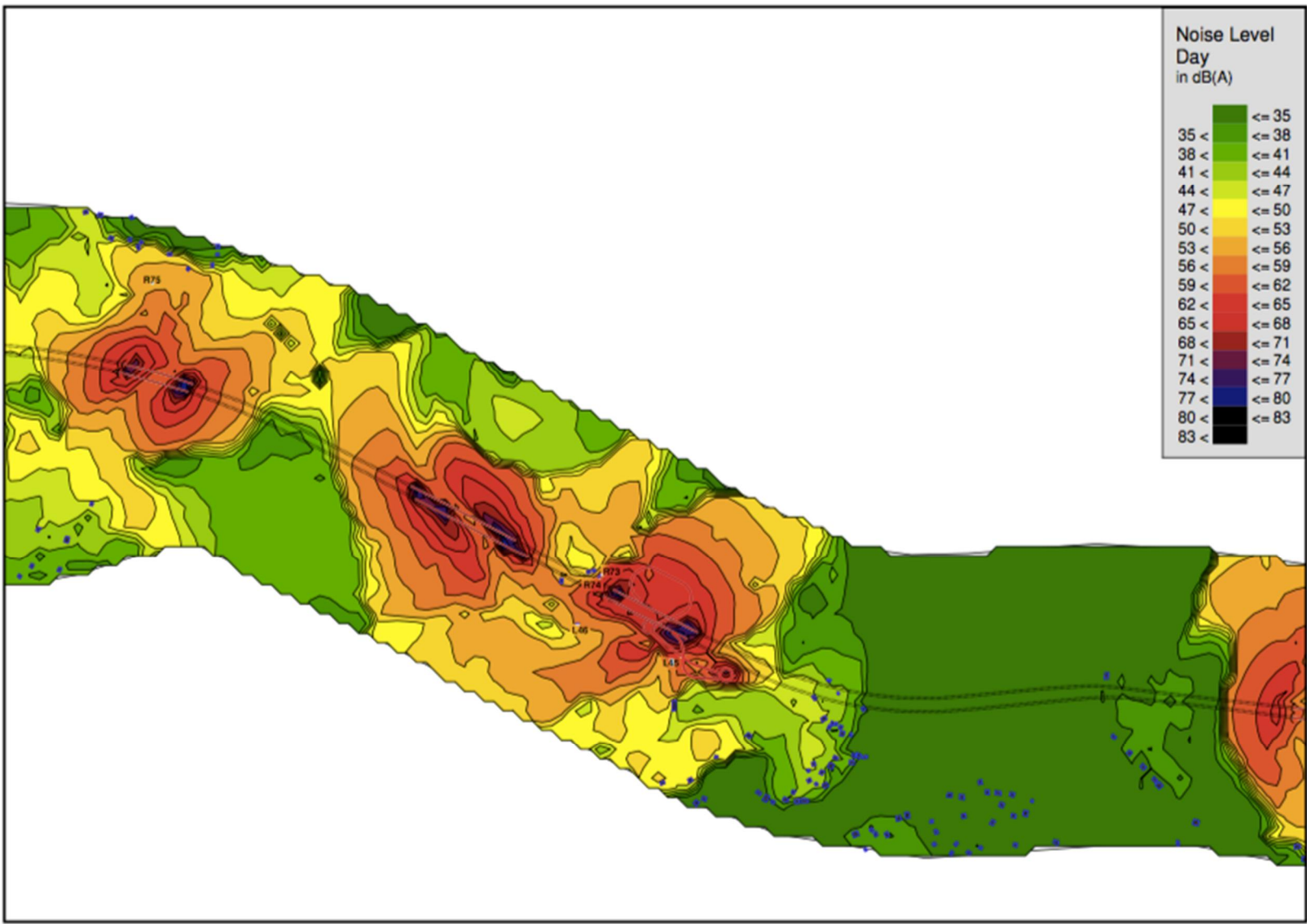
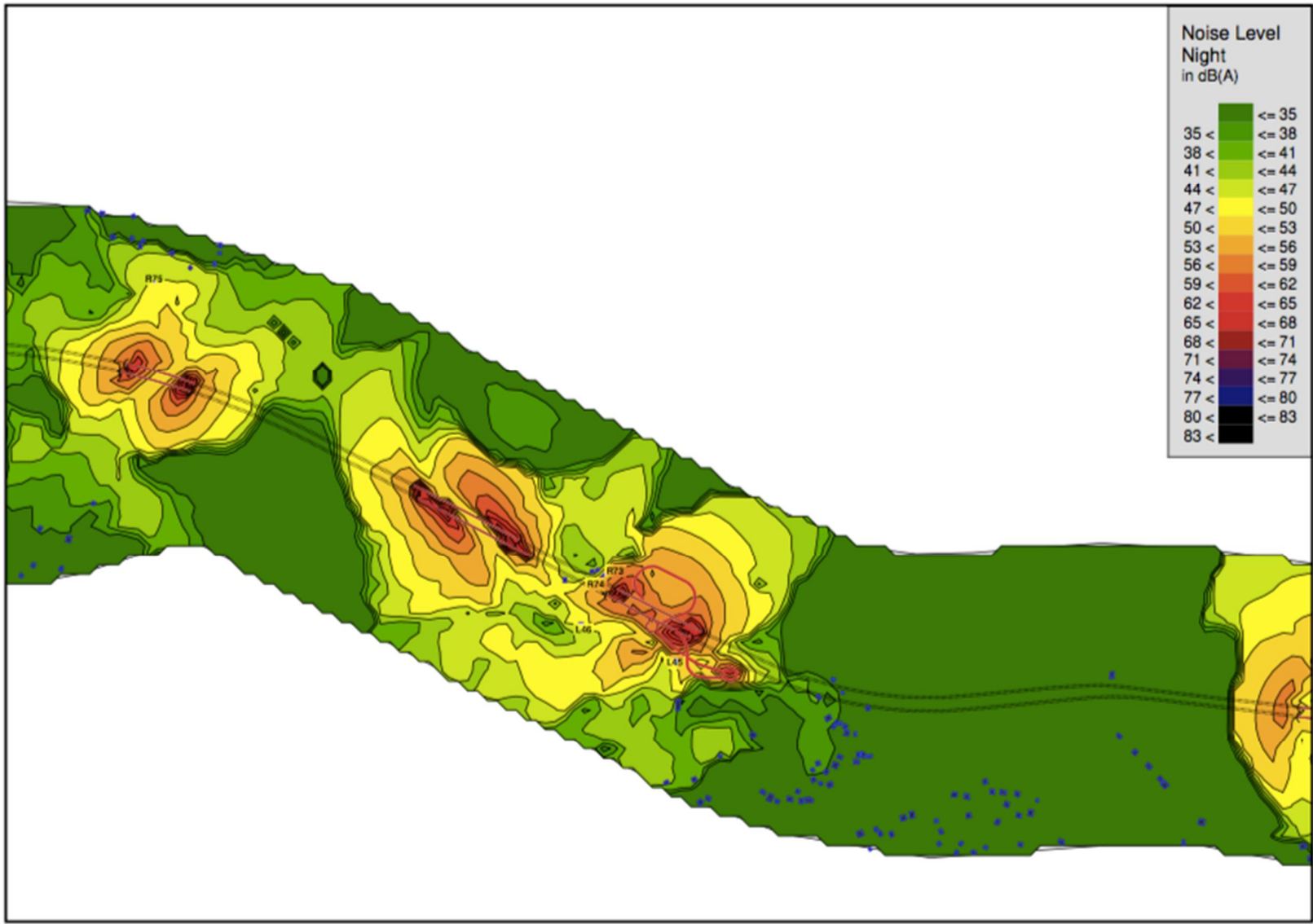


Figure 108: Predicted Noise Level, Daytime

dBA	Rec.
55.6	L45*
59.4	L46*
65.9	R73
65.9	R74
57.1	R75

*Commercial Property



**Figure 109: Predicted
Noise Level, Night time**

dBA	Rec.
47.5	L45*
51.3	L46*
57.8	R73
57.8	R74
49	R75

*Commercial Property

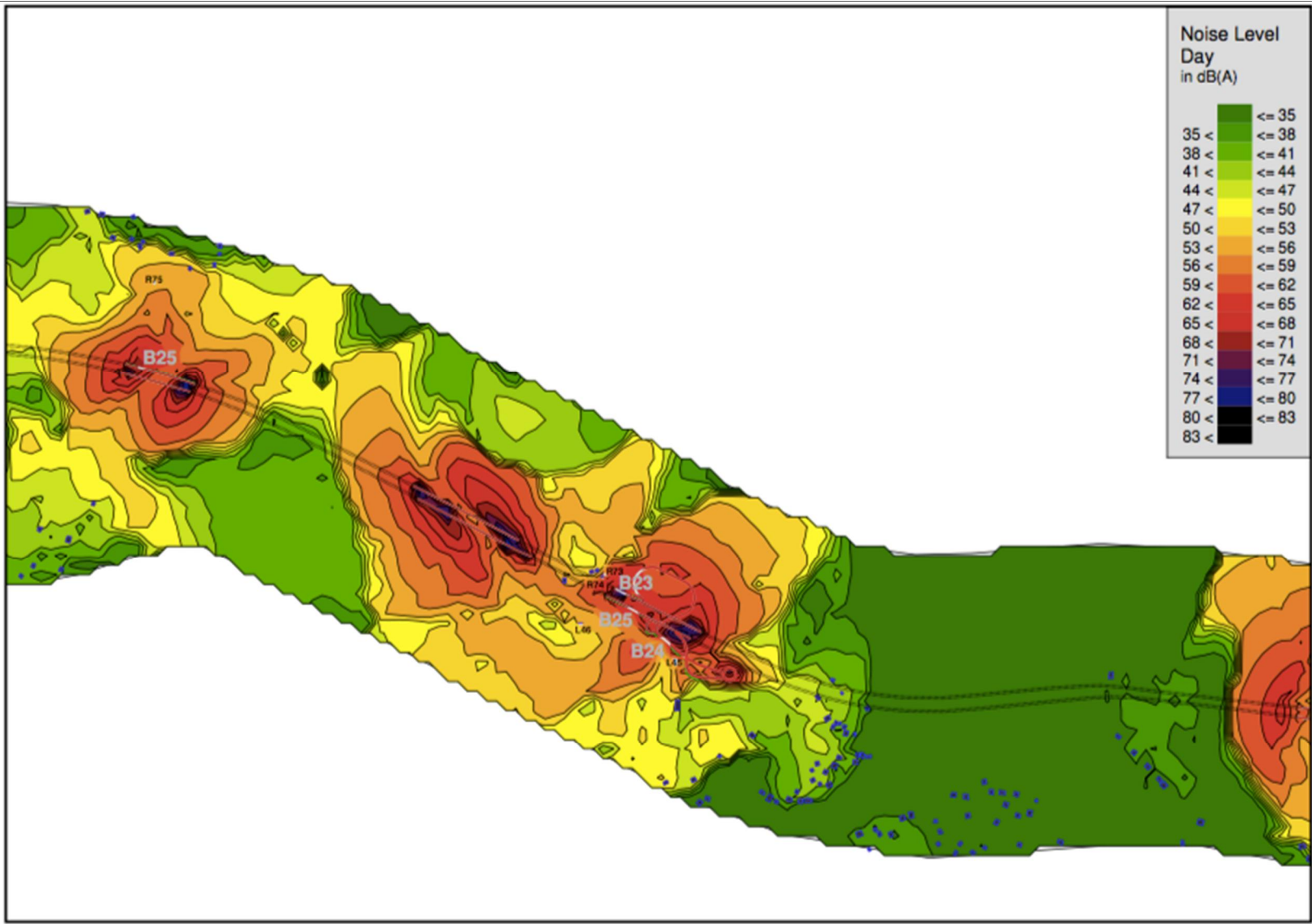


Figure 110: Predicted Noise Level, Daytime, with Noise Barrier

Rec.	dBA
L45*	54.3
L46*	56.7
R73	65.3
R74	65.8
R75	57

*Commercial Property

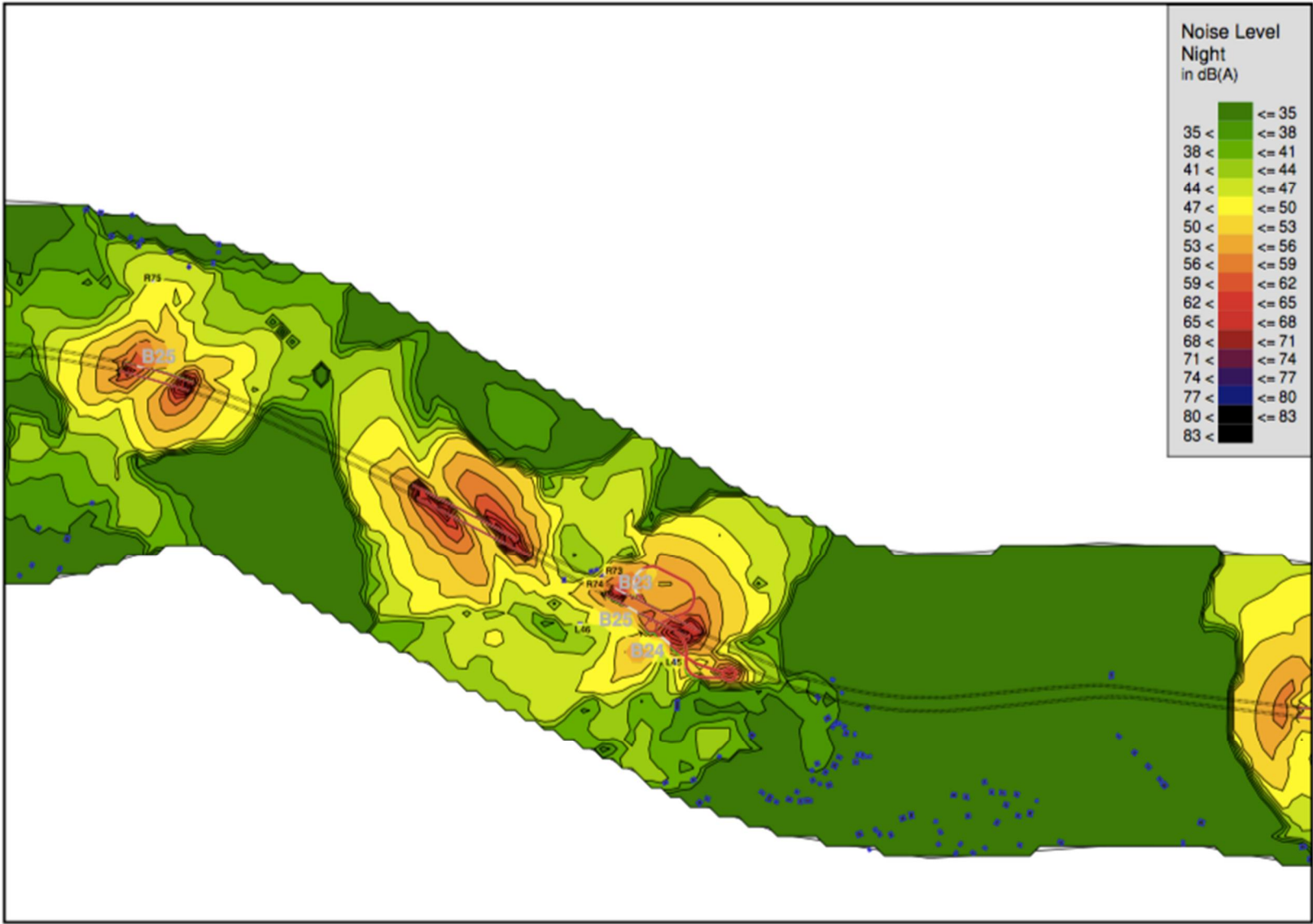


Figure 111: Predicted Noise Level, Night time with Noise Barrier

Rec.	dBA
L45*	46.2
L46*	48.7
R73	57.3
R74	57.7
R75	48.9

*Commercial Property

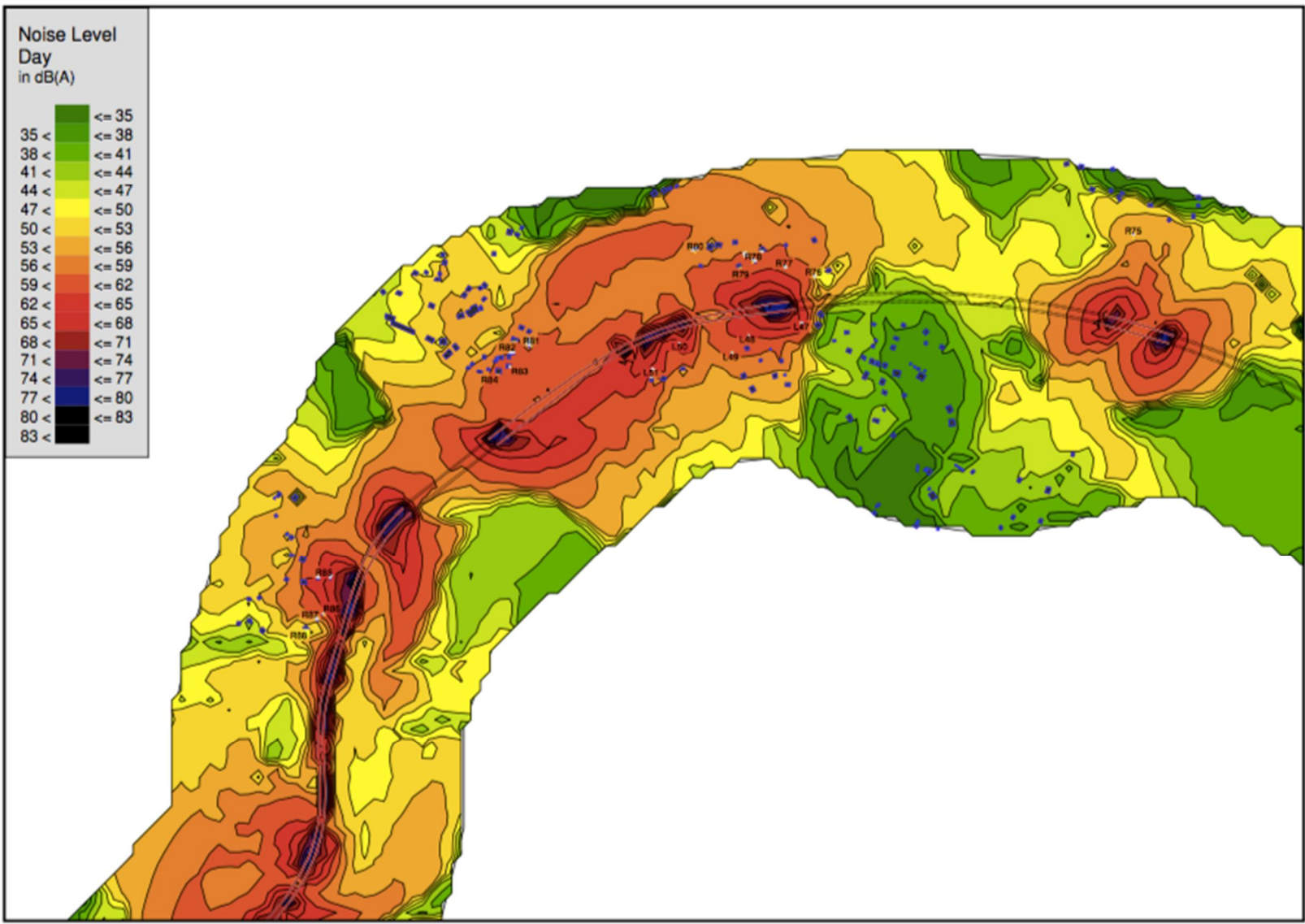


Figure 112: Predicted Noise Level, Daytime

dBA	Rec.
60	R76
62.7	R77
62.7	R78
60.9	R79
60.4	R80
61.9	R81
61.3	R82
61.3	R83
61.4	R84
69.2	R85
57.1	R86
53	R87
45.3	R88
60.7	L47
63.7	L48
61.4	L49
66.9	L50
66.7	L51

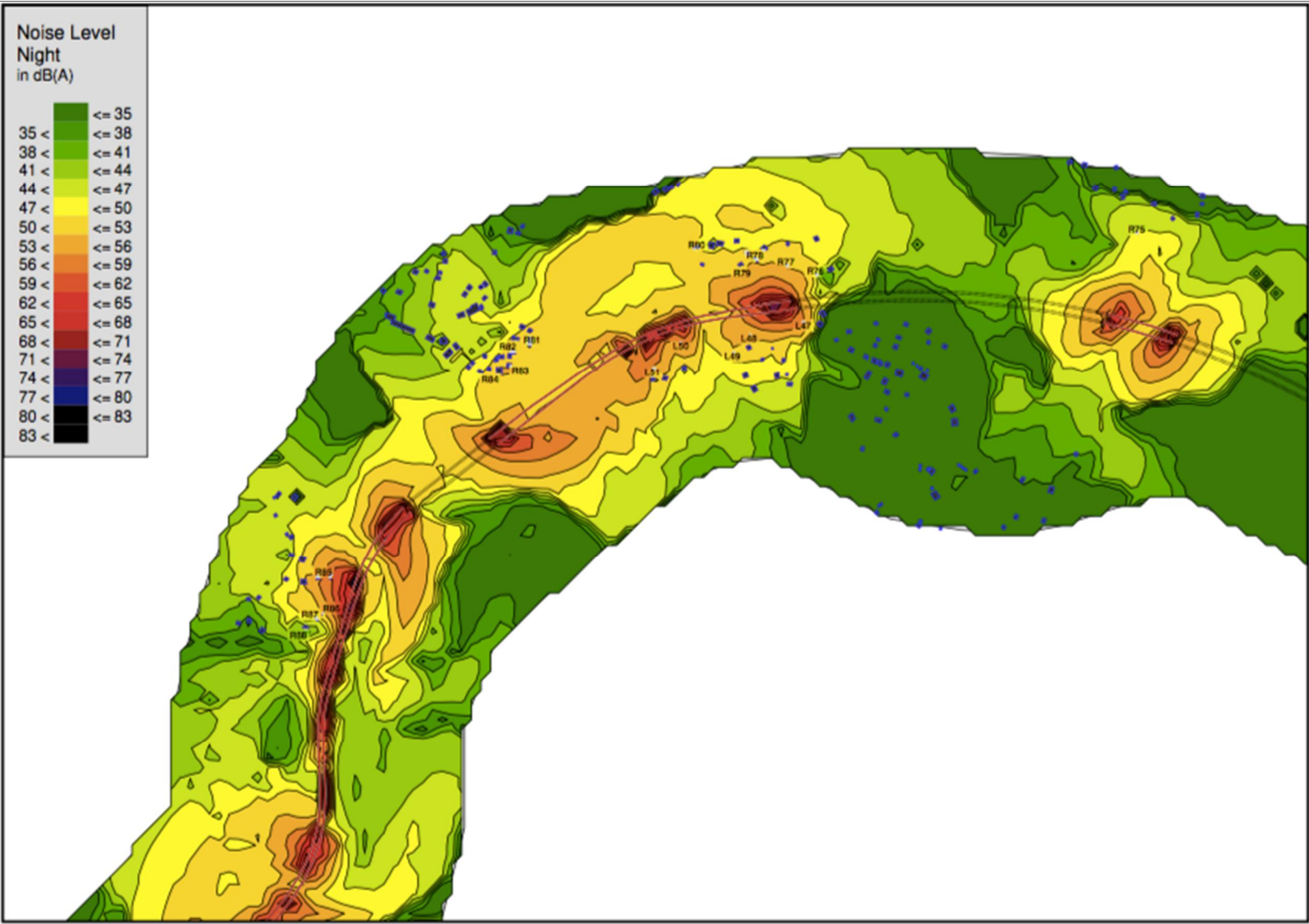


Figure 113: Predicted
Noise Level, Night time

dBA	Rec.
52	R76
54.7	R77
54.7	R78
52.9	R79
52.3	R80
53.8	R81
53.3	R82
53.3	R83
53.4	R84
61.2	R85
49	R86
44.9	R87
37.2	R88
52.7	L47
55.6	L48
53.3	L49
58.9	L50
58.7	L51

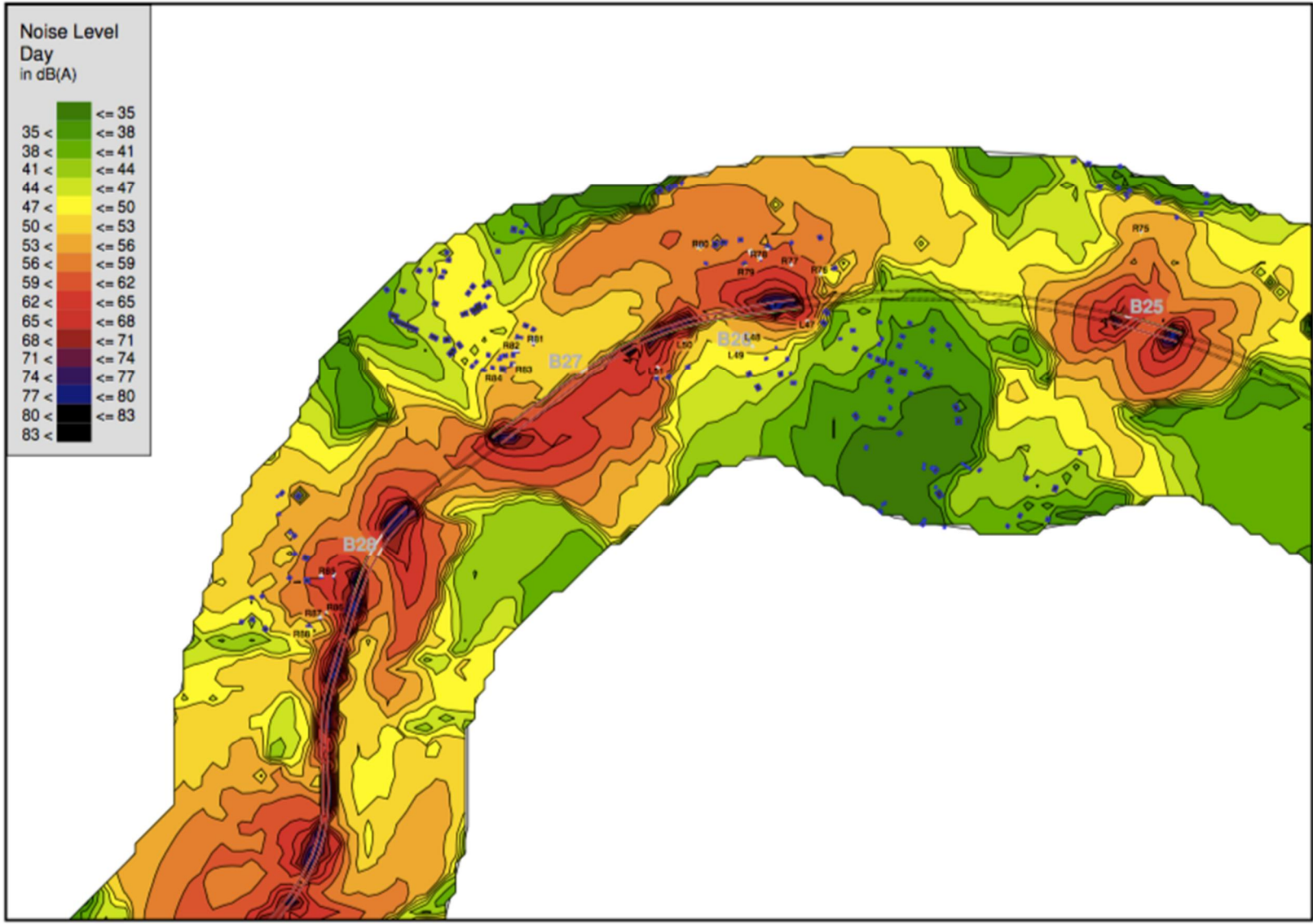
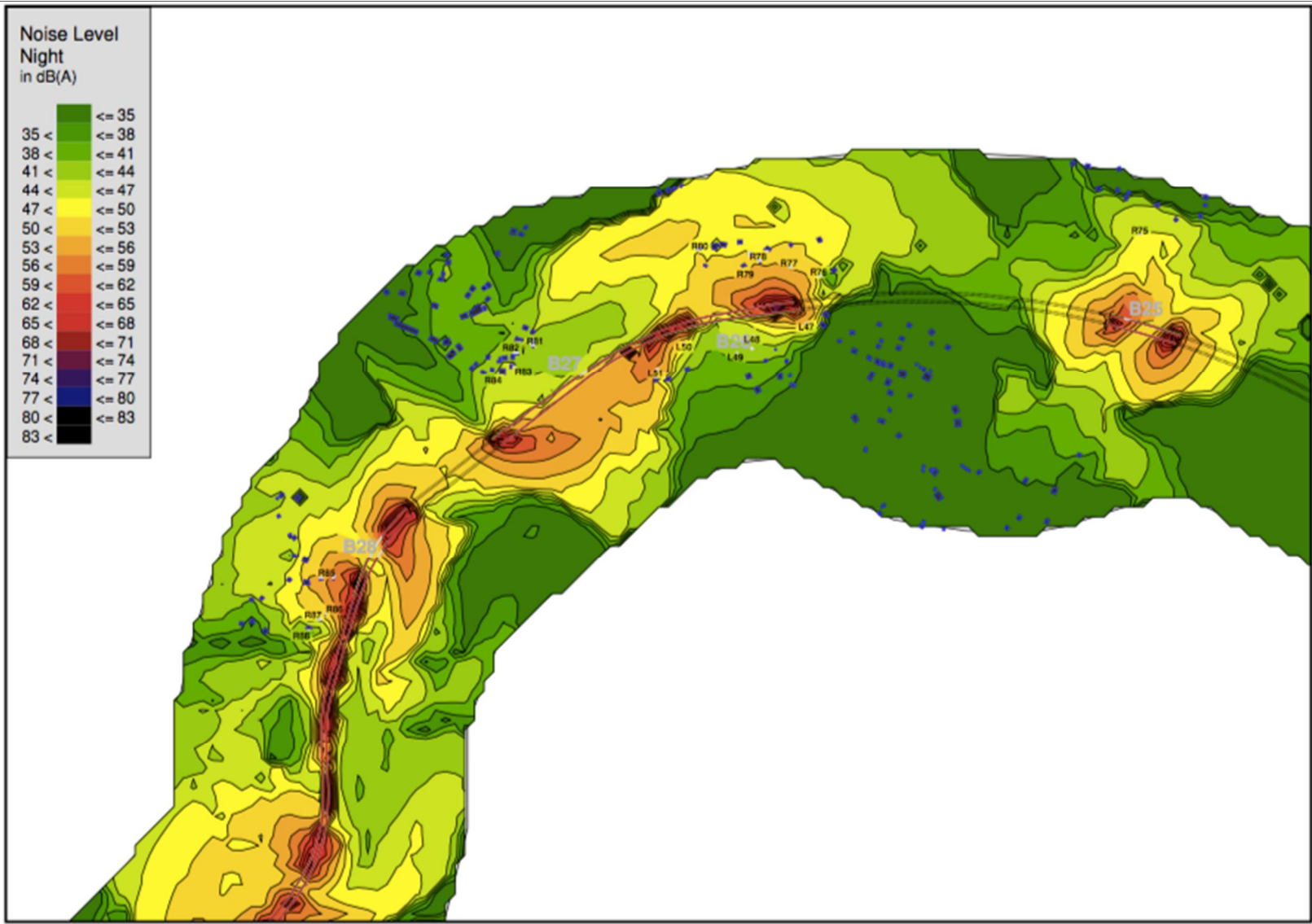


Figure 114: Predicted Noise Level, Daytime, with Noise Barrier

Rec.	dB(A)
R76	59.9
R77	62.7
R78	62.5
R79	60.8
R80	59.7
R81	53.7
R82	52.7
R83	51.7
R84	53.9
R85	67.1
R86	56.7
R87	52.9
R88	45.3
L47	57.2
L48	54
L49	50.9
L50	60.1
L51	66.7



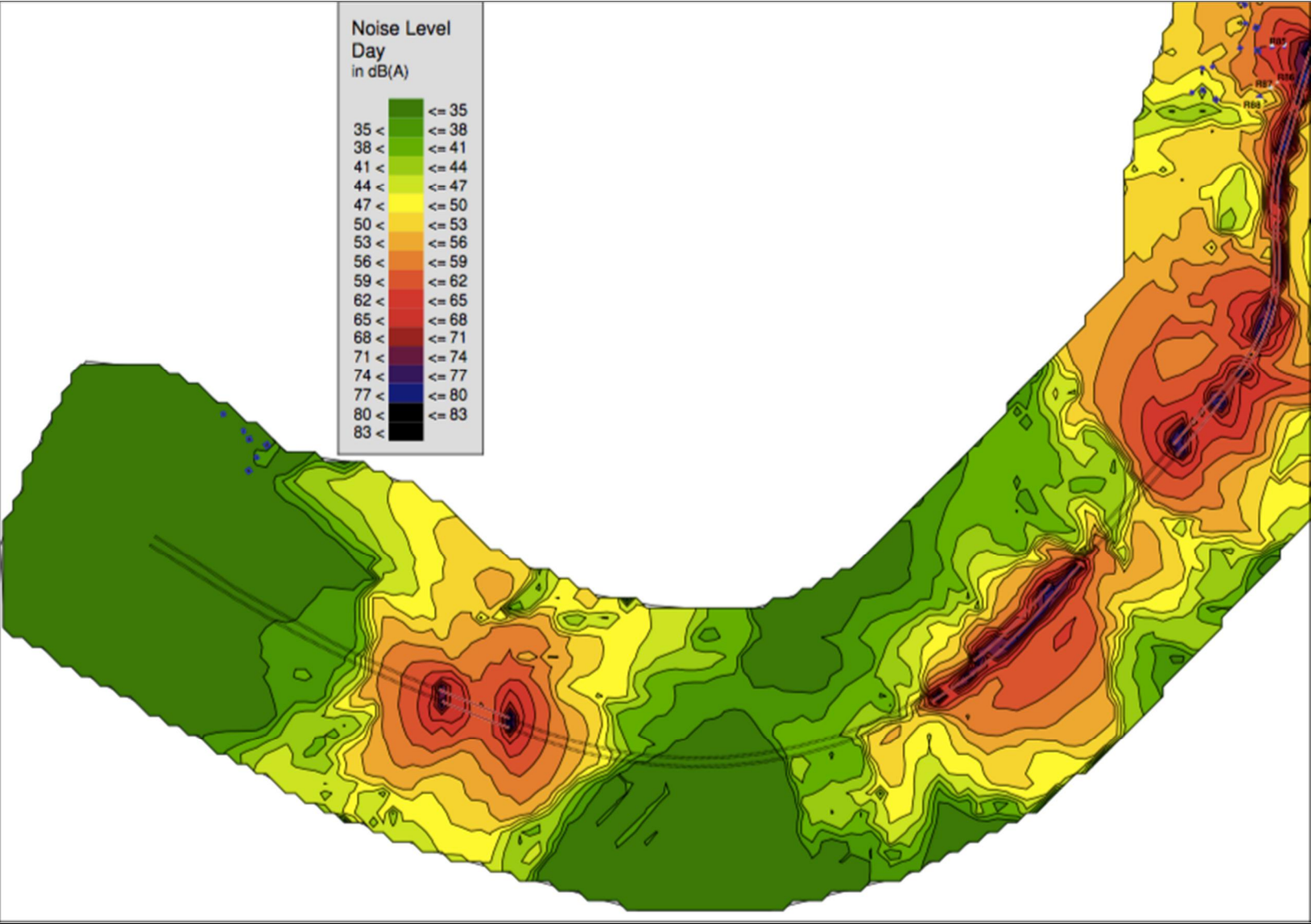


Figure 116: Predicted Noise Level, Daytime

No receptors

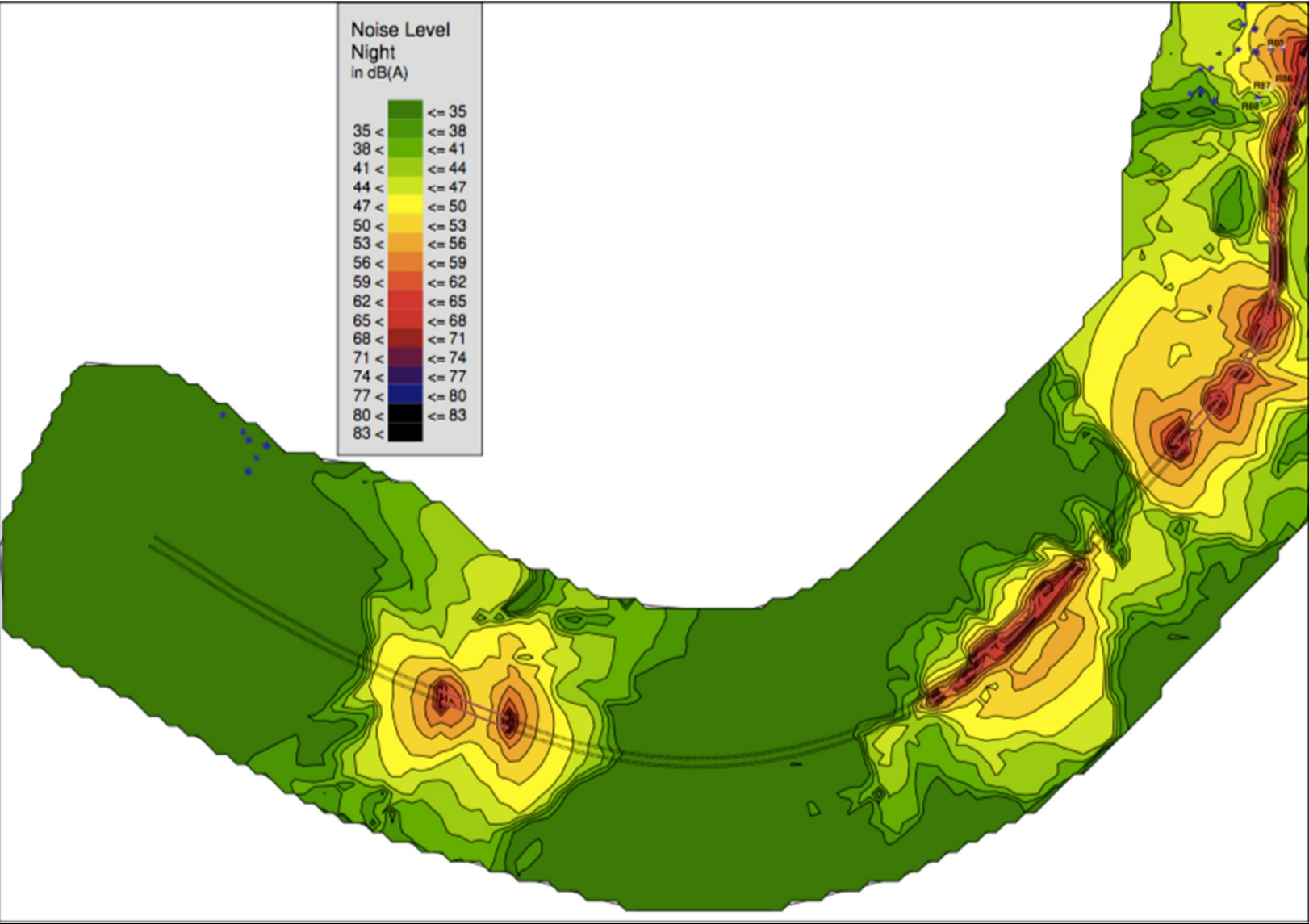


Figure 117: Predicted Noise Level, Night time

No receptors

An analysis of the results of the model has been undertaken below for each 'portion' which has been further divided into portion sub-sections for a more detailed analysis.

The analysis takes into account a model of the

Sub-section 1

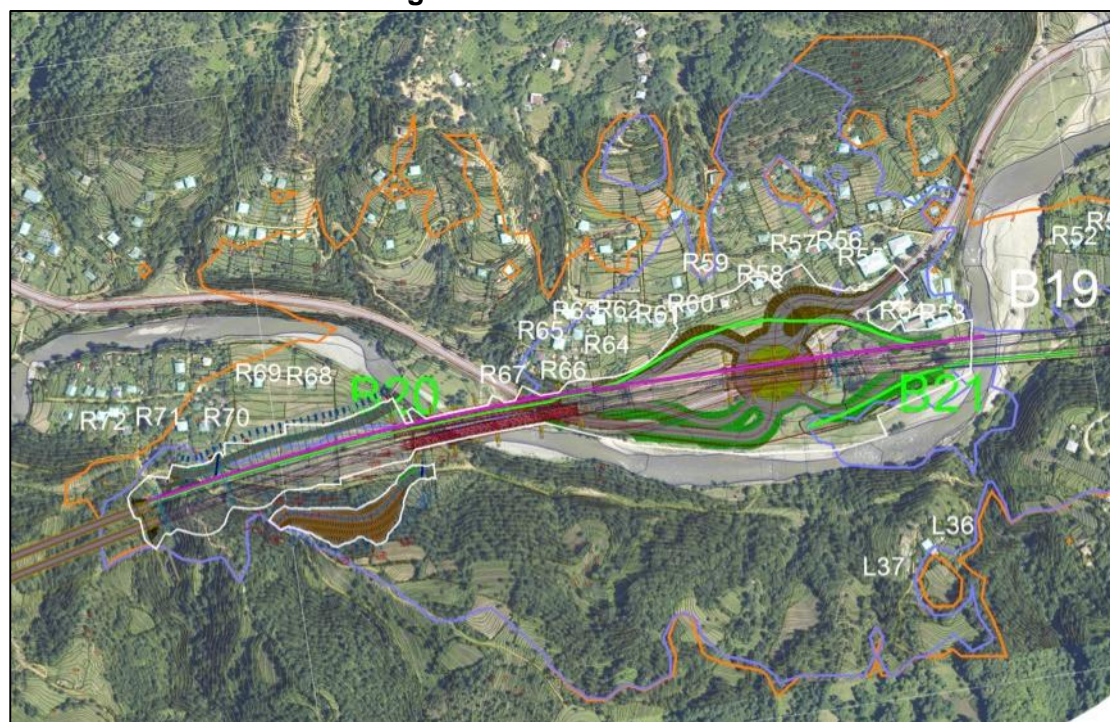
Analysis:

The noise model considers two noise barriers. Receptors L36 and L37 are part of F2 section, as such Barrier B21 is not discussed here.

In general the predicted noise for Receptors R66-R72 is within, or very close to 3dBA of the ambient noise levels Barrier B20 reduces noise levels below IFC standards for receptors.

Receptors R53 to R65 (with the exception are all impacted significantly by noise from the new alignment. The ambient modeled levels are exceeded by more than 10 decibels and in some instances by more than 19 decibels even with the introduction of Barrier B20. However, the barrier does reduce noise by 3-4 decibels – which is considered a doubling of noise level.

Figure 118: Sub-section 1



Key:

White line: Expropriation Buffer
Green Line: Noise Model Barrier
Magenta Line: Proposed Noise Barrier
Orange Line: Daytime Noise without Barrier
Purple Line: Daytime noise with Barrier

Recommendations:

1. Construct noise barrier B20 (approximate length 1,100m north side). The barrier (in Magenta) should be constructed along the main highway, and not curved around the ramps (shown in green).

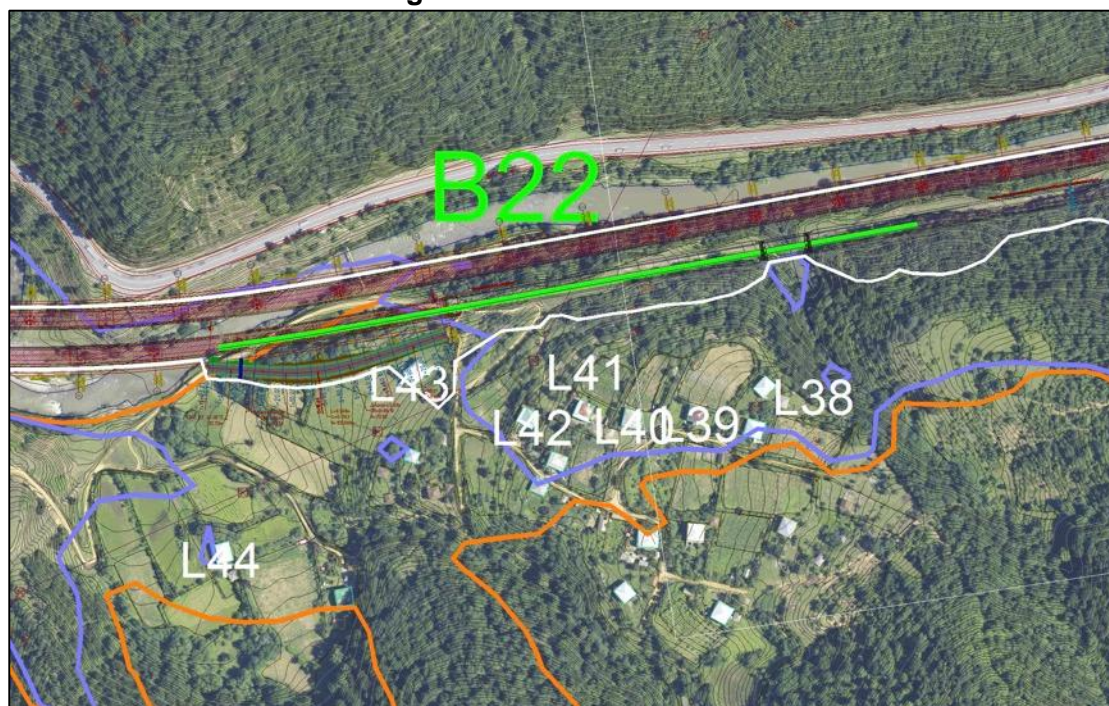
2. Monitor actual noise levels at the start of operation and then on an annual basis at receptors R53 to R67. If the noise levels at these receptors are more than the IFC daytime and nighttime standards, or 3 decibels above the modeled ambient additional noise mitigation should be considered. The RD shall consult with the affected owners to determine suitable noise management measures, such as noise proof windows.

Sub-section 2

Analysis:

The model shows that the noise barrier has little effect on receptors L38 to L41 which are located high above a new cut. Predicted noise levels are elevated considerably above the ambient in these locations (3-10 dBA). However receptors L42 to L44 do benefit from the introduction of the barrier with noise levels reduced to below, or close to ambient levels.

Figure 119: Sub-section 2



Key:

White line: Expropriation Buffer
Green Line: Noise Model Barrier
Magenta Line: Proposed Noise Barrier
Orange Line: Daytime Noise without Barrier
Purple Line: Daytime noise with Barrier

Recommendations:

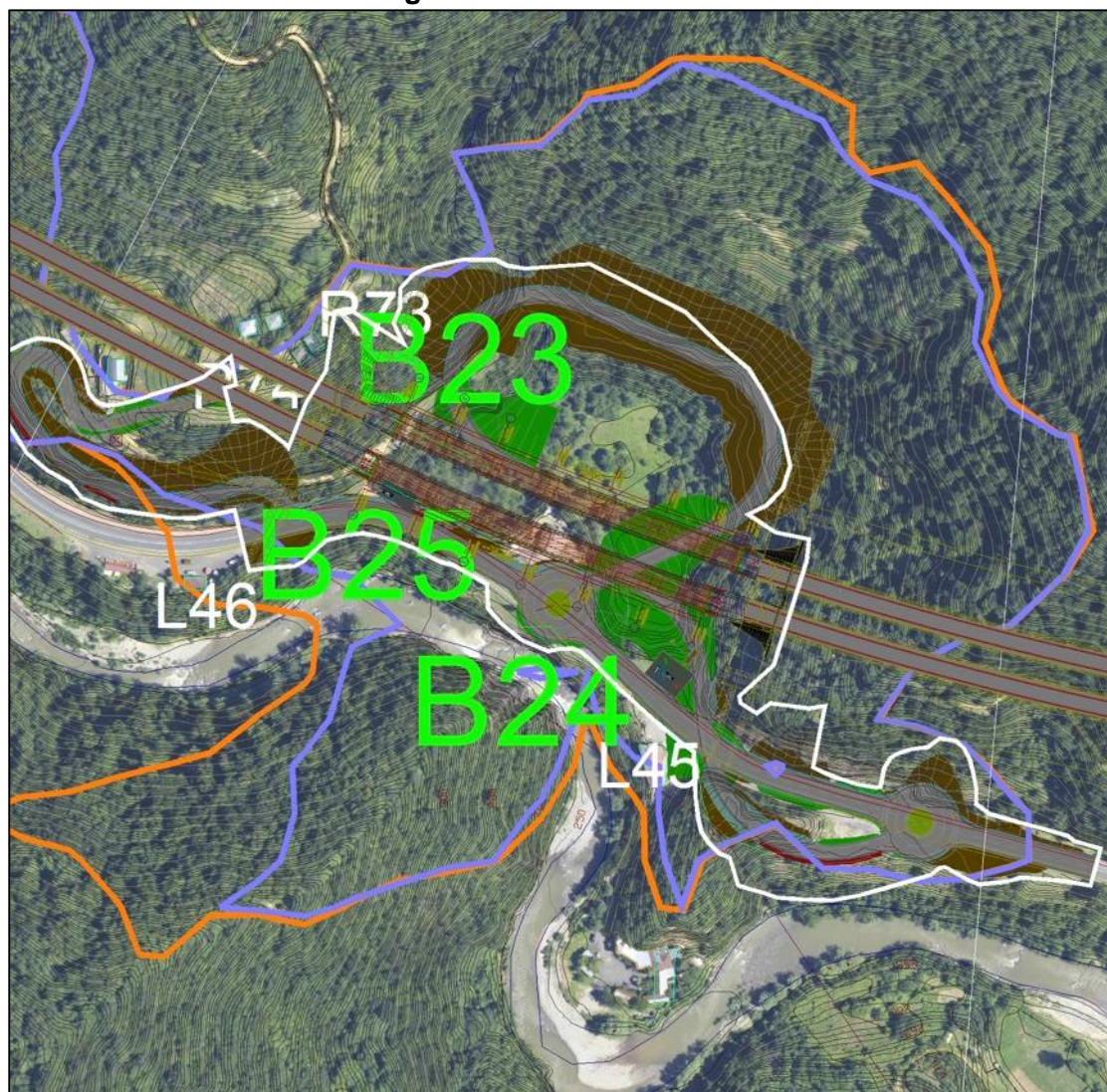
- Construct barrier B22 at the sections in front of receptors L42 to L44 (approximately 250 meters).
- Monitor actual noise levels at the start of operation and then on an annual basis at receptors L38 to L41. If the noise levels at these receptors are more than the IFC daytime and nighttime standards, or 3 decibels above the modeled ambient additional noise mitigation should be considered. The RD shall consult with the affected owners to determine suitable noise management measures, such as noise proof windows.

Sub-section 3

Analysis:

Receptors L45 and L46 are commercial properties. The predicted noise levels are below IFC standards for commercial properties. In any case the predicted noise levels at these locations are below the modeled baseline. The noise barrier, in its present location, does reduce nighttime noise to within 3dBA of the ambient at receptors R73 and R74, but does not have a noticeable impact on daytime noise.

Figure 120: Sub-section 3



Key:

White line: Expropriation Buffer
Green Line: Noise Model Barrier
Magenta Line: Proposed Noise Barrier
Orange Line: Daytime Noise without Barrier
Purple Line: Daytime noise with Barrier

Recommendations:

- Monitor actual noise levels at the start of operation and then on an annual basis at receptors R73 and R74. If the noise levels at these receptors are more than the IFC daytime and nighttime standards, or 3 decibels above the modeled

ambient additional noise mitigation should be considered. The RD shall consult with the affected owners to determine suitable noise management measures, such as noise proof windows.

Sub-section 4

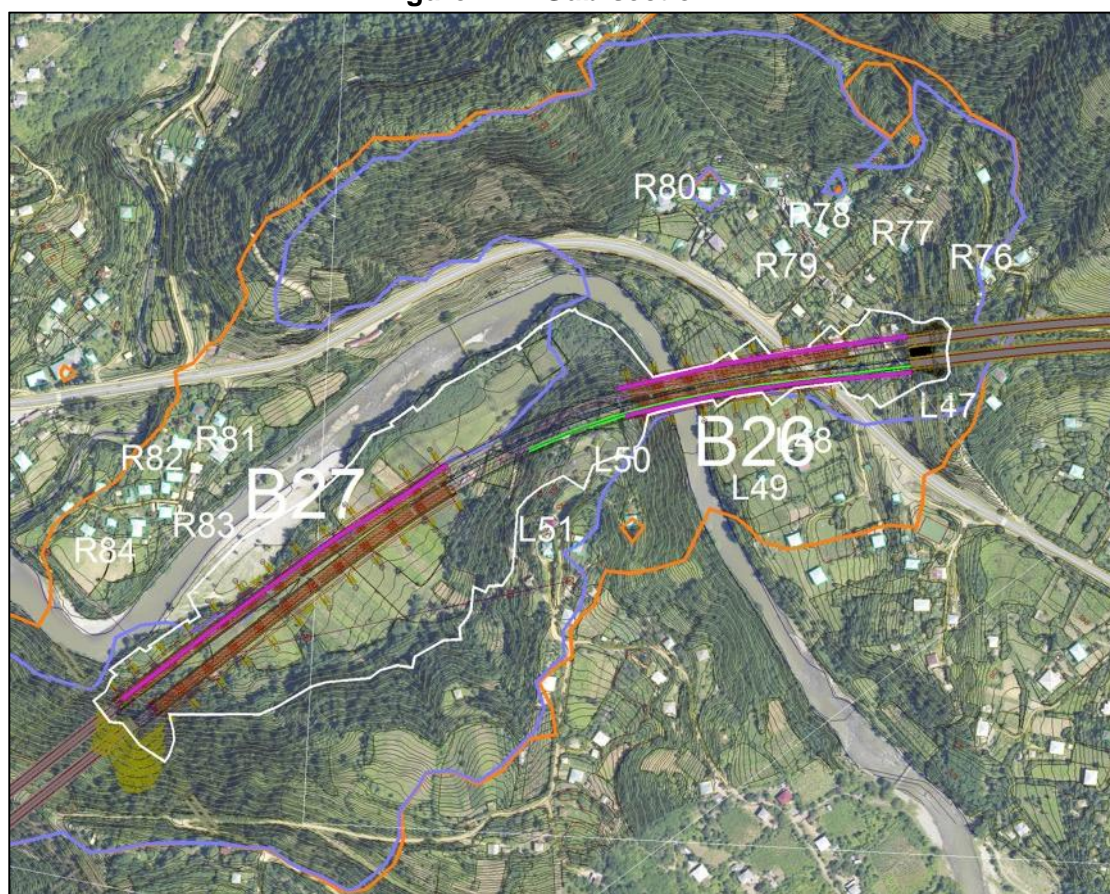
Analysis:

Barrier B26 has significant benefits to receptors L47 to L50 reducing noise levels in nearly all instances to within 3 decibels of the modeled ambient. The barrier affords no significant protection to receptor L51.

Receptors R76 to R79 are still above the IFC noise limits with the addition of the barrier B26, however, it is still considered beneficial in this location.

Barrier B27 has positive effects on receptors R81 to R84 putting them below IFC daytime and nighttime limits.

Figure 121: Sub-section 4



Key:

White line: Expropriation Buffer
Green Line: Noise Model Barrier
Magenta Line: Proposed Noise Barrier
Orange Line: Daytime Noise without Barrier
Purple Line: Daytime noise with Barrier

Recommendations:

- Installation of barrier B26 (300 m north side / 300m south side).
- Installation of barrier B27 (450 m north side).

- Monitor actual noise levels at the start of operation and then on an annual basis at receptors R76 to R79 and L51. If the noise levels at these receptors are more than the IFC daytime and nighttime standards, or 3 decibels above the modeled ambient additional noise mitigation should be considered. The RD shall consult with the affected owners to determine suitable noise management measures, such as noise proof windows.

Sub-section 5

Analysis: Receptors R87 and R88 will be below IFC daytime and nighttime standards in the modeled scenario. Receptors R85 and R86 will be subject to a significant rise in noise levels. Noise barriers have no significant benefits to these receptors.

Recommendations:

- Monitor actual noise levels at the start of operation and then on an annual basis at receptors R87 and R88. If the noise levels at these receptors are more than the IFC daytime and nighttime standards, or 3 decibels above the modeled ambient additional noise mitigation should be considered. The RD shall consult with the affected owners to determine suitable noise management measures, such as noise proof windows.

G.8.7.11 Operational Phase Noise Mitigation

As noted above, a number of potential mitigation measures are proposed for the Project. The following summarizes each of them.

Noise Barriers – The following noise barriers are recommended:

Table 98: Proposed Noise Barriers

Barrier ID	Proposed Length (m)	Height (m)
B20	1,100	4
B22	250	4
B26	600	4
B27	450	4

Routine Noise Monitoring – Monitoring of the Receptors discussed above should be undertaken on an annual basis to determine actual noise levels at these locations. If noise levels are above IFC limits, the RD shall consult with the effected owners to determine a suitable mitigation measures including for example:

- Fencing around individual properties;
- Planting of vegetation around the border of properties;
- Construction of earth embankments around groups of properties;
- Installation of sound proof windows in properties; and
- Expropriation / Compensation.

Residual Impacts – Implementation of the recommended mitigation and management measures will help to reduce noise levels at many locations. However, at some receptors noise levels may rise above IFC standards during the operational phase of the Project. Monitoring of these sites will be required on an annual basis to

determine actual noise levels in these areas, and where they exceed IFC standards the RD will consult with the affected owners to determine the most acceptable noise mitigation measures, including for example noise proof windows. There may be some vibration and noise nuisance during the construction phase of the Project, due to unforeseen events, but in general the measures outlined should ensure that all issues are suitably management and mitigated to prevent any long term significant impacts.

G.8.8 Induced and Cumulative Impacts

Induced impacts are not anticipated to be significant in this 12km section of road. The cumulative impacts of the Project relate mainly to the combined effect of F2, F3 and F4 which will be constructed more or less simultaneously. It is also noted that construction will soon begin on Section F1 (Rikoti Tunnel to Khevi) and has already started on Section F0 (before Rikoti Tunnel).

The key cumulative impacts identified are:

- Construction Traffic – Most construction vehicles will be operating within their specific section (and even the Contractors individual 'Lot'), however, there will also be numerous daily vehicle movements across all three sections for the delivery of materials and the movement of spoil material. These combined vehicle movements will have impacts to noise and air quality along the road, in addition to the potential safety aspects that come with the movement of as many as 1,000 construction vehicles per day along the combined F2, F3 and F4 section.
- Construction Camps – There are, potentially six construction 'Lots' for the all three sections. This means that there could be six different contractors as well as at least three supervision engineers. Each one will need their own construction camps and offices. As noted above, the valley is rather constrained in terms of land availability and six construction camps could place a strain on the local population and the ecology of the area.

668. The mitigation measures proposed are as follows:

- Construction Traffic – The RD shall coordinate with the Contractors and supervision engineers of all Lots to ensure that traffic management plans are aligned and to coordinate traffic movements through urban areas.
- Construction Camps – Efforts should be made by the RD to coordinate with all Contractors to ensure that facilities and camps are located along the alignment in such a way to minimize impacts to local communities and biodiversity. That means, for example, avoiding placing multiple camps close to villages and sharing of resources, such as asphalt plants and concrete batching plants.

Residual Impacts – *Successful coordination of the Contractors traffic management plans and siting of construction camps should mitigate the cumulative impacts.*

G.8.9 Compliance Impacts

In addition to the impacts associated with the construction and operation phases of the project several compliance impacts have also been identified as follows:

1. Lack of Environmental Clauses in Contracts – The EIA is an environmental statement prepared by the RD. While it is prepared by the EIA consultant the EIA defines the commitment by the GoG through the proponent and its contractors and consultants, to implement the mitigation and monitoring actions listed in the

EIA. For the measures proposed in the EIA's EMP to be taken seriously, they must become legally binding through inclusion as environmental clauses in the loan agreement between the GoG and EIB as well as the specifications in the contract-bid documents. This will be achieved by integrating the EMP into the contract specifications as a clause and using the EMP to prepare the SEMP defining specific steps to be taken by the contractors and the government during the project construction phase. References to the EMP will be made in the loan agreement between the GoG and EIB. It will be the Engineers responsibility to review the environmental mitigation and monitoring activities undertaken by the Contractor, with payments made only after verification that each work component has been completed as prescribed.

2. Lack of Construction Compliance Inspection Services and Environmental Training – While the EMP and the environmental covenants can be very clear and specific, if there is no one knowledgeable to undertake compliance monitoring, inspection and regular reporting, little of the EMP will be implemented or completed. The Engineer, through his National Environmental Specialist (NES) and International Environmental Specialist (IES), will ensure that compliance inspections are undertaken on a regular basis. In addition, the Engineers IES will also provide training to the Contractor and his Environmental Officer in the correct implementation of the SEMP's prior to the commencement of works

H. Environmental Management Plans and Institutional Requirements

H.1 Introduction

The EMP herewith provides the overall Project environmental management framework. It provides summary information of the types of impacts, which are described in detail in **Section G**. It also provides detailed information about the required mitigation and monitoring measures, their implementation arrangements reporting requirements. In addition, the approximate costs of the EMP are outlined.

H.2 Environmental Management Plan

Table 99, Table 100 and Table 101 provides the environmental mitigation and observational monitoring for the Project during the pre-construction, construction and operational phases of the Project respectively.

H.3 Instrumental Monitoring Plan

Regular monitoring of air quality, water quality and noise levels against Georgian and IFC standards shall be carried out throughout the construction and commissioning periods. The party responsible for monitoring will be the Engineer who will report the results monthly to the RD. The reports shall clearly indicate the monitoring dates, times, locations, weather conditions, types of equipment used and calibration information. Table 102 provides the monitoring actions required during the construction phase of the Project. Table 103 provides the monitoring actions for the operational phase of the Project.

Table 99: Environmental Management Plan - Detailed Design / Pre-construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Construction impacts	Preparation of an Air Quality Plan (AQP) which shall include the locations of haul routes and the items specified under Section F.5.1 of this EIA.	<ul style="list-style-type: none"> Contractor to prepare AQP Engineer to review and approve AQP. 	N/A	N/A
	Air quality impacts from stationary sources	<ul style="list-style-type: none"> Locations for concrete batching plants require approval from the Engineer and MoEPA and all necessary permits. All of the above facilities will also have the appropriate GoG permits and licenses. No batching plant shall be located within 500 meters of any urban area or sensitive receptor. 	<ul style="list-style-type: none"> Contractor to select sites. Engineer and MoEPA to approve sites. 	N/A	N/A
Land Use	Loss of land and Property	Before the commencement of the construction works of the Project at any road, the RD must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of EIB and then implement the plan and acquire the land.	<ul style="list-style-type: none"> RD to prepare the LARP. EIB to approve the LARP. RD to implement the LARP. 	N/A	N/A
	Tree cutting	The LARP shall also contain the compensation methods and payments for loss of trees on private land.	<ul style="list-style-type: none"> RD to prepare the LARP. EIB to approve the LARP. RD to implement the LARP. 	N/A	N/A
Climate Change	Damage to roads and drainage systems due to increased flooding and more intense rainfall.	<p>As part of the detailed design, the following measures will be considered:</p> <ul style="list-style-type: none"> Increase ditch and culvert capacity; Maintain positive cross slope to facilitate flow of water from surface; Increase pavement resistance to rutting; Reduce splashing/spray through porous surface mixtures; More frequent use of elevated pavement section; Improve visibility and pavement marking demarcation; and 	<ul style="list-style-type: none"> Engineer to review design documents prior to the start of construction and make any additions as necessary. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A

		<ul style="list-style-type: none"> Ensure that all embankments are seeded to help increase stability. 			
Soils	Loss of Agricultural Soils	Before the commencement of the construction works of the Project at any road, the RD must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of EIB and then implement the plan and acquire the land.	<ul style="list-style-type: none"> RD to prepare the LARP. EIB to approve the LARP. RD to implement the Plan. 	N/A	N/A
Hydrology	Bridge Construction	<ul style="list-style-type: none"> All new bridges shall be designed for the life expectancy of 100 years. A design discharge of 100 years return period is considered for bridges. Bridge designs should ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. The bridge run-off waters should lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off and prevent pollution of surface water courses. The bridge design and layout must be aesthetically pleasing and in harmony with the existing environment. 	<ul style="list-style-type: none"> DD Consultants Engineer to review design documents prior to the start of construction. 	N/A	N/A
		<ul style="list-style-type: none"> Establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period. 	<ul style="list-style-type: none"> Contractor to consult with MoEPA regarding fish spawning periods. Contractor to inform Engineer of any periods of construction restriction based on the consultations with MoEPA. 	N/A	N/A
	Culverts	A design discharge of 50 years return period is considered for culverts.	<ul style="list-style-type: none"> DD Consultants Engineer to review design documents prior to the start of construction. 	N/A	N/A
	Tunneling	Contractor shall develop a ground water management plan for each tunnel under which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works.	<ul style="list-style-type: none"> Contractor to prepare plan. Engineer to review and approve plan. 	N/A	N/A

	Siting of facilities	No construction camp, permanent or temporary, shall be located within 500 meters of any river, or irrigation channel (not including drainage channels) including the Dzirula and its tributaries.	<ul style="list-style-type: none"> Contractor to select sites. Engineer and MoEPA to approve sites. 	N/A	N/A
Flora & Fauna	Land clearance	<ul style="list-style-type: none"> The Contractor shall prepare a Clearance, Re-vegetation and Restoration Management Plan for prior approval by the Engineer. The Clearance Plan shall be followed strictly by the contractor. Areas to be cleared should be minimized as much as possible. Prior to the commencement of works the Contractor shall stake the boundary of the entire site, including intersections and areas under bridges. The Contractor will then undertake a survey of all trees within 5 meters of the boundary of the staked site and identify if any Georgian red-list species are located within this zone. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. All temporary construction facilities should be located on already heavily disturbed ground where secondary forest growth has not yet become well-established. 	<ul style="list-style-type: none"> Contractor to prepare and implement Plan. Engineer to review and approve plan. Contractor to survey trees for vulnerable species. 	N/A	N/A
	State Forest Fund	Prior to cutting trees in the identified State Forest Fund areas, it is required to obtain permit (Decree of the Government of Georgia on the "exclusion of certain areas from the State Forest Fund"), also known as 'delisting' the trees from the State Forest Fund and for compensation payments to be made.	<ul style="list-style-type: none"> RD to obtain permit and submit to Engineer for review. Engineer to review permit. RD to make compensation payments. 	N/A	N/A
	Impacts to Protected Areas	<ul style="list-style-type: none"> No haul route will pass through a protected area. 	<ul style="list-style-type: none"> Contractor to implement mitigation. 	N/A	N/A
	Impacts to birds from street lighting	<ul style="list-style-type: none"> Ensure that lower wattage lamps are used in street lights which direct light downwards to reduce glare. 	<ul style="list-style-type: none"> DD Consultants to incorporate the measures. 	N/A	N/A

Construction Camps	Selection of Construction Camp Site	<ul style="list-style-type: none"> Preparation of a Construction Camp Site Plan. Preparation of a Spills Response Plan. Construction camps shall not be located within one kilometer of an urban area and at least 50 meters from any surface water course and not within 2 kilometers of a protected area. Coordinate all construction camp activities with neighboring land uses. 	<ul style="list-style-type: none"> Engineer to review & approve Plans. Engineer and RD to approve camp locations. 	N/A	N/A
Transportation and Utilities	Damage to roads	Prior to the commencement of works a road condition survey will be undertaken to record the condition of access roads to asphalt plants, camps, etc.	<ul style="list-style-type: none"> Engineer to complete road condition survey. Contractor to review and agree to the findings of the road condition survey. 	N/A	N/A
	Traffic management	Preparation of a traffic management plan as part of the SEMP.	<ul style="list-style-type: none"> Contractor to prepare plan. Engineer to review and approve plan. 	N/A	N/A
Occupational Health and Safety	Worker Health and Safety	<ul style="list-style-type: none"> Prepare an Occupational Health and Safety Plan (OHS Plan), including the items specified by Section F.8.3 of this EIA. Ensure that sub-contractors are provided with copies of the SEMP and that they adhere to the content of the SEMP. 	<ul style="list-style-type: none"> Contractor to prepare OHS Plan. Contractor to provide copies of the SEMP to sub-contractors prior to their access to the site. Engineer to review and approve OHS Plan. 	N/A	N/A
	Traffic Safety	Submit a Traffic Management Plan (TMP) to local traffic authorities prior to mobilization.	<ul style="list-style-type: none"> Contractor to prepare TMP. Engineer to approve TMP. 	N/A	N/A
Emergency Response	Fires, explosions, earthquake, etc.	Preparation of an Emergency Response Plan (ERP).	<ul style="list-style-type: none"> Contractor to prepare ERP Engineer to review and approve ERP. 	N/A	N/A
Waste Management	Management of waste materials	<ul style="list-style-type: none"> Preparation of a waste management plan, including measures to re-use and recycle wastes and measures to dispose of hazardous waste. 	<ul style="list-style-type: none"> Contractor to prepare Plans Engineer to review 	N/A	N/A

Section F3 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

		<ul style="list-style-type: none"> Preparation of a construction camp management plan to manage liquid wastes. 	and approve Plans.		
	Tunnel and Embankment Spoil	<ul style="list-style-type: none"> Preparation of a Spoil Re-use and Disposal Plan according to Section F.8.3. 	<ul style="list-style-type: none"> Contractor to prepare plan. RD and Engineer to review and approve the plan. 		
PCR	Chance Finds	The Contractor shall prepare a chance find procedure in line with the requirements of the GoG. Appendix E provides a sample procedure.	<ul style="list-style-type: none"> Contractor to prepare Plans Engineer to review and approve Plans. 	N/A	N/A
Noise	Noise barriers	Include areas for the installation of the identified noise barriers in Table 98 in the detailed design.	<ul style="list-style-type: none"> Detailed Design Consultant. 	N/A	N/A
Vibration	Construction vibration	The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule.	<ul style="list-style-type: none"> Contractor to prepare Plans Engineer to review and approve Plans. 	N/A	N/A
SEMP Requirement	Preparation of SEMP	Prepare SEMP.	<ul style="list-style-type: none"> Contractor to prepare SEMP. Engineer to review and approve SEMP. 	N/A	N/A
	Incorporation of Items into Bid Documents	A specific environmental and social section shall be included within the main Bid Documents indicating that the Contractor shall be responsible for conforming with the requirements of this EMP.	<ul style="list-style-type: none"> RD to ensure EMP is included within Bid Documents. 	N/A	N/A
Project Awareness	Stakeholder Awareness	Prior to start of site works residents, business representatives in the project area, local authorities and other stakeholders, including NGOs, who are likely to be affected by the project or are interested in the project) shall be informed on the construction schedule and activities, potential environmental impacts and mitigation measures through public meetings at each affected community.	<ul style="list-style-type: none"> RD to undertake public meetings. 	N/A	N/A
	GRM	Prior to start of site works, the Contractor shall: <ul style="list-style-type: none"> Communicate the GRM to communities in the project impact zone. Set-up and publicize a 24-hour hotline for complaints. Ensure that names and contact numbers of 	Contractor	N/A	N/A

		representatives of GRCE and the Contractor are placed on the notice boards outside the construction site.			
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Table 100: Environmental Management Plan - Construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Open burning of waste materials	No burning of debris or other materials will occur at any camp or construction site.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Rock-crushing plant	<ul style="list-style-type: none"> Rock crushing plant equipment shall be fitted with water sprinklers that will run continuously while the plant is operational. If the sprinklers stop working, the plant shall also cease operation until the sprinklers are functioning. Water run-off from the sprinkler system shall not discharge directly to surface water courses without first passing through a silt trap or any other suitable device to prevent siltation of surface waters. 	<ul style="list-style-type: none"> Contractor to implement mitigation. Engineer to routinely monitor Contractors activities. 	Engineers NES	Daily site inspections, throughout construction period.
	Exhaust emissions from the operation of construction machinery	<ul style="list-style-type: none"> No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer. 	<ul style="list-style-type: none"> Contractor to implement mitigation. Engineer to routinely monitor Contractors activities. 	Engineers NES	Daily site inspections, throughout construction period.
	Emissions from Construction vehicles.	<ul style="list-style-type: none"> Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered: Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine 	<ul style="list-style-type: none"> Contractor to implement mitigation. Engineer to routinely monitor Contractors activities including vehicle maintenance records. 	Engineers NES	<ul style="list-style-type: none"> Daily site inspections, throughout construction period. Annual inspection of

		<p>maintenance programs.</p> <ul style="list-style-type: none"> • Drivers should be instructed on a routine basis by the Contractors EM on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits. • Implement a regular vehicle maintenance and repair program. 			vehicle maintenance records.
	Fugitive emissions.	<ul style="list-style-type: none"> • Conveyor belts (e.g. at batching plants and rock crushing plants) shall be fitted with wind-boards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize dust emission. • 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 25 °C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. • Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community. 	<ul style="list-style-type: none"> • Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities. 	Engineers NES	Daily site inspections, throughout construction period.
Soils Erosion and Soil Contamination	Contamination of Soils	<ul style="list-style-type: none"> • All fuel and chemical storage will be sited on an impervious base within a bund and secured by fencing. • The storage area will be located away from any watercourse or wetlands. • The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund). • The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills (including oil interceptor tanks), there will be no vehicle maintenance activities on open ground. • Filling and refueling will be strictly controlled and subject to formal procedures. • Drip pans will be placed under all filling and 	<ul style="list-style-type: none"> • Contractor to implement mitigation. • Engineer to review and approve bunding prior to the start of construction. • Engineer to review and approve vehicle fueling area prior to the start of construction. 	Engineers NES	Daily site inspections, throughout construction period.

		<p>fueling areas. Waste oils will be stored and disposed of by a licensed contractor.</p> <ul style="list-style-type: none"> • All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding. • Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing. • Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils. 			
	Loss of topsoil	<ul style="list-style-type: none"> • Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Rip ground surface prior to the spreading of topsoil. • Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. • Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the RoW, as much as possible, to avoid soil compaction and damage to privately owned land. • If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

	Soil Erosion	<ul style="list-style-type: none"> Material that is less susceptible to erosion will be selected for placement around bridges and culverts. Re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local flora; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
Hydrology	Ground and surface water pollution.	<ul style="list-style-type: none"> Implementation of the specific mitigation measures outlined under Construction Camps, below and Soil Contamination above. Provide portable toilet facilities for workers at road work sites. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Groundwater depletion	<ul style="list-style-type: none"> Routine monitoring of groundwater levels in groundwater wells in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating, in line with his groundwater management plan. The monitoring shall continue for a two month period after the tunnel is sealed. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the groundwater levels are recharged. Monitoring shall continue for a two month period after the completion of the tunnels. If the wells fail to re-charge, new boreholes will be constructed for affected persons. 	Contractor to implement mitigation	Engineers NES	Weekly review of groundwater monitoring reports.
	Bridges	<p>The Contractor will:</p> <ul style="list-style-type: none"> Divert the water flow near the bridge piers. Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams. Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a 	Contractor to consult with MoEPA and provide copies of letters confirming construction periods to the Engineer.	Engineers NES	Routine monitoring of bridge works to ensure they are in compliance with MoEPA guidelines.

		<p>containment unit.</p> <ul style="list-style-type: none"> • Carry out bridge construction works without interrupting the traffic on the existing road with the provision of suitable diversions. • Ensure no waste materials are dumped in the river, including re-enforced concrete debris. • Place generators more than 20 meters from the river. • Ensure that no concrete waste from concrete mixers is dumped in the river. • Provide areas where concrete mixers can wash out leftover concrete without polluting the environment. This may be in the form of a lined settling pond at each bridge site. Drivers will be informed of these locations and the requirements to use these settling ponds on a routine basis by the Engineer. Dried waste from the settling ponds can be used as backfill for culverts, etc. • Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment. • Ensure that no hazardous liquids are placed within 10 meters of the river. • Provide portable toilets at bridge construction sites to prevent defecation by workers into the river. • Ensure that workers are provided with correct PPE including harnesses. • During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river. • In addition, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period. 			
	Drainage and Flooding	<ul style="list-style-type: none"> • During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to 	Contractor to implement mitigation.	Engineers NES	Monitor drainage channels on a weekly basis.

		<p>properties and land by flooding and silt washed down from the works.</p> <ul style="list-style-type: none"> • Arrange with the village representatives those works which might interfere with the flow of irrigation waters to be carried out at such times as will cause the least disturbance to irrigation operations. • Should any operation being performed by the Contractor interrupt existing irrigation facilities, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. • The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. 			
	Dewatering of tunnels	The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase.	<ul style="list-style-type: none"> • Contractor to implement mitigation. • Engineer to review and approve settlement tank locations and designs. 	Engineers NES	<ul style="list-style-type: none"> • Review of weekly water monitoring results. • Weekly inspection of settlement tanks.
	Water Supply	Only legally permitted water resources shall be used for technical water supply, including rivers.	Contractor to implement mitigation. Engineer to review all water extraction permits.	Engineers NES	<ul style="list-style-type: none"> • Weekly inspections, throughout construction period. • Annual review of permits.
Flora & Fauna	Tree cutting	<ul style="list-style-type: none"> • Trees cleared from private land plots will be compensated in accordance with the Land Acquisition and Resettlement Plan (LARP). • Tree cutting shall not occur during bird nesting seasons. 	GoG to implement the LARP.	According to the LARP	According to the LARP

	State Forest Fund	<ul style="list-style-type: none"> The Contractor will be provided with plans indicating the areas of State Forest Fund. Tree-cutting works in the State Forest Fund areas shall be implemented under the supervision of specialists of the National Forestry Agency. Contractor to remove the trees to a location specified by the National Forest Agency. 	<ul style="list-style-type: none"> RD to provide plans to Contractor. Contractor to undertake tree cutting. Contractor to remove trees. 	National Forestry Agency	None
	Tree Re-planting	<ul style="list-style-type: none"> Coordinate with MoEPA and National Forest Agency to identify a site, or sites, within the Project area where trees can be re-planted. Also determine the number and types of species to be replanted. Plant maintenance will be carried out for at least two years. Monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% re-plant on a 1:1 basis to compensate for losses. 	<ul style="list-style-type: none"> Contractor to coordinate with MoEPA and NFA. Contractor to purchase, plant and maintain the seedlings. Contractor to plant additional seedlings if success rate not met. 	<ul style="list-style-type: none"> Engineer to monitor success rate (NFA to determine success rate criteria). 	Monthly monitoring of success rate.
	Protection of Vulnerable Species	The Contractor will place protective wood fencing around the any Georgian red-list species identified within 5 meters of the site boundary in the pre-construction survey in order to protect the tree during construction works, including its root zones.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Vegetation clearance	No chemicals shall be used to clear vegetation.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Fish Spawning	The Contractor shall consult with the MoEPA to determine when works in rivers should be ceased in order to limit impacts to fish spawning periods.	Contractor to implement mitigation.	Engineers NES	Review of documentation provided by MoEPA.
	Impacts to habitat	Prior to the start of construction in river beds, or close to river embankments (within 10 meters), the Contractor shall undertake a site survey (using a local ecologist) to ensure that there are no other holts in these areas. If holts are found in these areas the Contractor will prepare a method statement for the management of these areas which will be sent to the Engineer for review and approval.	<ul style="list-style-type: none"> Contractor to hire local ecologist. Contractor to prepare method statement. Engineer to review and approve method statement. 	Engineers NES	Review method statement and periodically monitor works in this area.

	Poaching	Poaching of wildlife shall be strictly prohibited.	Contractor to implement mitigation.	N/A	N/A
Waste Management and Spoil	Recycling and re-use	<ul style="list-style-type: none"> Where possible, surplus materials will be reused or recycled. Used oil and grease shall be removed from site and sold to an approved used oil recycling company. 	Contractor to implement mitigation.	Engineers NES	Monthly review of waste manifests to determine if wastes are being recycled.
	Spoil	<ul style="list-style-type: none"> Under no circumstances shall the Contractor dump excess materials on private lands. Excess spoil shall not be dumped or pushed into any river at any location. Spoil re-use and disposal haul routes shall be included within the traffic management plan. The Contractor will be responsible for upgrading and maintenance of any locals roads used for the transport of spoil materials. Transport of spoil material from tunnels on local roads shall be prohibited between 10pm and 6am. Routine spraying of haul routes during dry periods. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Inert Solid & Liquid waste	<ul style="list-style-type: none"> Provide refuse containers at each worksite. Maintain all construction sites in a cleaner, tidy and safe condition. Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. Train and instruct all personnel in waste management practices and procedures. Collect and transport non-hazardous wastes to all approved disposal sites. Keep copies of waste manifests on site. Keep a record of waste on-site and waste removed. 	<ul style="list-style-type: none"> Contractor to implement mitigation and conduct training. Engineer to approve any waste disposal site. 	Engineers NES	Daily site inspections, throughout construction period. Regular review of Contractors training sessions.
	Asphalt and Concrete	<ul style="list-style-type: none"> Waste asphalt will be recycled where possible for base material and shoulder material. Unused or rejected tar or bituminous products shall be returned to the supplier's production plant. Waste concrete shall be crushed and re-used as fill material, or base material where possible. Under no circumstances should concrete 	<ul style="list-style-type: none"> Contractor to implement any recommendations for re-use of asphalt. Contractor to implement mitigation. 	Engineers NES	Daily site inspections, throughout construction period.

		mixers be washed out onto open ground at construction sites, such as bridges.			
	Hazardous Waste	<ul style="list-style-type: none"> Storage of hazardous waste shall be in specific secure locations as identified by the waste management plan. Hazardous liquids must be stored within impermeable bunds (the bund should be able to contain at least 110% of the volume of the largest storage tank within the bund). Collect and temporarily store used hazardous waste separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources and according to the requirements of their MSDS. Training and suitable PPE will be provided to all personnel handling hazardous waste. Disposal of waste materials shall be undertaken by a licensed waste management company. Keep copies of the companies licenses on record as well as the agreements with the company. Keep records of the types and volumes of waste removed from the site on a weekly basis. Keep copies of waste manifests. 	<ul style="list-style-type: none"> Contractor to implement mitigation. Engineer to approve any waste disposal site. Engineer to review waste manifests. 	Engineers NES	Daily site inspections, throughout construction period. Monthly review of waste manifests.
Transport and Utilities	Transportation	<p>The Contractor will:</p> <ul style="list-style-type: none"> 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; Allow for adequate traffic flow around construction areas via diversions or temporary access roads; If temporary access roads are to be constructed with a gravel surface they shall be routinely watered by the Contractor during dry weather to reduce dust impacts; and Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control. 	Contractor to implement mitigation.	Engineers NES	Weekly inspections, throughout construction period.

Section F3 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

		<ul style="list-style-type: none"> Access roads for batching plants, etc, will be maintained during the construction phase and rehabilitated at the end of construction. 			
	Working Close to Railways Lines	<ul style="list-style-type: none"> The Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in the area above the railway line at KM12.0. 	<ul style="list-style-type: none"> Contractor to prepare method statements. Engineer to review and approve method statements 	Engineers NES	Weekly monitoring of works in these areas.
	Utilities	<ul style="list-style-type: none"> All utilities in the Project area shall be kept operational, particularly during the winter months. The Contractor will be responsible for liaising with the relevant utilities operators to ensure all utilities remain operational. Should utilities need relocating in a different location the Contractor will consult with the relevant utilities and local community to ensure that there is no change in supply as a result of these changes. 	Contractor to implement mitigation.	Engineers NES	Weekly inspections, throughout construction period.
Asphalt Plants	Emissions & Noise	<ul style="list-style-type: none"> Asphalt plants will be located downwind of urban areas and not within one kilometer of any urban area. Adequate PPE will be provided to staff working in areas of high noise and emissions. Storage and Use of Hazardous Materials (including bitumen): Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS). Copies of MSDS will be kept on site with all hazardous materials. The Contractor will keep a log of the type and volume of all hazardous wastes on site. The Contractor will keep a plan of site indicating where all hazardous materials are stored. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period. Monthly review of hazardous waste log.
	Vehicle Movement	<ul style="list-style-type: none"> The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Health and	<ul style="list-style-type: none"> To prevent bitumen burns it will be 	Contractor to implement	Engineers	Daily site

	Safety	<p>compulsory for the workers handling hot bitumen to wear full-body protection.</p> <ul style="list-style-type: none"> • All transportation, handling and storage of bitumen will be handled safely by experienced personnel. • The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates. • Ear-muffs will be provided those working on the plant. • First Aid kit will be available on site for the workers in case of emergency. • The Material and Data Sheet (MSDS) for each chemical product will be made accessible onsite and displayed. 	mitigation.	NES	inspections, throughout construction period.
Construction Camps	Pollution and Emissions	<ul style="list-style-type: none"> • The Contractor will ensure that all of the following conditions are met: • Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors. • There will be no direct discharge of sanitary or wash water to surface water. • In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site wastewater treatment facilities. For sites servicing a small number of employees (less than 150), septic tanks may be used. For larger sites, liquid wastes will as a minimum receive primary treatment in anaerobic tank or pond preceded by a bar screen to remove large solid objects (e.g. sticks, rags). • There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies. • Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis. • Disposal of materials such as, but not limited 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		<p>to, lubricating oil and onto the ground or water bodies will be prohibited.</p> <ul style="list-style-type: none"> • Liquid material storage containment areas will not drain directly to surface water. • Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly. • Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area. • Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities. • Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge. • 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. • Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage: • Fueling operations will occur only within containment areas. • All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks. • Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids. 			
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		<ul style="list-style-type: none"> • All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses. • Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited. • Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste. • If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. • If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. • The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. • The Contractor will be responsible to maintain and cleanup campsites and respect the rights of local landowners. 			
Concrete Batching Plants	Pollution and Emissions from Concrete Batching Plants	<ul style="list-style-type: none"> • To limit impacts from dust, the following conditions will apply: <ul style="list-style-type: none"> – Batching plants will be located downwind of urban areas and not within one kilometer of any urban area. – The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material. – Sand and aggregates will be delivered in a dampened state, using 	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		<p>covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker.</p> <ul style="list-style-type: none"> - Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile. - The hopper or bunker will be fitted with water sprays which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition. - Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed. - Rubber curtain seals may be needed to protect the opening of the overhead bin from winds. - Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed. - Conveyor belts will be fitted with belt cleaners on the return side of the belt. - Weigh hoppers at front end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened 			
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		<p>stockpile.</p> <ul style="list-style-type: none"> - Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight. - Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling. - Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector. - Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere. - An inspection of all dust control components will be performed routinely – for example, at least weekly. <ul style="list-style-type: none"> • All contaminated storm water and process wastewater will be collected and retained on site. • All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues. • Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications: <ul style="list-style-type: none"> - The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain. - Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling. - An outlet (overflow drain) in the bund, one metre upstream of the 			
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		<p>collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).</p> <ul style="list-style-type: none"> - Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments. - Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails. - Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity. 			
Community Health and Safety	Blasting	Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	HIV / AIDS	<ul style="list-style-type: none"> • Subcontract with an Approved Service Provider to provide an HIV/AIDS Awareness Program to the Contractor's Personnel and the Local Community. • Repeat the HIV/AIDS Awareness Program at intervals not exceeding four months 	<ul style="list-style-type: none"> • Contractor to implement mitigation. • Service Provider to implement training. • Engineer to review program. 	Engineers NES	Annual review of awareness program activities.
	Code of Conduct	The Contractor shall develop an induction program, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each worker.	Contractor to implement mitigation.	Engineers NES	Routine assessment of workers staff to determine if the code of conduct has been presented.
	Monthly Meetings	The Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period.	Contractor to implement mitigation.	Engineers NES	Engineers NES to attend all community meetings.

Occupational Health and Safety	Worker Health & safety	<ul style="list-style-type: none"> Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site. Develop a Safety Training Program including training to recognize and respond to workplace chemical hazards. Safety Meetings conducted on a monthly basis. Regularly inspect, test and maintain all safety equipment. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, shall be repaired or replaced immediately. All construction plant and equipment used on or around the Site shall be fitted with appropriate safety devices. A fully equipped first aid base shall be provided at the Construction Camp and Asphalt Plant. Coordinate with local public health officials and shall reach a documented understanding with regard to the use of hospitals and other community facilities. Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers. Provide portable toilet facilities for workers at road work sites. Provide fencing on all areas of excavation greater than 2 m deep. Install warning signs. 	<ul style="list-style-type: none"> Contractor to implement mitigation. Engineer to review and approve training program. 	Engineers NES	Daily site inspections, throughout construction period. Periodic attendance of training sessions to determine quality and numbers in attendance.
	Sub-contractor H&S	<ul style="list-style-type: none"> All sub-contractors will be supplied with copies of the SEMP. Provisions to be incorporated into all sub-contracts to ensure the compliance with the SEMP. All sub-contractors will be required to appoint a safety representative who shall be available on the Site. 	<ul style="list-style-type: none"> Contractor to provide SEMP. Sub-contractors to ensure compliance with SEMP 	Engineers NES	Routinely monitor sub-contractors activities.
	Noise	Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE	Contractor to implement mitigation.	Engineers NES	Daily site inspections and

		must be worn by workers.			monitoring (with smartphone technology) throughout construction period.
PCR	Impacts to Religious Monument	During the construction phase the boundary of the monument shall be fenced off to ensure that there is no encroachment into this area by construction workers or equipment.	Contractor to implement mitigation.	Engineers NES	Weekly site inspections of the fencing.
	Impacts to Historical and archeological areas	In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines and as outlined in the Contractors Chance Find Procedure.	Contractor to implement mitigation.	Engineers NES	Daily site inspections throughout construction period.
Noise	Construction noise	<ul style="list-style-type: none"> During the construction phase the Contractor will be responsible for the following: <ul style="list-style-type: none"> Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. 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 residential, nursery, or medical facilities, the Contractor's hours of working shall be limited to 8 AM to 6 PM. Use temporary noise barriers while working in sensitive locations in case accident of allowable limits is expected. Placing the barrier close to the source proves to be effective. Give notice as early as possible to sensitive receptors for periods of noisier works such as excavation. 	Contractor to implement mitigation.	Engineers NES	Daily site inspections throughout construction period.

		<p>Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress.</p> <ul style="list-style-type: none"> - Within normal working hours, where it is reasonable to do so: - schedule noisy activities for less sensitive times. - provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise). - The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times. - All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair. - Maintenance tools, machines and equipment so that they are in good conditions. When some wrong is found, they must be fixed immediately in order to reduce noise from the equipment. - Fit all pneumatic tools with an effective silencer on their air exhaust port. - Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning 			
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		<p>systems must be followed.</p> <ul style="list-style-type: none"> - Turn off plant when not being used. - All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the Engineer. - Keep good conditions of trucks that use to transport construction materials so they cause no loud noise and control the truck speed, to be not exceeded 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways. - Where possible, no truck associated with the work should be left standing with its engine operating in a street adjacent to a residential area. - Provision of noise protection kits such as ear plug, earmuff, for workers who are working in the area with noise level is higher than 85 dB(A). It is designated as a regulation that workers must wear protection kits in case of working in a noisy area. 			
Vibration	Tunneling Vibration	The Contractor shall follow the procedures outlined in Section F.8.6 of the EIA.	Contractor and Engineer to implement mitigation.	N/A	N/A
	Piling Vibrations	Condition surveys of all properties within 50 meters of bridge piles.	Engineer	N/A	N/A
	Blasting	<ul style="list-style-type: none"> • No blasting will be carried out within 100 m of the portal of the tunnel. • Blasting will be scheduled during the day only. • Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule. 	Contractor and Engineer to implement mitigation.	Engineers NES	Routine inspections of blasting activities.

Table 101: Environmental Management Plan – Operational Phase

Subject	Potential Impact / Issue	Mitigation / Monitoring Measure	Responsibilities
Hydrology	Drainage issues	<ul style="list-style-type: none"> Monitor drainage along the road to ensure that it does result in increased run-off and flooding. 	RD
	Groundwater depletion	<ul style="list-style-type: none"> If groundwater fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties. 	Contractor during DFL period
Tree re-planting	Tree maintenance	<ul style="list-style-type: none"> If tree maintenance extends beyond the construction and DFL period the RD shall engage an operator to continue maintenance of the trees to complete the two-year maintenance period. 	RD to contract a suitable operator.
Tunnels	Air quality	<ul style="list-style-type: none"> Ensure continued maintenance of tunnel ventilation system. 	RD
Fauna	Impacts to animals	<ul style="list-style-type: none"> Register and analyze road kills. Develop additional mitigation measures if found to be necessary. During maintenance works strictly comply with wildlife/vegetation impact mitigation measures set for construction stage. Prohibit poaching (ensure that tunnel operator staff is aware of the ban). 	RD
Road Maintenance	Pollution of water	<ul style="list-style-type: none"> Perform maintenance paving of the road sections and bridge decks only in dry weather to prevent runoff contamination. Use staging techniques to reduce the spread of paving materials during the repair of potholes and worn pavement. These can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines. Comply with mitigation measures defined for water protection during construction. Remove all waste, material, machinery and tool from the area after completion of works. Reinstate disturbed areas – if the case. 	RD
Waste Management	Pollution of the environment	<ul style="list-style-type: none"> Install waste collection bins in technical buildings area. Use garbage bins fitted with lids to avoid scattering around and attraction of scavengers. Segregate hazardous, non-hazardous and reusable waste streams. Manage and dispose hazardous waste according to the type and the class of hazard. Note: for hazardous waste removal licensed company must be contracted. Until removal (temporarily) waste must be stored within secure facilities with weatherproof flooring and roofing. Dispose garbage according to agreement with licensed waste management contractors. 	RD

Table 102: Construction Phase Instrumental Monitoring

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
Air Quality	Establish routine ambient air quality monitoring throughout the construction period. The following parameters shall be monitored: Particulate Matter (PM ₁₀ & PM _{2.5}).	<ul style="list-style-type: none"> At the baseline monitoring locations (six) 	Monitoring to be undertaken monthly during construction period (30 months)	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within three days of the monitoring activity.
Noise	Ensure that routine noise monitoring is undertaken throughout the construction period. Parameters to be monitored include: Laeq 1h (dBA)	<ul style="list-style-type: none"> At the baseline monitoring locations 	Monitoring to be undertaken monthly both daytime and night-time measurements during construction period (30 months)	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within three days of the monitoring activity.
Vibration	Vibration sensors for PPV monitoring.	At each tunnel location	Throughout tunnel blasting period.	Contractor to purchase, install and monitor vibration.	Weekly reporting of vibration results to the Engineer.
Surface Water Quality	Establish routine water quality monitoring throughout the construction period. The following parameters shall be monitored: pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO ₃); Phosphate (PO ₄); Oil and Grease	50 meters upstream from all bridge sites crossing rivers (8 locations) during construction; 50 meters downstream of the bridge site.	Monitoring to be undertaken monthly during bridge construction works	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within seven days of the monitoring activity.
Tunnel water	Monitoring of water from tunnel dewatering settlement tanks. Parameters will include all required to meet Georgian drinking water standards.	At all settlement tanks.	Weekly	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within 5 days of the monitoring activity.
Ground water	Monitoring of groundwater levels.	Selection of ten sites	Weekly	The Engineer shall hire certified laboratory to	Weekly reporting to the Engineer.

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
				perform the monitoring activities.	

Table 103: Operational Phase Instrumental Monitoring

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
Noise	Monitoring of noise affected Receptor Parameters to be monitored include: Laeq 24h (dBA)	<ul style="list-style-type: none"> 28 receptors identified in the noise model 	Monitoring to be undertaken once per annum over a 24 hour period.	The RD shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the RD within three days of the monitoring activity.

H.4 EMP Costs

Most costs associated with the environmental recommendations of the EMP are a normal part of preparing the bid and contract documents and ensuring that proper environmental provisions are incorporated therein. The installation of septic systems at construction camps, for example, is an environmental necessity, but not generally considered an “environmental cost”. Table 104 lists the proposed mitigation measures and indicates where they would be “included in the project budget” as part of a bid document and where additional costs are a likely “environmental cost” beyond what would normally be included in a project budget.

Table 104: EMP Costs

Activity	Item	Number of Units / Unit cost /US\$	Cost estimate / US\$	Responsibility	Source: JICA	Source: RD
Pre-construction						
SEMP	SEMP and associated plans	Included in Project Construction costs	-	Contractor	X	
Approval of Camp locations	Approval	Included in Project Construction costs	-	Engineer	X	
Incorporation of Environmental Items into Bid Documents	Item in Bid Document	Included in Detailed Design Budget.	-	RD		X
Obtain permits	Permits	Included in Project Construction costs	-	Contractor	X	
SFF	Compensation	TBD	TBD	Contractor		X
Total Pre- construction costs						\$0
Construction						
Standard site management	Septic Tanks	Included in Project Construction costs	-	Contractor	X	
Additional environmental measures	Spill Kits	20 / US\$200	4,000	Contractor	X	
	Bunds for fuel and oil storage	Included in Project Construction costs	-	Contractor	X	
	Waste containers	Included in Project Construction costs	-	Contractor	X	
	Waste Storage areas	Included in Project Construction costs	-	Contractor	X	
	Waste collection and disposal	Included in Project Construction costs	-	Contractor	X	
	Storage areas for hazardous materials	Included in Project Construction costs	-	Contractor	X	
	Sprinklers for rock crushing plant	Included in Project Construction costs	-	Contractor	X	
	Drainage (including oil and grease interceptors)	Included in Project Construction costs	-	Contractor	X	

Section F3 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

Activity	Item	Number of Units / Unit cost /US\$	Cost estimate / US\$	Responsibility	Source: JICA	Source: RD
	Vehicle washing bay	Included in Project Construction costs	-	Contractor	X	
	Fire safety	Included in Project Construction costs	-	Contractor	X	
	PPE	Included in Project Construction costs	-	Contractor	X	
	Impervious hardstanding (for maintenance yards, bitumen storage, etc)	Included in Project Construction costs	-	Contractor	X	
	First aid facilities	Included in Project Construction costs	-	Contractor	X	
	Animal Crossings	Included in Project Construction costs	-	Contractor	X	
	Fencing around PCR	1 / \$1,000	1,000	Contractor	X	
	Water bowsers	Included in Project Construction costs	-	Contractor	X	
	Water sprinklers (rock crushing plant)	Included in Project Construction costs	-	Contractor	X	
	Dust control measures (rock crushing and batching plants)	Included in Project Construction costs	-	Contractor	X	
	Tarpaulins	Included in Project Construction costs	-	Contractor	X	
SFF Tree Cutting and tree removal	Labour	Included in Project Construction costs	-	Contractor	X	
Fencing around red-list species (over 8cm in diameter)	Fencing	Approximately 200 / \$50	10,000	Contractor	X	
General Re-planting (5-6 y/o seedling)	Seedlings	30,000 / \$3	90,000	Contractor	X	
Tunnel Excavation	Pre-condition surveys	Approximately 200 / \$100	20,000	Contractor	X	
Tree / Vegetation maintenance	Labour and water	Included in Project Construction costs	-	Contractor	X	
Embankment vegetation and soil erosion measures	Vegetation, Labor and maintenance	Included in Project Budget	-	Contractor	X	
Training & Awareness Programs	Safety Training	Included in Project Budget	-	Contractor	X	
	HIV/AIDS Training	4 / US\$1,000	4,000	Independent Contractor	X	
	Toolbox Training	Included in Project Budget	-	Contractor	X	

Activity	Item	Number of Units / Unit cost /US\$	Cost estimate / US\$	Responsibility	Source: JICA	Source: RD
	Construction orientation meetings	Included in Project Budget	-	Contractor	X	
	Periodic meetings with stakeholders	Included in Project Budget	-	Contractor	X	
Clean-up of construction sites.	Labor, waste disposal	Included in Project Budget	-	Contractor	X	
Environmental Staff	EO	36 / US\$ 2,000	72,000	Contractor	X	
	H&S Specialist x 2	72 / US\$ 2,000	144,000	Contractor	X	
	H&S Specialist	36 / US\$ 1,500	54,000	Engineer	X	
	IES	6 / US\$ 20,000	120,000	Engineer	X	
	NES	36 / US\$ 1,500	54,000	Engineer	X	
Total Construction Costs						US\$573,000
Operation						
Noise	Noise Barriers ²²	2,400 m / \$1,352 m	3,244,800	Contractor	X	
	Noise Barrier foundations	750 m / \$200 m	150,000	Contractor	X	
	Other noise mitigation (noise proof windows, etc)	Maximum 28 receptors / US\$2,000	56,000	Contractor	X	
Operation Costs						US\$3,450,800
Total Cost						US\$4,023,800

Table 105: Construction Phase Instrumental Monitoring Costs

Activity / Item	Frequency / Responsibility	Unit Cost	Cost /USD
Air Quality Monitoring	Monthly (six sites) / Engineer to hire certified laboratory.	200 per site	36,000
Noise Monitoring	Monthly (six sites) / Engineer to hire certified laboratory.	200 per site	36,000
Surface Water Quality Monitoring	Weekly during construction period at the bridge sites crossing rivers (eight sites) / Engineer to hire certified laboratory.	200 per site	28,800
Groundwater levels	Weekly during construction period of each tunnel / Engineer to hire certified laboratory.	20 per site	2,880
Tunnel dewatering	Weekly during construction period of each tunnel / Engineer to hire certified laboratory.	200 per site	41,600
Vibration Monitoring	Continuous during blasting in the vicinity of tunnels. One sensor for each cluster of house within the risk zones. At least 5 sensors within 100 m and 5 beyond. 10 sensors in total	800	8,000

²² Cost estimate is provided by **Appendix G**.

	/ Contractor		
Total			169,280

Table 106: Operational Phase Instrumental Monitoring Costs

Activity / Item	Frequency / Responsibility	Unit Cost	Annual Cost /USD
1. Noise Monitoring for Noise Mitigation.	Annually (at 28 receptors) / RD	200 per site	5,600
Total			5,600

H.5 Specific EMP (SEMP)

The SEMP is the documents that the Contractor shall prepare outlining how he intends to implement the EMP and ensure that all of the mitigation and monitoring is completed according to the implementation arrangements specified in this EMP and the EIA as a whole.

The SEMP will describe the precise location of the required mitigation / monitoring, the persons responsible for the mitigation / monitoring, the schedule and reporting methodology. The SEMP will also include the following plans:

- Topic Specific Plans:
 - Waste Management Plan.
 - Spoil Disposal Plan for Arrangement of Spoil Disposal Area.
 - Re-cultivation Plan.
 - Traffic Management Plan.
 - Occupational Health and Safety Plan.
 - Emergency Response Plan.
 - Air Quality Plan.
 - Spill Response Plan.
 - Vibration Monitoring Plan.
 - Clearance, Re-vegetation and Restoration Management□Plan.
 - Groundwater Management Plan.
 - Tunnel Blasting Plan.
 - Noise Management Plan.
 - Biodiversity Management Plan.
- Site Specific Plans:
 - Construction Camp Plan.
 - Asphalt Plant Plan.
 - Rock Crushing Plant Plan.
 - Concrete Batching Plant Plan.

The SEMP will be submitted to the Engineer and RD for approval at least 10 days before taking possession of any work site. No access to the site will be allowed until the SEMP's are approved by the Engineer and RD.

H.6 Bid Documents

The Bid Documents for the potential Contractor will contain two sections relating to environmental issues, firstly a basic clause indicating that the Contractor will be responsible for following the requirements of the EMP and that he should prepare his

own SEMP for the Project. Secondly, the EMP shall be repeated in its entirety as an Annex to the Bid Documents so as the bidder is aware of his environmental requirements under the Project and help him put environmental costs to his proposal.

H.7 Contract Documents

The Contract Documents will follow a broadly similar pattern to the Bid Documents. It is not considered necessary to repeat the mitigation measures verbatim in a list of environmental contract provisions, rather the Contract will specify that the Contractor is responsible for implementation of the EMP via his SEMP. Again, the EMP will be included as an Annex to the Contract so the Contractor will be liable for any non-conformance with the EMP, and thereby this EIA.

H.8 Contractor Requirements

As stated above, the Contractor will be responsible for the preparation of the SEMP. The SEMP will need to be fully compliant with the EMP and this EIA as a whole and will need to be prepared within 30 days of Contract award and approved 10 days prior to access to the site.

During construction the Contractor must retain the expertise of an Environmental Officer (EO) to implement and continually update the SEMP and to oversee and report on the operation throughout the contract period. The EO should be full-time member of staff on the Contractors roster and should be on site at least five days per week.

The required qualifications of the EO are as follows:

- Degree in environmental sciences and related expertise.
- Fluent in Georgian and English.
- Experience of at least one construction project of a similar size and scale.

The EO will be responsible for the preparation of weekly environmental checklists and an environmental section of the Contractor's monthly progress reports that shall be submitted to the Engineer for review. The Engineer shall provide a template of the checklist to the Contractor.

The monthly reports, which will include the weekly environmental checklists, shall contain sections relating to:

- (1) General Progress of the Project.
- (2) Environmental Incidents; e.g. spills of liquids, accidents, etc.
- (3) Progress of any environmental initiatives, e.g. energy savings, recycling, etc.
- (4) Records of any environmental monitoring, both observational and instrumental.
- (5) Conclusions and Recommendations.

The EO shall provide daily toolbox training at the construction camp and also at construction sites. The EO shall keep a record of all monthly training and toolbox training undertaken.

The Contractor shall also hire two qualified Health and Safety Specialists for the Project duration. The H&S specialists shall have at least five years on-site experience of similar sized infrastructure Projects.

H.9 Engineer Requirements

As noted in the mitigation plans below, the Engineer is tasked with specific responsibility to review designs and ensure safeguard compliance of civil works – with particular emphasis on the monitoring of implementation of EMP through the Contractors SEMP and related aspects of the project. The Engineer will also be responsible for reviewing and approving the monthly reports prepared by the Contractor, especially the first monthly report, to ensure that it contains all of the required reporting elements, such as instrumental monitoring results. The Engineer will also be responsible for regular review and attendance of the Contractors environmental, health and safety training.

The Engineer is also responsible for engaging external services from a certified laboratory for instrumental monitoring of air quality, noise and water during the construction phase.

The Engineer should retain the use of Environmental Specialist, both national (NES) and international (IES), to ensure that the Contractor is compliant with his environmental obligations. Terms of reference for both specialists is provided below.

Engineers National Environmental Specialist

Scope of Services: He/she will (i) review all documents and reports regarding the integration of environmental including contractor's environmental action plan, (ii) supervise the contractors' compliance to EMP, and (iii) prepare monthly compliance reports.

Qualification: Degree in environmental sciences or equivalent. Preferably five years' experience in conducting environmental impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures during implementation of projects including highway projects funded by developing partners.

Time Period – The NES shall be employed permanently over the duration of the construction period.

Engineers International Environmental Specialist

Scope of Services: The IES will prepare a detailed action plan including environmental monitoring checklists to be completed by the NES. He/she will conduct environmental training and briefings to provide environmental awareness on ADB and the government environmental safeguards policies, requirements and standard operating procedures in conformity with the government's regulations and international practice for project and RD Safeguards staff; ensure baseline monitoring and reporting of Contractor's compliance with contractual environmental mitigation measures during the construction phase.

Qualification: Degree or diploma in environmental sciences or equivalent. Preferably fifteen years' experience in conducting environmental impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures and health and safety plans during implementation of projects including road projects funded by developing partners, including twelve years' international experience. Working knowledge of Georgia is preferred.

Time Period: The IES shall be engaged on a part-time basis for a period of five months spread over the duration of the construction period (two months per year).

The specific on-site inputs will be determined by the Engineers Team Leader and the RD.

The Engineer shall also retain a national health and safety specialist for the duration of the Contract. The specialist will be responsible for the day to day monitoring of health and safety aspects of the Contractors works as well as keeping a log of safety statistics.

H.10 Project Management Unit (PMU) Requirements

A review of the capacity of the RD was undertaken as part of this EIA. The review indicates that the existing RD has sufficient expertise to adequately manage the Contractors environmental performance. The RDs safeguard department has extensive experience of implementing road projects for a range of donors, including ADB. As such no further capacity building is recommended within the RD.

H.11 EMP Implementation Summary

The following Table summarizes the various institutional responsibilities for the implementation of the environmental management plan at various stages of the Project Road rehabilitation.

Table 107: EMP Implementation

Project Stage	Responsible Institution	Responsibilities
Detailed Design	RD with the Detailed Design Consultant and EIA Team.	<ul style="list-style-type: none"> Incorporate EMP mitigation measures into engineering design.
	RD	<ul style="list-style-type: none"> Ensure EMP is incorporated into the works Contracts.
	RD	<ul style="list-style-type: none"> Review Contractors proposals to ensure that they are aware of the EMP requirements and that line items for environmental management as per the EMP are included in the BOQ.
Pre-construction	Contractor	<ul style="list-style-type: none"> Prepare SEMP
	Contractor	<ul style="list-style-type: none"> Prepares EIA for spoil disposal site.
	Engineer, ADB and PMU	<ul style="list-style-type: none"> Review and approve SEMP
	Contractor and Engineer	<ul style="list-style-type: none"> Site Induction
Construction	Contractor (through its EM)	<ul style="list-style-type: none"> Daily monitoring of environmental issues Preparation of weekly environmental checklists Preparation of Monthly environmental reports Preparing Corrective action plans
	PMU	<ul style="list-style-type: none"> Routine site visits to monitor Contractors performance.
	Engineer	<ul style="list-style-type: none"> Weekly monitoring of the Contractors compliance with EMP / SEMP by the NES. Issuing the Contractor with Non-compliance Notices Monthly reporting to RD of Contractors performance based on the review of Contractors weekly checklists and weekly site visits. Quarterly Environmental Reports prepared by the IES and submitted to PMU and ADB.

I. Public Consultation, Information Disclosure & Grievance Mechanism

I.1 Public Consultations

According to the ADB Safeguard Policy Statement (2009):

“The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:

- 1. Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;*
- 2. Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;*
- 3. Is undertaken in an atmosphere free of intimidation or coercion;*
- 4. Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and*
- 5. Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.*

Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report.”

Category A EIAs require two rounds of consultations which were undertaken in June 2017 and February 2018.

I.1.1 Scoping Consultations

Scoping consultations were held in June, 2017 in Boriti. The consultations were arranged by the RD. Information about the date, time and venue of the meeting was published in a newspaper. Communication with local municipal authorities was also undertaken to inform them of the meeting. Participants in the consultations were given an overview of the proposed project and then asked what they thought may be the significant issues that would require detailed study as part of an EIA. A copy of the presentation made can be found as **Appendix A**. The following provides an overview of the consultations (names of all attendees can be found in **Appendix B**).

Table 108: Boriti Scoping Consultation

Date: 7 th June, 2017			
Location: Boriti			
Panel Members:			
Mr. Nick Skinner – International Environmental Specialist			
Mr. Giansante Bonin – Team Leader			
Ms. Maka Stamateli – National Environmental Specialist			
Ms Lika Bubashvili – Environmental Specialist, Roads Department of Georgia			
Mr. Gia Sopadze – Head of Environmental Division, Roads Department of Georgia			
List of Participants:			
25 Participants (see Appendix B for list)			
#	Question / Comment	Answer	EIA Status

1	When the works commence we will need to be informed in advance of where exactly the works will occur.	We will prepare procedures as part of the EIA to ensure that the Contractor provides adequate advance warning of construction works in specific areas.	Addressed under section G.7.1 - Transportation Facilities & Utilities.
2	When will construction of the road start?	Within the next 12 months.	N/A
3	How will you dispose of spoil material from tunnels?	At the moment we are unsure about the exact locations for spoil disposal. However, we will ensure that all locations are approved by the relevant authorities and that no unauthorized disposal of spoil will occur.	Addressed under section G.7.3 – Waste Management.
4	Roadside businesses should be protected from construction impacts, e.g. dust, restricted access.	The EIA will have specific mitigation measures to ensure these types of impacts do not significantly impact upon roadside businesses.	Addressed as part of section G.5.1 – Air Quality and G.7.1 - Transportation Facilities & Utilities.
5	Cattle underpasses should be considered.	This is an issue that we need to consider during the design.	No specific requirement for cattle underpasses due to the fact that the Project comprises mainly tunnels and bridges so cattle can move either beneath the bridges or over the tunnels.
6	Will all three construction lots be undertaken at the same time, or will they be phased? This could cause a lot of traffic disruption.	They will be phased, but at some point construction will be on-going in all three lots. Traffic management plans will be prepared by Contractors to limit traffic related impacts.	Addressed under section G.7.1 - Transportation Facilities & Utilities.
7	Will access to properties be disrupted during construction?	There will be temporary impacts to access during the construction phase. The Contractors will be required to coordinate all of his activities with locals to ensure minimal disruption.	Addressed under section G.7.1 - Transportation Facilities & Utilities.
8	There are periods of very high flow in the river, this should be carefully considered during the detailed design to ensure that flooding does not occur.	During detailed design hydrological studies will be undertaken to ensure that all bridges, culverts, etc are designed and constructed to the correct specification.	Addressed under section G.5.5 – Hydrology.
9	I am a bee-keeper and am concerned about the potential impacts to my business.	The road is unlikely to have significant impacts on the bee-keeping industry in the region. However, if there are specific issues during the construction phase that affect your business they can be raised through the grievance redress mechanism.	Addressed under section G.3 – Grievance Mechanism.

Figure 122: Scoping Consultation in Boriti, 7th June, 2017



H.1.2 Public Consultations

A second round of consultations were held in Kharagauli in February 2018. Participants in the consultations were presented with the initial findings of the Georgian version of the EIA (see **Appendix C** for the presentation). The following provides an overview of the consultations (names of all attendees can be found in **Appendix D**).

Table 109: Boriti Public Consultation

<p>Date: 22nd February, 2018 Location: Kharagauli Administrative Building</p>			
Chairman of the meeting:		Gia Sopadze, Head of division for Resettlement and Environmental Protection, Roads Department of Georgia	
Secretary of the meeting:		Maia Stamateli, environmental specialist, Gamma Consulting Ltd	
Attendees:		Representatives of Roads Department of Georgia, representative of Kharagauli administration, local residents, Representatives of Gamma Consulting Ltd, representative of the Ministry of Environment Protection and Agriculture, representative of Georgian Greens (See Appendix C)	
#	Question / Comment	Answer	EIA Status
1	Population is asking for a map of alignment to know where the new road will be	Gia Sopadze promised to provide pdf version of the map to local authorities for reference.	Project map is provided as part of the EIA which will be disclosed.
2	Will project have impact on ground water	Tunneling may have impact on ground water. To avoid impact of possible water level change on water users, the monitoring of water level in the areas	Addressed as part of G.7.6 – Tunnels.

		where population relies of wells will be carried out.	
3	Construction of the road may block surface runoff, what measures are considered to avoid that	The road design considered surface runoff. Drainage system and culverts are designed with consideration of the relief	Project Description, Section B , provides a summary of the drainage system and culverts.
4	There are cultural heritage sites in the area. Is there any risk of impact on them during construction and operation of the new road	The road bypasses cultural heritage sites. There is no risk of impact on aboveground monuments. Archaeological conclusion for submission to cultural heritage protection authorities is being prepared. The chance find procedure is available. Construction company identified through tender will be responsible to implement the mentioned procedure in case of any chance find.	Addressed under Section G.8.5 – PCR .
5	Since the new road will create a barrier for free movement of the residents it is vital to arrange passages to allow passing from one side of the highway to another	The project alignment includes bridges, tunnels. In Tbilisi Argveta direction 18 bridges and 9 tunnels, whereas in Argveta-Tbilisi direction 16 bridges and 11 tunnels will be built. Two interchanges are planned one - in the area of Sakasria village, at the left side of the river and another in the end of the Lot F2 in Boriti area. Existing road will remain in place.	Explained throughout the report that the new road will not present a barrier to the free movement of residents.
6	Will impact on trees be high?	Taxation will provide exact information on the type of species and number of the trees to be cut for the needs of the project. Impact on vegetation adjacent to the RoW will be mitigated by a range of measures suggested by the team. This includes: keeping to the boundaries of the worksites and RoW, fencing of the sensitive areas to avoid accidental damage during works, briefing of the staff in environmental HS measures and requirements.	Addressed under section G.6.1 – Flora .
7	Is there a risk that blasting works affect properties	Prior to blasting works properties located in potential impact zone will be checked. The status – recorded. Inspection will also help to determine blasting method and dosage. Type, 'size' of the charge, selection of time between detonations, design (e.g. closer hole spacing, smaller diameter holes), presplitting blasting, perimeter blasting and millisecond blasting technique can be used in sensitive locations to minimize blasting effect.	Addressed under section G.8.6 – Noise and Vibration
8	What will happen on case of damage of existing infrastructure by heavy machinery	Damage to existing road infrastructure will be repaired after completion of works in the area. The same approach will apply to any third party property (in	Addressed under Section G.7.1 – Transportation and Utilities .

		case the claim is justified).	
9	Will other secondary roads be rehabilitated	The project does not envisage rehabilitation of secondary roads unless they are damaged because of the project activities.	N/A
10	Spoil disposal issue is crucial for the area. What will happen with material removed from the tunnels	The issue is very important. The EIA states the need for careful selection of the site for spoil disposal. Location of the site and spoil disposal will be done based on the spoil management plan. The latter will be agreed with local administration and environmental authorities.	Addressed under section G.7.3 – Waste Management .

Figure 123: Consultation in Kharagauli, February, 2018



I.2 Planned Information Disclosure

It is anticipated that in compliance with EIB's requirements for EIAs, the document will be provided for disclosure on the EIB website and the RD Website (in local language).

The RD PMU will be responsible to notify and inform the public of construction operations prior to construction works, publish an emergency response plan disclosing his intentions to deal with accidents and emergencies, including environmental/public health emergencies associated with hazardous material spills and similar events, etc.

I.3 Grievance Mechanism

I.3.1 Introduction

Grievance redress mechanisms (GRMs) are institutions, instruments, methods, and

processes by which a resolution to a grievance is sought and provided. GRM is seen by ADB as a pre-litigation mechanism for conciliation of disagreements and addressing concerns of project affected persons (PAPs) at early stages of dispute. GRM is aimed on smooth and creative resolution of disputes, minimizing time and resources waste and reputational risk to the project. The experience gained in ADB and other donor funded projects demonstrates that the efficient GRM enables to avoid time-consuming and complex legal procedures in majority cases of claims.

The GRM is an integral part of the ADB Accountability Mechanism that complements the problem solving (OSPF) and compliance review (CRP) functions of the ADB AM Policy 2012.

The GRM should be established and operated in compliance with the Georgian Regulations and ADB Policy requirements.

According to the ADB requirements, the GRM should be arranged to address the resettlement related issues (SPS 2009 – Safeguard Requirements 2: Involuntary Resettlement, Requirement 7. Grievance Redress Mechanism) and the environmental concerns of the affected communities and other stakeholders (SPS 2009 - Safeguard Requirements 1: Environment, Requirement 5. Grievance Redress Mechanism).

I.3.2 Georgian Regulations

The Administrative Code of Georgia is the legal document defining the rules and procedures for the grievance review and resolution.

According to the law, the Administrative body receiving officially lodged claims is obliged to review the claims and engage the claimant in the grievance review and resolution process, and issue final decision in that regard.

Clause 181. defines the content and the grievance submission forms. In particular, the grievance package should include: a) Name of the administrative body to whom the complaints are addressed; b) Name, address and contact details of the claimant; c) Name of the administrative body, who's decisions or administrative acts are the subject of complain; d) Name of the administrative act or decision, which is subject of complain; e) Content of the claim; f) The context and facts, based on which the complaint is substantiated; g) list of attachments;

Clauses 194 and 198 define the rules and procedures ensuring participation of the claimants in the grievance review process.

According to the clause 202, the decision issued by the Administrative Body in relation with the reviewed claim has a status of individual administrative legal act.

The standard period given for the issuance of the decision in relation with the grievance is 1 month.

I.3.3 ADB Policy (SPS, 2009) Requirements

The borrower/client will establish a mechanism to receive and facilitate the resolution of affected persons' concerns and grievances about physical and economic displacement and other project impacts, paying particular attention to the impacts on vulnerable groups.

The grievance redress mechanism should be scaled to the risks and adverse impacts of the project.

It should address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

The mechanism should not impede access to the country's judicial or administrative remedies. The borrower/client will inform affected persons about the mechanism.

I.3.4 Grievance Redress Process

At the LARP/EIA preparation stage, during the consultation meetings and negotiations the PAPs shall be fully informed of the grievance redress mechanism, its functions, procedures, contact persons and rules of making complaints.

Grievance resolution is viewed as a two-stage process, first involving local resources for the grievance resolution and only in case of failure engaging top management and entire capacity of the central offices of RD/PIUs.

Grievance redress procedures of Stage 1 represent an informal tool of dispute resolution allowing the PAPs and the project implementation team to resolve the disagreement without any formal procedures, procrastination and impediments. Such informal grievance redress mechanism helps to solve most of the complaints without formal procedures (i.e. without using the procedures specified in the Administrative Code or litigation). This mechanism enables unimpeded implementation of the Project and timely satisfaction of complaints.

Care will always be taken to prevent grievances rather than going through official procedures of Stage 2. The achievement of this goal can be ensured through careful planning and preparation of EIA and LARP, active participation of PAPs, effective consultations, proper communication and coordination among local communities, IAs and local authorities.

In case of failure of the grievance resolution attempts at the stage 1, the process of grievance review and resolution enters Stage 2. Stage 2 is a process formalized in accordance with the Administrative Code of Georgia. The claimant submits official claim in a written form to the RD and the RD as an administrative body is conducting the grievance review and response process following requirements of the law, regarding time frames, involvement of claimant, etc. The stage 2 process may require involvement of different departments and specialists of the RD, its consultants, local authorities and other stakeholders.

If the grievance is not resolved at the stage 2, the claimant has right and possibility to apply to court and the GRM helps the claimant to prepare application package.

I.3.5 Grievance Redress Mechanism

The GRM consists of temporary, project-specific units established at the municipal level in project affected municipality and regular system established at the RD level:

- **Grievance Redress Committee (GRCE)** established at municipal level as a project-specific instrument, which is functional only for the period of the project implementation.

- **Grievance Redress Commission (GRCN)** is formed as permanently functional informal structure within the RD to ensure grievance review, resolution and record.

I.3.6 Grievance Redress Commission for Stage 1

A Grievance Redress Committee (GRCE) is an informal, project-specific grievance redress mechanism, established to administer the grievances at Stage 1. This informal body will be established at community level in both the affected Municipality. The representative of Zestafoni Municipality will be a Chairman of the GRCE. The RD representative(s) of Environmental and Resettlement Unit in GRCE shall coordinate the GRCE formation. The Contact Person will then be responsible for the coordination of GRC activities and organizing meetings. In addition, GRCE shall comprise representative of Shorapani (Secretary), representatives of PAPs, women PAPs (if any), and appropriate local NGOs to allow voices of the affected communities to be heard and ensure a participatory decision-making process.

GRCEs will be established at the community level (office of the official Representative of Zestafoni Municipality). The establishment of GRCE will be formalized by the protocol of the first meeting, as a part of binding agreement of the Government and ADB. For the GRCE following composition is proposed (Table 110). There shall be at least one female member of the GRCE.

Table 110: GRCE Composition

1	Representative(s) of Environmental and Resettlement Safeguards Unit of RD	Member
2	Representatives of Zestafoni Municipality	Chairman
3	Representative of Shorapani	Member
4	Representative of PAPs	Member
5	Representative of NGO	Member
6	Representative of Contractor	Member
7	Environmental and Resettlement Specialists of Engineer	Member

The representative(s) of the Environmental and Resettlement Unit of RD shall coordinate the work of the Committee and at the same time they will be the contact person for collecting the grievances and handling grievance log. The local authorities at the municipal level (Zestafoni), Contractor, Engineer, as well as PAPs (through informal meetings) will be informed about the contact person.

The PAPs should be informed about the available GRM. This shall be achieved through the public consultation process and routine community meetings throughout the construction phase.

I.3.7 Grievance Redress Commission for Stage 2

Grievance Redress Commission (GRCN) is formed by the order of the Head of the

RD as a permanently functional informal structure, engaging personnel of RD from all departments having regard to the environmental and LARP issues and complaint resolution. This includes top management, Environmental and Social Safeguards Units, Legal Departments, PR department and other relevant departments (depending on specific structure of the RD). The GRCN is involved at the Stage 2 of grievance resolution process. The Order shall also state that if necessary representative of local authorities, NGOs, auditors, representatives of PAPs and any other persons or entities can be engaged in a work of GRCN. For the GRCN the following composition is proposed in Table 111. There shall be at least one female member of the GRCE.

Table 111: GRCN Composition

1	RD Management	Member
2	Head of Environmental and Social Safeguards Unit at RD	Member
3	Legal Department of RD	Member
4	PR Department of RD	Member

I.3.8 Grievance Redress Procedures

Stage 1 – informal review of the AP’s complaint (whether written or oral)

Grievance Collection and registration. The representative(s) of the Environmental and Resettlement Unit of the RD is the person responsible for collecting the grievances received from different entry points and for recording them. Through the consultations conducted at the early stages of the project development and throughout construction, the PAPs will be informed that grievances should be addressed directly to the Contact Person. However, it is expected that some portion of grievances will be addressed to the local authorities at the Municipal level, to the Contractor and Engineer. All these stakeholders will arrange entry points and recording systems for grievances and will readdress the grievances to the Contact Person. Further, the Contact Person will register the grievances and will coordinate the grievance resolution process, engaging the required members of GRCE.

Step 1: Informal negotiations

The Representative of the RD will review the grievance, and based on that will:

- Define the list;
- Agree with the claimant the date and site for the informal meeting;
- Conduct meetings, site visits and negotiations with the PAP with participation of □relevant members of the GRCE; and
- Will document all site-visits, meetings and discussions with the involved parties (minutes of meetings, photos, etc.)

In case of amicable resolution of the dispute, a Protocol of Agreement (Protocol 1: Action Plan) will be prepared by the RD describing agreed actions, dates, other conditions. The protocol will be signed by the claimant and Contact Person. The Action Plan should define:

- Clear timeline for each action; and
- Parties responsible for undertaking and completing each action, budget.

After implementation of the agreed action another protocol is prepared by the RD (Protocol of Grievance Closure), which confirms the fact that the parties have finally resolved the dispute. The protocol will be signed by RD as a representative of GRCE

and by the claimant.

Step 2.: Formal Review of the Grievance by GRCE:

If informal negotiations conducted as step 1 of the stage 1 process fails to resolve the issue, the official procedure of the grievance review by the GRCE is triggered.

The Contact Person of Environmental and Resettlement Safeguards Unit of RD assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

The written claim will contain the following information:

- Name and contact details of the claimant;
- Date of submitting claim;
- The brief description of the essence of claim; and
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim.

The RD and all members of the GRCE regarding the need of execution of the formal GRCE procedure. The RD will agree the date of formal meeting with the chairman and Secretary of the GRCE and inform the claimant and all members of the GRCE regarding the meeting site and date. The meeting should be held not later than two weeks after the notification issued by the RD. The RD will distribute the claim supplementary documents among the GRCE members.

The GRCE will engage all required specialists in reviewing the claim and, in case of need, will invite them on a planned meeting. During 1 week after the meeting the GRCE will issue its Conclusion and the Contact Person will inform the claimant about the decision.

In case of amicable resolution of the dispute, a Protocol of Agreement is prepared by the RD describing agreed actions, dates, other conditions. The protocol is signed by the claimant and Chairman of the GRCE.

After implementation of the agreed action the Protocol of Grievance Closure is prepared by the RD. The protocol will be signed by the Chairman of GRCE and by the claimant.

If informal negotiations conducted as stage 1 process fails to resolve the issue, the grievance resolution by GRCE at the local level is considered as not sufficient and the claim resolution process by GRCN at the central level is triggered.

The RD assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

The written claim will contain following information:

- Name and contact details of the claimant;
- Date of submitting claim;
- The brief description of the essence of claim; and
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim. □

Stage 2 – Official Review of the Grievances by GRCN

The Stage 2 process is triggered by notice from the RD sent to the GRCN with the attached claim and the supplementary package of documents prepared with the assistance of the RD.

The notice sent by the RD contains brief description of the grievance review and resolution attempts made at the Stage 1, including explanation of the reasons of disagreement and attachments (minutes of meetings, protocols, photos etc.).

Upon receiving the grievance and supplementary documents, the secretary of the GRCN will register the claim in a grievance log and initiate the formal grievance review and resolution process in accordance with the requirements of the Administrative Code. The GRCN members will discuss the issue and engage relevant departments and specialists of the RD, in order to find solutions for the grievance resolution. In case of need the specialists from other governmental institutions or expert groups could be also engaged.

Not later than two weeks from receiving the claim, the GRCN will conduct a formal hearing participation of the claimant at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved PAP will appear before the GRCN at the RD office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim, proposed solutions and final agreement.

In case of amicable resolution of the dispute, a Protocol of Agreement (protocol 1) is prepared by the Secretary of GRCN, describing agreed actions, deadlines and other conditions. The protocol is signed by the claimant and Chairman of the GRCN.

After implementation of the agreed action the Protocol of Grievance Closure is prepared by the Secretary of GRCN. The protocol will be signed by the Chairman of GRCE and by the claimant.

If the RD decision fails to satisfy the aggrieved PAPs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). GRCN (secretary) will help the claimant to prepare the documents for submission to the Rayon (municipal) court.

A brief description of all stages of Grievance Resolution Process are given in the Table 112 below.

Table 112: Grievance Resolution Process

Steps	Action Level	Process
Stage 1 (GRCE Level)	Step 1: Informal negotiations with PAPs	The complaint is informally reviewed by the GRCE Contact Person – Representative of Environmental and Resettlement Unit of RD, which takes all necessary measures to resolve the dispute amicably. At this stage, RD Contact Person engages in discussions with PAP only those members of the GRCE, who have direct relation to the issue.
	Step 2: Formal negotiations with PAPs GRCE level resolution of grievance	If the oral grievance is not solved during the negotiations, the GRCE will assist the aggrieved PAPs to formally lodge the grievances to the GRCE. The aggrieved PAPs shall submit their complaints to the GRCE within 1 week after completion of the

		<p>negotiations at the village level or later, as he wishes. The aggrieved PAP shall produce documents supporting his/her claim. The GRCE RD Contact Person will review the complaint and prepare a Case File for GRCE hearing and resolution. A formal hearing will be held with the GRCE at a date fixed by the GRCE RD Contact Person.</p> <p>On the date of hearing, the aggrieved PAP will appear before the GRCE at the Municipality office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim.</p> <p>The decisions from majority of the members will be considered final from the GRCE at Stage 1 and will be issued by the RD Contact Person and signed by other members of the GRCE. The case record will be updated and the decision will be communicated to the complainant PAP.</p> <p>After implementation of the agreed action the Protocol of Grievance Closure is prepared by the RD Contact Person. The protocol will be signed by the Chairman of GRCE and by the claimant.</p>
Stage 2	Step 3 Decision from central RD GRCN	<p>If any aggrieved PAP is unsatisfied with the GRCE decision, the next option will be to lodge grievances to the RD at the national level. GRCE should assist the plaintiff in lodging an official complaint to GRCN (the plaintiff should be informed of his/her rights and obligations, rules and procedures of making a complaint, format of complaint, terms of complaint submission, etc.). The aggrieved PAP shall produce documents supporting his/her claim, in accordance with the legal requirements (Administrative Code of Georgia).</p> <p>The GRCN of the RD shall review the complaint in compliance with the procedures specified in the Administrative Code of Georgia.</p> <p>If needed, a formal hearing will be held with the GRCN at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved PAP will appear before the GRCN at the RD office for consideration of grievance. The Contact person will note down the statements of the complainant and document all details of the claim.</p> <p>The plaintiff shall be informed of the decision.</p>
Stage 3	Step 4 Court decision	<p>If the RD decision fails to satisfy the aggrieved PAPs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). The aggrieved PAP can take a legal action not only about the amount of compensation but also any other issues, e.g. occupation of their land by the contractor without their consent, damage or loss of their property, restrictions on the use of land/assets,</p>

		etc.
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I.3.9 Grievance Log

The Grievance Logs will be developed at GRCE level.

Grievance Log in GRCE

The GRCE Grievance Logs will be developed and maintained at the Municipal level.

The Grievance Logs will be developed and managed by the RD representative at site. The logs will be kept on Excel files and shared copies will be available at the RD and at site in the Engineers office. The records in Grievance logs include the following information:

- Name and contact details of the claimant;
- Date of receiving claim;
- Form of claim – (oral or written);
- To whom the claim has been addressed initially (entry point);
- The brief description of the essence of claim;
- The stages, dates and participants of negotiations with the PAP with GRCE (stage 1);
- Minutes of meetings;
- Final decision of the GRCE (in case of the dispute is resolved, the decision is about closure of the issue. In case if the dispute remains unresolved, the decision is about passing to the stage 2 of the grievance redress process);
- Date of decision of GRCE; and
- Documents prepared by PAP with the help of GRCE for passing to GRCN.

The copies of the records/documents may be also kept in the municipal office.

I.3.10 Disclosure and Communication of the Grievance Process

The complaints resolution process was presented formally during the public consultations. The grievance redress mechanism will also be presented during routine community meetings in the Project area during the construction phase of the Project. In addition the Contractor shall set-up and publicize a 24-hour hotline for complaints and Ensure that names and contact numbers of representatives of GRCE and the Contractor are placed on the notice boards outside the construction site.

I.3.10 ADB and EIB Complaints Mechanisms

ADB Accountability Mechanism Policy, 2012

In addition to the GRM, the ADB has also developed its Accountability Mechanism (AM) Policy. The AM provides a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures. It consists of two separate but complementary functions: problem solving function and compliance review function. The objective of the Accountability Mechanism Policy 2012 is to be accountable to people for ADB-assisted projects as a last resort mechanism.

EIB Complaints Mechanism

Any natural or legal person affected, or perceived to be affected, by a decision of the EIB may lodge a complaint to its Secretary General, either in writing or through the internet. The Complaints Office ensures the centralized handling and registration of complaints, a structured investigation, internal and external reporting and a proactive approach. □

If the affected party is not satisfied with how the complaint is dealt with by the internal EIB process, s/he may lodge a complaint concerning maladministration against the Bank with the European Ombudsman EO. Maladministration covers the failure to act in accordance with the requirements of the Bank, including applicable legislation and/or respect for human rights and the principles of good administration.²³

²³ EIB Statement of Environmental and Social Principles and Standards (2009)

J. Conclusions and Recommendations

J.1 Conclusions

This EIA has established that, with the exception of the residual impacts mentioned below, there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable GoG and international standards for Project activities.

The identified residual impacts include:

- Greenhouse Gasses - Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road.
- Surface Water Drainage - It is noted that the Project requires interceptor tanks for bridge run-off and this should also be considered for the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.
- Employment - After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project.
- Visual Impacts - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go some way to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.
- Noise - Implementation of the recommended mitigation and management measures will help to reduce noise levels at many locations. However, at some receptors noise levels may rise above IFC standards during the operational phase of the Project. Monitoring of these sites will be required on an annual basis to determine actual noise levels in these areas. Where they exceed IFC standards the RD will consult with the affected owners to determine the most acceptable noise mitigation measures, including for example noise proof windows. There may be some vibration and noise nuisance during the construction phase of the Project, due to unforeseen events, but in general the measures outlined should ensure that all issues are suitably management and mitigated to prevent any long term significant impacts.

The total estimate costs of the environmental mitigation and management to be funded by ADB has been calculated at approximately US\$4,198,680, or approximately 1.5% of the total project cost of \$330m.

J.2 Recommendations

The EMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components. The Bid documents state that the Contractor will be responsible for the implementation of the

requirements of the EMP through his own SEMP which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors camp locations. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

The EMP and all its requirements will then be added to the Contractors Contract, thereby making implementation of the EMP a legal requirement according to the Contract. He will then prepare his SEMP which will be approved and monitored by the Engineer. Should the Engineer note any non-conformance with the SEMP (and the EMP) the Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the SEMP the Contractor should employ an Environmental Manager to monitor and report Project activities throughout the Project Construction phase.

APPENDIX A

List of Consultation Attendees, June 2017

[illegible]

APPENDIX B

Consultation Presentation, June, 2017

Environmental Impact Assessment (EIA)

ROADS DEPARTMENT OF GEORGIA
Road Corridor Investment Program, Tranche
3

Khevi-Ubisa-Shorapani-Argveta section

ADB Loan No. 2843-GEO
Stakeholder Consultations
7th June 2017



Project Overview

The Project is construction of a new road requiring new tunnels, bridges and other structures in order to allow traffic capacity expansion. Construction will be undertaken in difficult topographic and geological conditions without interrupting the traffic flow.

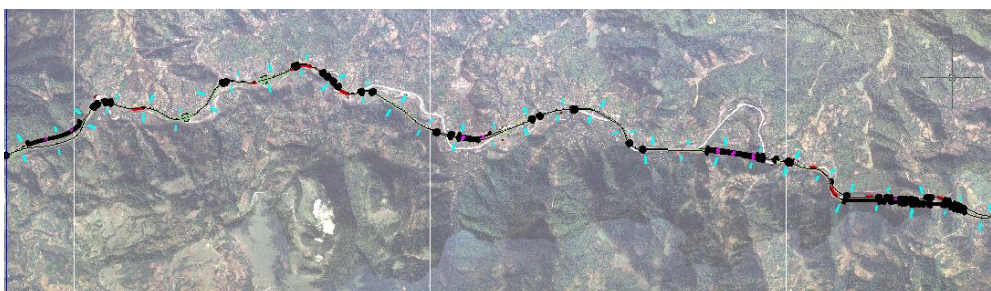
Item	Description
Road Length	41.665 km
Road Width / Number of Lanes	27m/4 lanes
Design Speed	100/80 km/h
Number of Bridges	77
Number of Tunnels	40
Construction Period	3 years



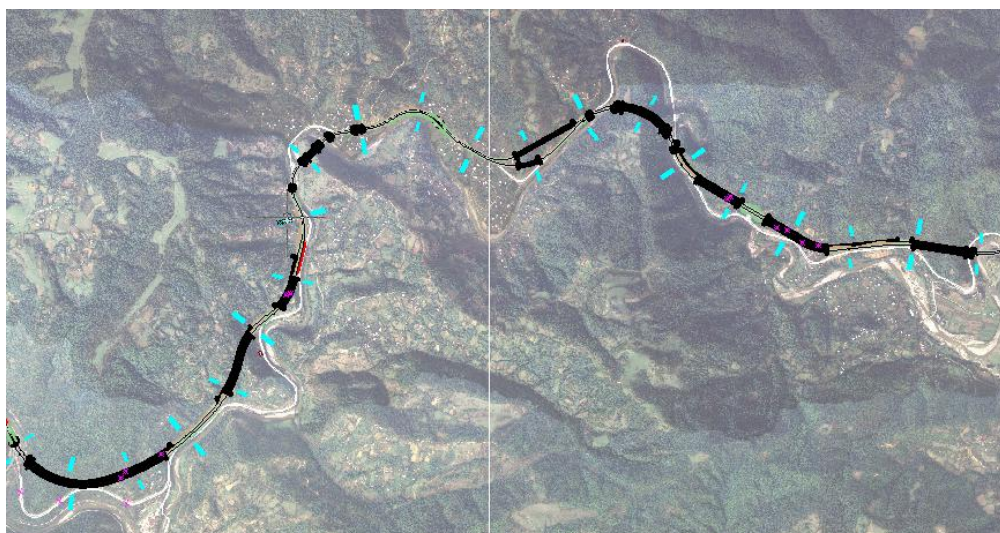
Project Location

Khevi-Argveta section of E60 Highway starts at the 9th km west from the existing Rikoti tunnel and ends near village Argveta. The entire section is divided in 3 Lots: F2-F3-F4

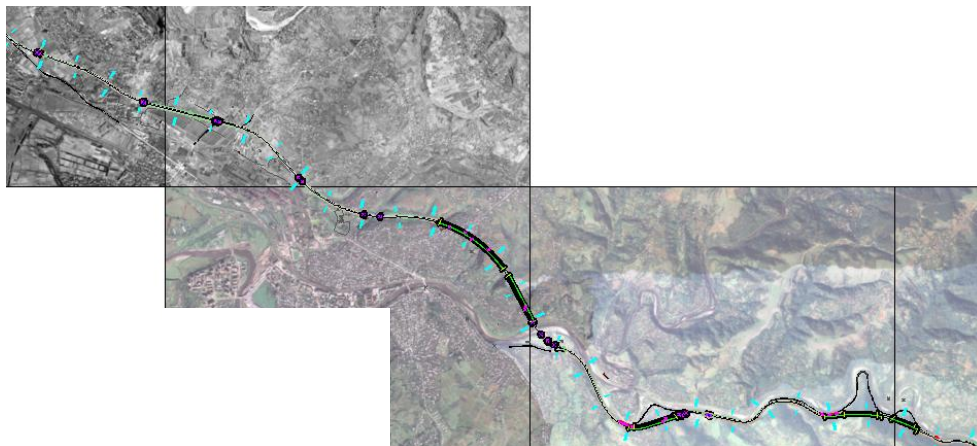
1st Lot: F2 (from km 8+880 to km 24+266 – Tot Length = 15.4 km



3rd Lot: F4 (from km 34+695 to km 50+545 – Tot Length = 10.4 km



2nd Lot: F3 (from km 24+266 to km 34+695 – Tot Length = 10.4 km



Need for the Project

Transport sector development in Georgia is essential for the achievement of sustainable economic growth, alleviation of poverty and promotion of tourism.

Deterioration of transport infrastructure increases the cost of doing business, deters foreign investment, hampers transit traffic growth, and leaves segments of the population out of mainstream economic activities.

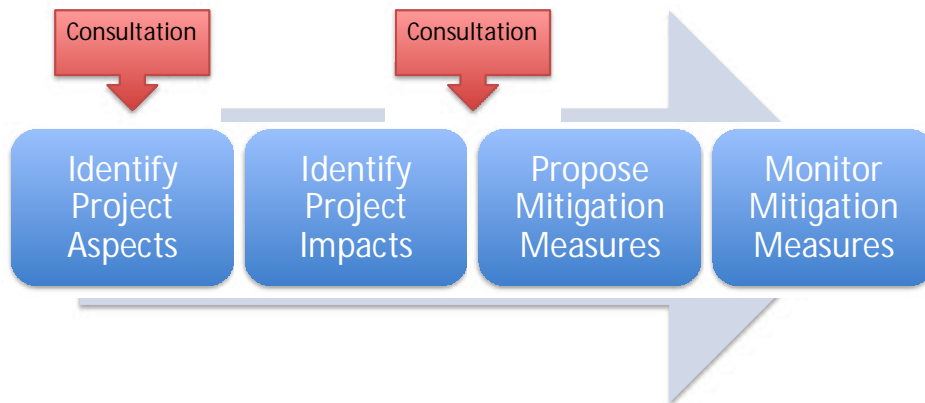
Georgia's geographical location is at the center of East-West (Black Sea and Caspian Sea) and North-South (between Russia and Turkey) transit routes.

Trade with neighboring countries is therefore an important driver of Georgia's economy.



What is EIA?

"A process for predicting and assessing the potential environmental and social impacts of a proposed project, evaluating alternatives and designing appropriate mitigation, management and monitoring measures."



Need for Consultations

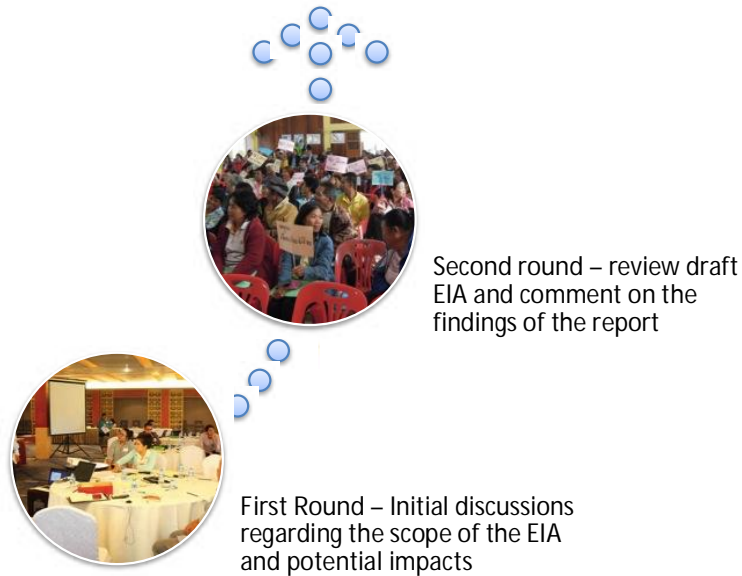
EIA of the Project is required by both Government of Georgia and the Asian Development Bank (ADB)

ADB specifically state:

"The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation."

For environment category A projects, such consultations will include consultations at the early stage of EIA field work and when the draft EIA report is available during project preparation, and before project appraisal by ADB.

Type of Consultations



Other EIA Activities

1. Collection of Baseline Data, including surveys of flora, fauna & rivers.
2. Instrumental monitoring of existing air quality, noise and water quality.
3. Review regulatory requirements.
4. Examine potential alternatives.
5. Assess impacts using tools such as impact matrices and models (air and noise)
6. Prepare of Environmental Mitigation and Monitoring Plans

Potential Physical Impacts

Aspect	Potential Impact
Air quality	<ul style="list-style-type: none"> Dust during construction – from vehicle movement, batching plants, blasting, tunneling, etc. Vehicle and machinery emissions both during construction and operational phases of the project.
Soils	<ul style="list-style-type: none"> Spills and leaks of hazardous liquids. Poor management of borrow pits. Soil Erosion during the operational phase.
Water Quality	<ul style="list-style-type: none"> Spills and leaks of hazardous liquids into rivers. Sedimentation of water ways. Poor disposal of waste water from camp sites.
Climate Change	<ul style="list-style-type: none"> Increased levels of GHGs from vehicle emissions. Impacts of climate change to the Project, e.g. flooding.

Potential Biological Impacts

Aspect	Potential Impact
Flora	<ul style="list-style-type: none"> Clearance of vegetation for road widening, borrow pits, construction camps and access roads. Illegal cutting of trees. Damage to trees and vegetation during construction.
Fauna	<ul style="list-style-type: none"> Destruction of habitat for road widening, borrow pits, construction camps and access roads. Blocking migration routes. Degradation of river habitat and associated impacts to fish and other aquatic fauna.
Protected Areas / Forests	<ul style="list-style-type: none"> Degradation of forests for road widening, borrow pits, construction camps and access roads.

Potential Socio-economic Impacts

Aspect	Potential Impact
Access	<ul style="list-style-type: none"> Construction works impeding access to properties and shops / businesses.
Noise	<ul style="list-style-type: none"> Elevated noise levels during both construction and operational phases of the project.
Traffic and Safety	<ul style="list-style-type: none"> Construction traffic accidents. Blasting during tunnel excavation and embankment works. Accidents to workers. Accidents involving the public at work sites.
Waste	<ul style="list-style-type: none"> Illegal dumping of solid and liquid waste Poor management of hazardous waste leading to pollution of soil, groundwater and health impacts
Cultural Heritage	<ul style="list-style-type: none"> Road encroaching on cemeteries and sites of cultural value

Your Thoughts

APPENDIX C

List of Consultation Attendees, January 2018

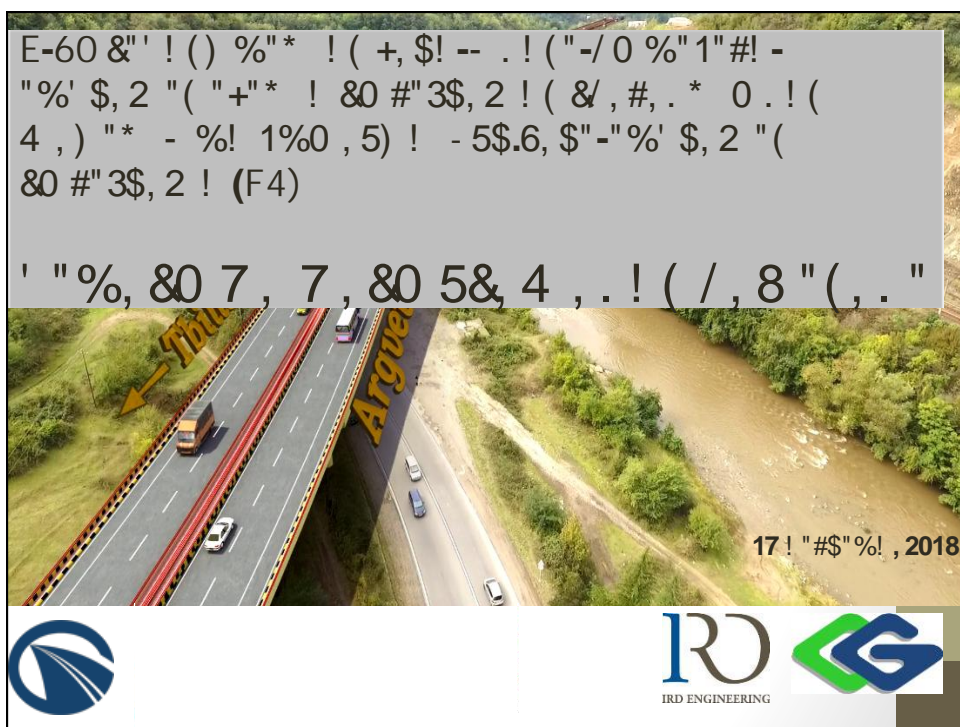
Section F3 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

[illegible]

№	განმარტება	განმარტება	განმარტება	განმარტება
25	სოფლის მეურნეობა		სოფლის მეურნეობა	558 42 33 33
26	სოფლის მეურნეობა		სოფლის მეურნეობა	558 42 33 33
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APPENDIX D

Consultation Presentation, January, 2018



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[2]

პროექტის მიზანი

- საქართველოს მთავრობა ახორციელებს ქვეყნის ძირითადი საგზაო მაგისტრალების მოდერნიზაციას.
- პროგრამის ფარგლებში, ევროპის იაპონიის საერთაშორისო განვითარების სააგენტოს (JICA) დაფინანსებით, იგეგმება ქვ.წევა-არგვეთას გზის მონაკვეთის მშენებლობა.

[3]

პროექტის გზშ -ს საფუძველი - საქართველოს კანონმდებლობა და საერთაშორისო მოთხოვნები

- საქართველოს კანონმდებლობით - საერთაშორისო და შიდასახელმწიფოებრივი მნიშვნელობის საავტომობილო გზის, რკინიგზის და მათზე განთავსებული ხიდის, გზაგამტარის, გვირაბის საჭიროებს გარემოზე ზემოქმედების შეფასებას.
- საერთაშორისო საფინანსო ინსტიტუტების მოთხოვნების შესაბამისად - პროექტი მიეკუთვნება ე.წ. A კატეგორიას და საჭიროებს გარემოზე ზემოქმედების შეფასებას

[4]

მონაწილე მხარეები

- ✓ პროექტი ხორციელდება რეგიონალური განვითარების და ინფრასტრუქტურის სამინისტროს საავტომობილო გზების დეპარტამენტის ხელმძღვანელობით;
- ✓ პროექტი მუშავდება იტალიური კომპანიების „აი არ დი“-ს და „სპეა“-ს (IRD- SPEA) კონსორციუმის მიერ;
- ✓ გარემოზე ზემოქმედების შეფასება და განსახლების სამოქმედო მომზადებაზე პასუხისმგებელია „გამა კონსალტინგი“ IRD- SPEA-ს ექსპერტებთან თანამშრომლობით.

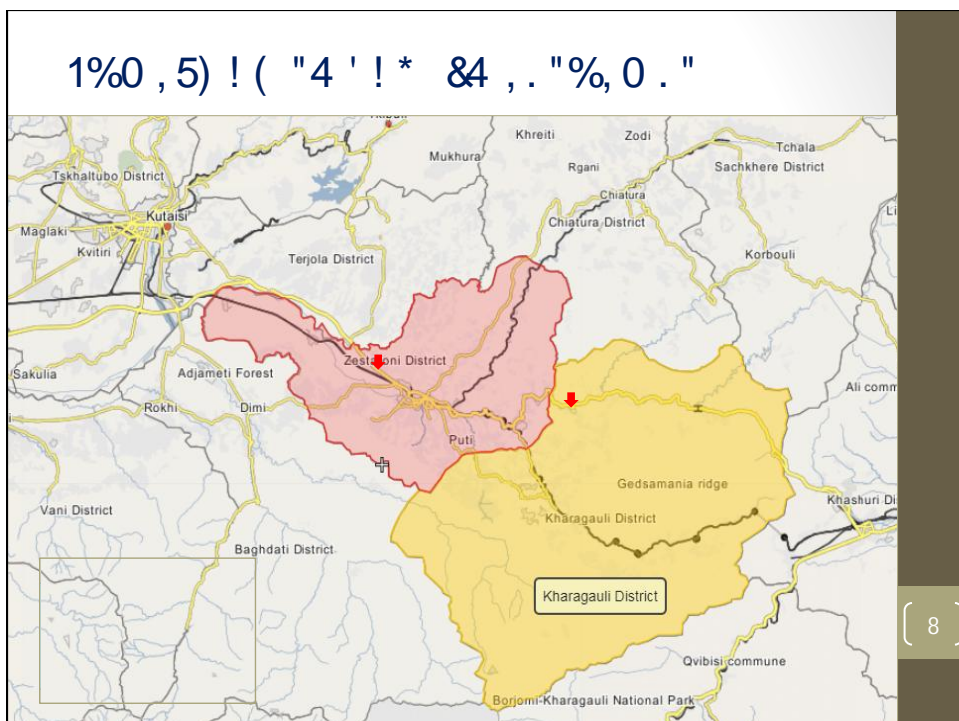
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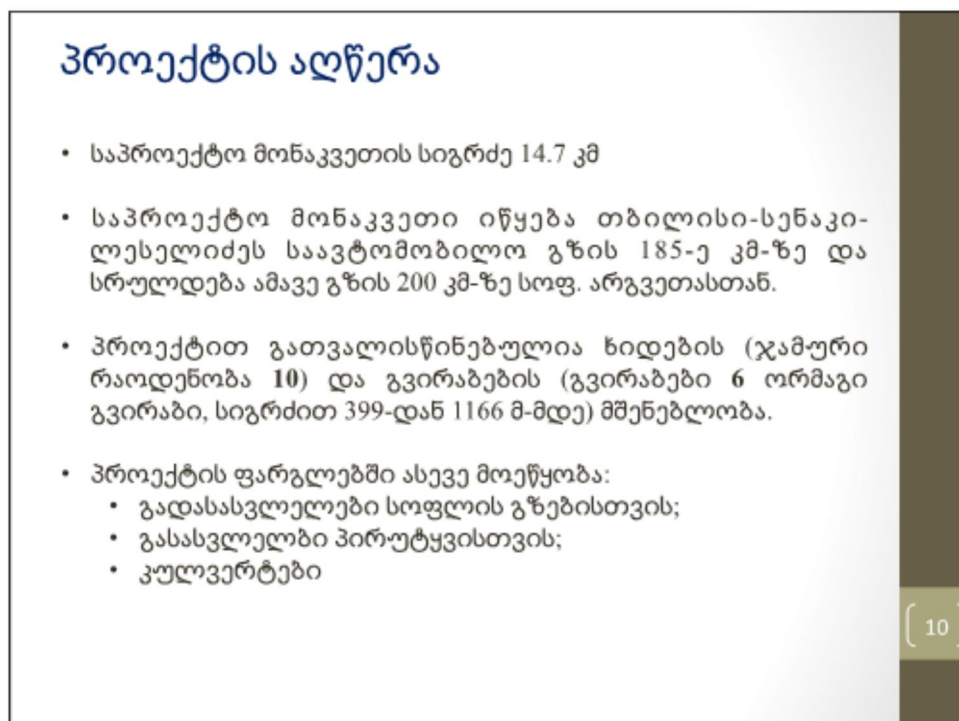
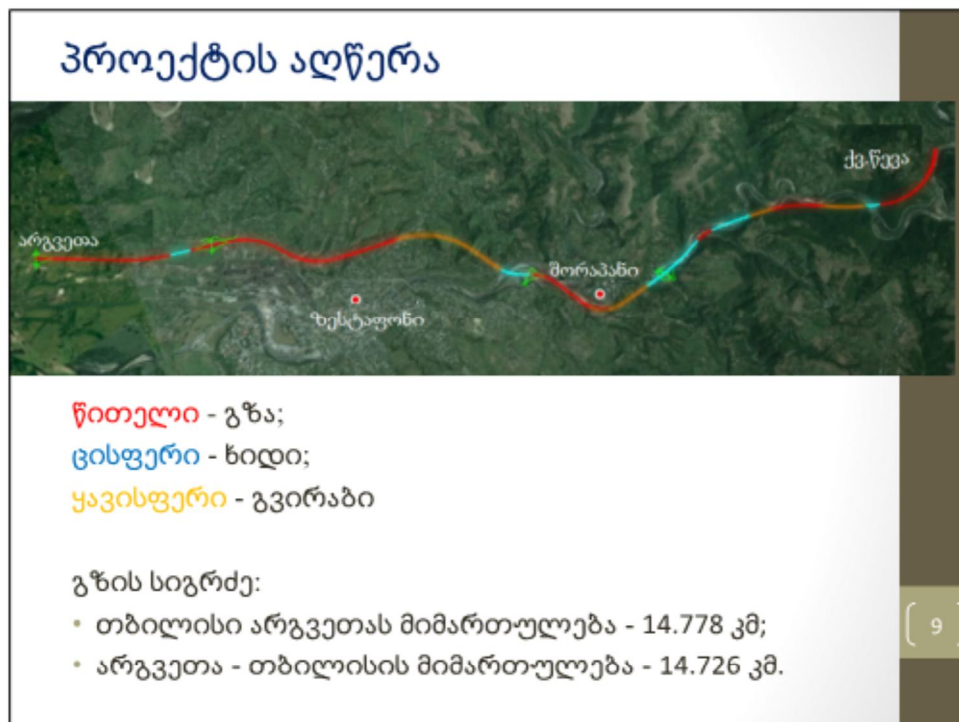
ალტერნატივები

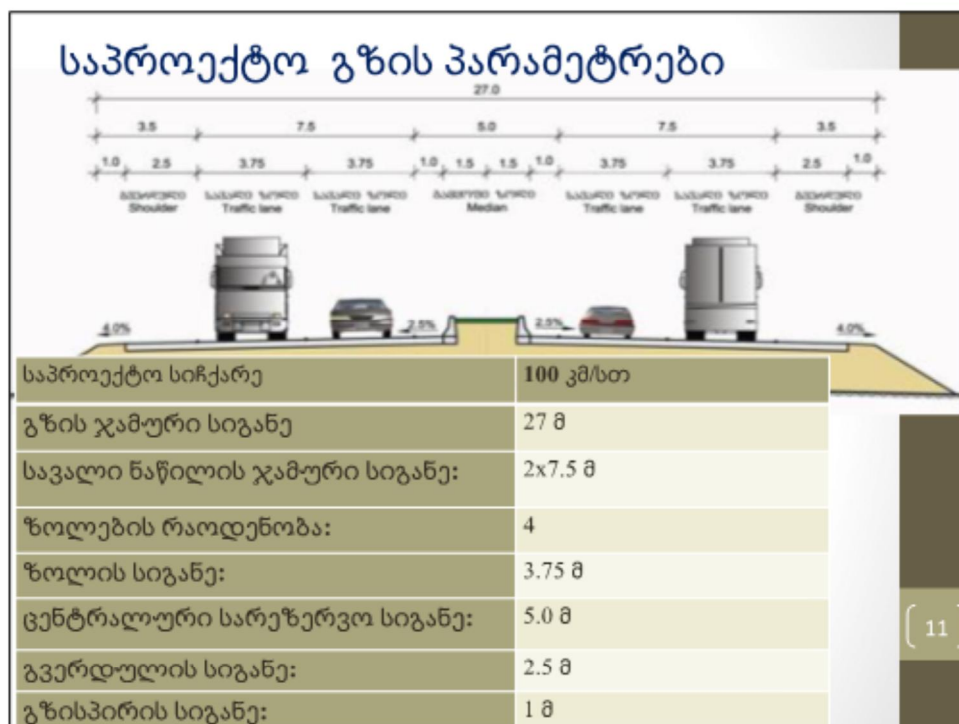
უპირატესი ვარიანტის შესარჩევად განხილული ალტერნატივები:

- ნულოვანი (არაქმედების) ალტერნატივა
- ტექნიკურ-ეკონომიკური შეფასების ეტაპზე განხილული 3 ოპტიმიზებული ალტერნატივა
- ახალი მარშრუტი (ტექნიკურ-ეკონომიკური შეფასებისას განხილული დერეფნის ფარგლებში)
- გზის საფარის ალტერნატივები (მყარი/ხისტი)

[6]







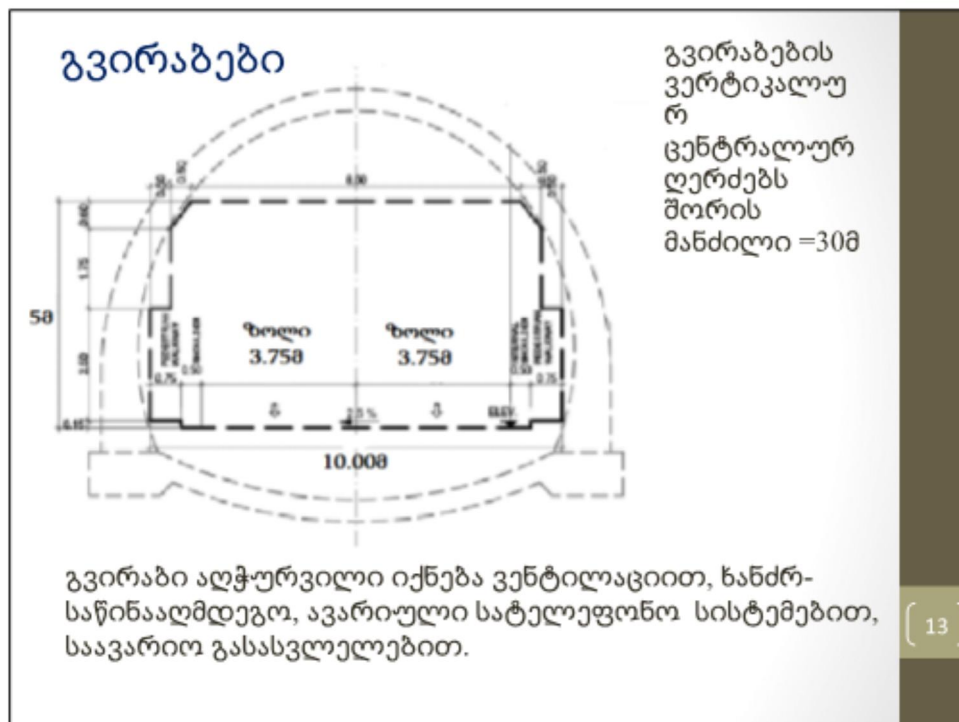
(11)

ხიდეები

ხიდი #	დასაწყ. კვ (მ)	ბოლო კვ (მ)	მდინარე	ხიდის სიგრძე (მ)	მაღის სიგრძე, მ
1-AT	1,256	1,846	ძირულა	589	42, 48, 54
1-TA	1,250	1,890	ძირულა	640	და 60
2-AT	2,039	2,980	ძირულა	941	
2-TA	2,050	2,930	ძირულა	880	
3-AT	3,230	3,485	ბორიმელა	255	34
3-TA	3,210	3,470	ბორიმელა	260	
4-AT	5,862	6,317	ყვირილა	455	48, 54, 60
4-TA	5,853	6,273	ყვირილა	420	და 72
5-AT	9,044	9,240	-	196	34
5-TA	9,018	9,214	-	196	
6-AT	7,061	7,101	-	40	
6-TA	7,031	7,071	-	40	
ჯამი				4,912	

#3,5 - სხმული ბეტონის; # 1,2,4 - ფოლად-ბეტონის

(12)



გვირაბები

გვირაბ ი #	სიგრძე (მ)	პიკეტაჟი		ლითოლოგია
		დასაწყ.(მ)	ბოლო (მ)	
01-AT	560	165	725	საშუალო ხარისხის ქანები
01-TA	399	226	625	
02-AT	510	725	1,235	
02-TA	445	725	1,220	
03-AT	1,165	3,472	4,637	
03-TA	804	3,490	4,294	
04-AT	715	6,330	7,045	ზომიერად სუსტიდან საშ. ხარისხის ქანებამდე
04-TA	723	6,300	7,023	
05-AT	1,193	7,137	8,330	
05-TA	1,152	7,107	8,259	
06-AT	450	9,277	9,727	
06-TA	444	9,265	9,709	

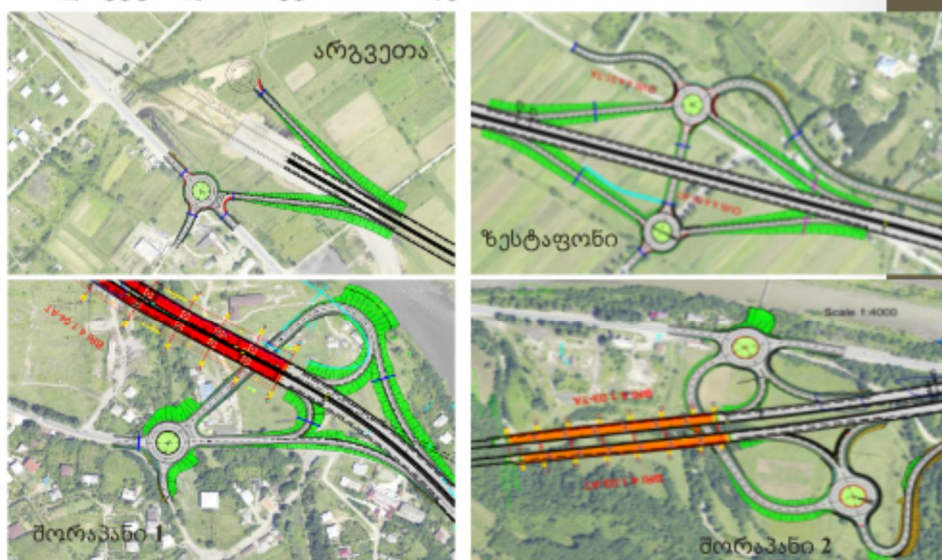
გასასვლელები და გადასასვლელები

- 6 გასასვლელები ადგილობრივი გზებისთვის - 6.0x4.5 მ
- 4 ნაწირსარეკი - 4.0x2.5 მ
- 17 კულვერტი - 2.0x2.5 მ
- 2 კულვერტი (წყალსატარი) - 4.0x2.5 მ
- 1 გადასასვლელი (km 11+854-ზე) - სიგრძე = 40 მ.

(15)

კვანძები

დაგეგმილია 4 კვანძის მოწყობა





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- "%=0 8! 2! 7, &0 5& 4, .! (/, & ! %, .! (' 7, .! (' "#("79 \$%"



/, &'%. ! * , , , * ! 9 0 #! (:! , , , ! (' ") "%, .! (/, &4 , ' , .6
#" %? , #! 7, &0 5& 4, .! (' "#("79 \$%"



' "%, &0 (4 "; \$! 2! & #, @& #) ! 4 " &0 #!) 0 %! #! (4 " ", ' &\$"

[18]

ეტაპები

- ფონური მდგომარეობის შესწავლა - კამერალური და საველე სამუშაოები;
- რეცეპტორების განსაზღვრა, ზემოქმედების და მისი მნიშვნელოვნების შეფასება;
- ალტერნატივების შედარება პოტენციური ზემოქმედების; შერბილების შესაძლებლობის; საჭირო ზარჯების; ნარჩენი ზემოქმედების მნიშვნელოვნების თვალსაზრისით.
- უპირატესი ალტერნატივის შერჩევა;
- პროექტის ეტაპებისთვის ზემოქმედების მართვის და მონიტორინგის გეგმის მომზადება.

[19]

შეფასების “საზღვრები“

ხმელეთის ბიომრავალფეროვნება	200 მ საპროექტო გზის ორივე მხარეს. 5 მ მოსასვლელი გზიდან.
წყლის ბიომრავალფეროვნება	მდინარის გადაკვეთის უბანზე - 50 მ დინების ზედა და 250მ დინების ქვედა მიმართულებით.
ჰაერი	გზის ღერძულა ხაზიდან 200 მ.
ხმაური	გზის ღერძულა ხაზიდან 250 მ,

ზემოქმედება მოსამზადებელ (წინა-სამშენებლო) ეტაპზე

დაგეგმილი სამუშაო/ქმედება	ზემოქმედება
<ul style="list-style-type: none"> ნებართვების აღება პროექტთან დაკავშირებით; გეგმების (როგორიცაა: ნარჩენების მართვის, სატრანსპორტო მოძრაობის მართვის, ეროზიის მართვის) შემუშავება და დამტკიცება; მასალების წყაროს/ მიმწოდებლების იდენტიფიცირება; დროებითი ბანაკებისათვის. მასალის. ნიადაგის ნაყოფიერი ფენის. გრუნტისა და ნარჩენების (დროებითი. ხანმოკლე) განთავსების ადგილების შერჩევა გარემოსდაცვის და უსაფრთხოების მოთხოვნების გათვალისწინებით; 	<p>გ ა რ ე მ ო ზ ე ზ ე მ ო ქ მ ე დ ე ბ ა</p> <p>მოსალოდნელი არ არის</p>

დაგეგმილი სამუშაო/ქმედება	ზემოქმედება
<ul style="list-style-type: none"> ტერიტორიის მომზადება - მცენარეული საფერის მოხსნა, ნაყოფიერი ნიადაგის მოხსნა და დროებით დასაწყობებას. სამუშაო ტერიტორიის პროფილირება; ტერიტორიაზე და მის გარეთ წარმოებულ სამუშაოები. 	<ul style="list-style-type: none"> მტვრის და წვის პროდუქტების ემისია; ხმაური და ვიბრაცია; ნარჩენების წარმოქმნა; საწვავის/ზეთების შემთხვევითი დაღვრა - ნიადაგისა და წყლის დაბინძურება; ნიადაგის ეროზია/დატყეპნა; ზემოქმედება ფლორასა და ფაუნაზე; საგზაო მოძრაობის ზრდა - ზემოქმედება ინფრასტრუქტურაზე; განსახლების/მიწის შეძენის (დროებით სარგებლობაში აღების) საჭიროება; უსაფრთხოების რისკები - პერსონალის და მოსახლეობის უსაფრთხოება; დროებითი დასაქმება (შენიშვნა: დადებითი ზემოქმედება).

ზემოქმედება მშენებლობის ეტაპზე

დაგეგმილი სამუშაო/ქმედება	ზემოქმედება
<ul style="list-style-type: none"> ინერტული მასალების შემოტანა გზის ვაკისის მოსაწყობად; მასალის დასაწყობება სპეციალურად გამოყოფილ ადგილას; გვირაბის გაყვანა; ვაკისის მოწყობა - ფორმირება. დატკეპნა; დრენაჟის სისტემის მოწყობა; შპუნტური კედლების მოწყობა მდინარის კალაპოტში ზიდის მშენებლობისას; ზიდის მშენებლობა - მიწის. ბ ე ტ ო ნ ი ს , ს ა მ ო ნ ტ ა ქ ო 	<ul style="list-style-type: none"> ემისიები – მტვერი. გამონაბოლქვი, შედუღების აეროზოლები; ხმაური და ვიბრაცია; წყლის ხარისხის შესაძლო გაუარესება მდინარის კალაპოტში ან მის უშუალო სიახლოვეს მუშაობისას; კალაპოტის ჩახერგვის რისკი; ნავთობპროდუქტების ავარიული დაღვრის შემთხვევაში - ნიადაგის დაბინძურების შესაძლებლობა; ნიადაგის ეროზია/დატკეპნა;

დაგეგმილი სამუშაო/ქმედება	ზემოქმედება
<ul style="list-style-type: none"> ზიდის და სავალი ნაწილის საფარის მოწყობა. გვერდულების ჩათვლით; გზის მონიშვნა და საგზაო ნიშნების დადგმა; ტერიტორიაზე და მის გარეთ წარმოებული სამუშაოები. 	<ul style="list-style-type: none"> ნარჩენების წარმოქმნა; ზემოქმედება ფაუნაზე; ზემოქმედების რისკი მცენარეულობაზე; სატრანსპორტო ნაკადის ზრდა; ზემოქმედება საგზაო ინფრასტრუქტურაზე; კერძო საკუთრების შემთხვევითი დაბინძურების რისკი; დროებითი დასაქმება მშენებლობის დროს (დადებითი ზემოქმედება); შესაძლო უსაფრთხოების რისკები - პერსონალის და მოსახლეობის უსაფრთხოება; სატელიტური ბიზნესის ხელშეწყობა (დადებითი

ზემოქმედება ექსპლოატაციის ეტაპზე

დაგეგმილი სამუშაო/ქმედება

- სატრანსპორტო მოძრაობა ახალ მარშრუტზე;
- ხიდებისა და გზების ტექმომსახურება/მოვლა

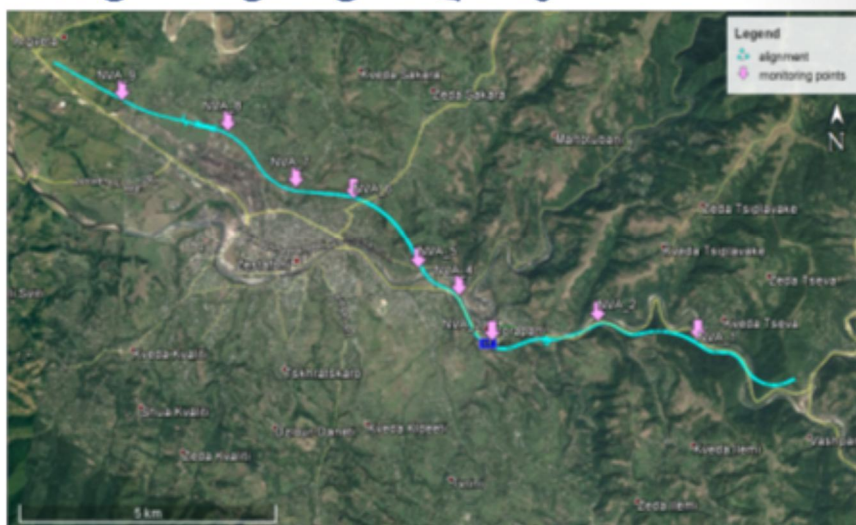
ზემოქმედება

- ემისია - მტვერი.
- გამონაბოლქვი;
- ხმაური და ვიბრაცია;
- უსაფრთხოების რისკები;
- ზემოქმედება ტექმომსახურების/შეკეთების დროს - ზემოქმედების სახეები და რისკები მსგავსია მშენებლობის დროს მოსალოდნელის. თუმცა ნაკლები სიდიდის და უფრო ლოკალური.

გარემოზე ზემოქმედების შეფასების ჯგუფის მიერ ჩატარებული საველე კვლევები

- პროექტის ზემოქმედების ზონაში მცენარეული საფარის/ფლორის და ცხოველთა სამყაროს შესწავლა
- ზედაპირული, გრუნტის წყლის და ნიადაგის ფონური ხარისხის განსაზღვრა;
- ხმაურის და ჰაერის ხარისხის ფონური დონე;
- ვიბრაციის გაზომვა;
- სოციალურ-ეკონომიკური ინფორმაციის შეგროვება.

ხმაურის ფონური დონე



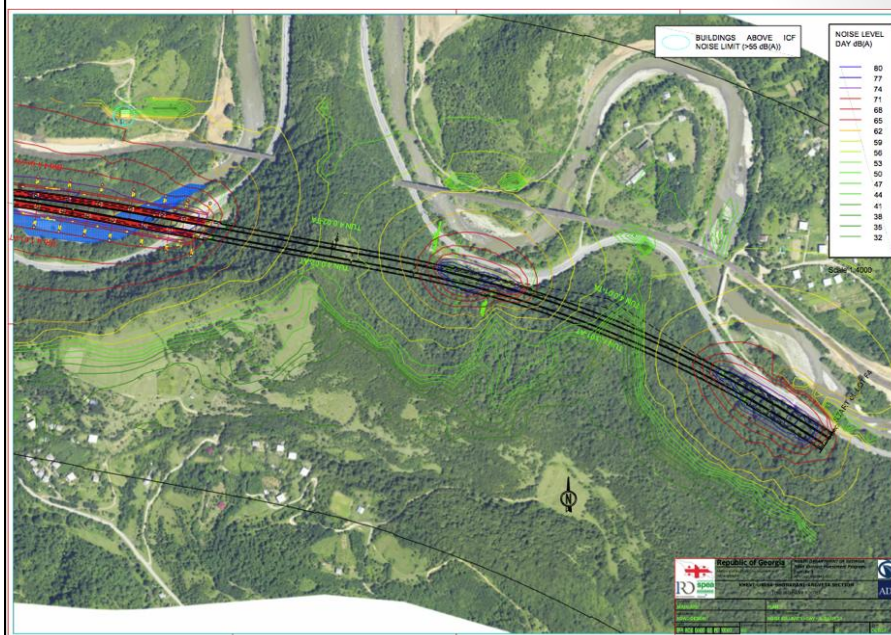
(27)

ხმაურის მოდელირება

- მშენებლობის დროს 25-50მ ხმაურის დონე დღის და ღამის საათებისთვის დაწესებულ ნორმას გადააჭარბებს. 100მ დაშორებით ხმაური დღის ნორმის ფარგლებში იქნება. 250მ-ზე - დღის და ღამის საათებში ხმაურის დონე დასაშვებს არ აღემატება.
- ხმაურის მოდელირება გზის ექსპლოატაციისას SOUND PLAN VER. 7.2 პროგრამის გამოყენებით - სატრანსპორტო ნაკადის პროგნოზული (30 წელი) ნაკადის გათვალისწინებით.

(28)

+&" - %! 4 9! (("2 , . /!



+&" - %4 " & "\$! . "%! , %!



- - +, /! & "+" 0 , . ! 2 +&" - %! (' "# 4 " (" ; "\$" 4 (">! %0 ! 5#, . " @&! & "+" 0 , . ! 2 11.8 3&. "%! , %! (& 0 6=0 . " .
- +&" - %! (4 " , & (! , . ! (' "# 4 " (" ; "\$" 4 " (, \$, / , (" : * , . , * ! " 10&(! " "#! (& 6\$"#, . "%! , % , . ! (/ , 5&#".
- (" 3! 2 +! 4 " 7- () 4 , . " & 0 #!) 0 %! #! ((" 8- : \$, * 7, .

[30]



ვიბრაცია

- ვიბრაცია მშენებლობისას წყაროდან 25მ დაშორებით არ გადააჭარბებს 10მმ/წმ.

ვიბრაციის შედეგად სტრუქტურული დაზიანების
შესაძლებლობის კრიტერიუმები

ზიანი მოსალოდნელი არ არის	PPV < 5 mm/s
კონსტრუქტული დაზიანების რისკი	PPV 5 to 15 mm/s
კონსტრუქციული დაზიანების რისკი	PPV > 15 mm/s

- სამუშაოების დაწყებამდე (გვირაბის მოწყობის
მონაკვეთი ზესტაფონთან) საჭირო იქნება
ახლომდებარე შენობების ტექნიკური მდგომარეობის
შემოწმება.
- ექსპლუატაციის დროს კონსტრუქციული დაზიანების
შესაძლებლობის მქონე ვიბრაციის ონე მოსალოდნელი
არ არის

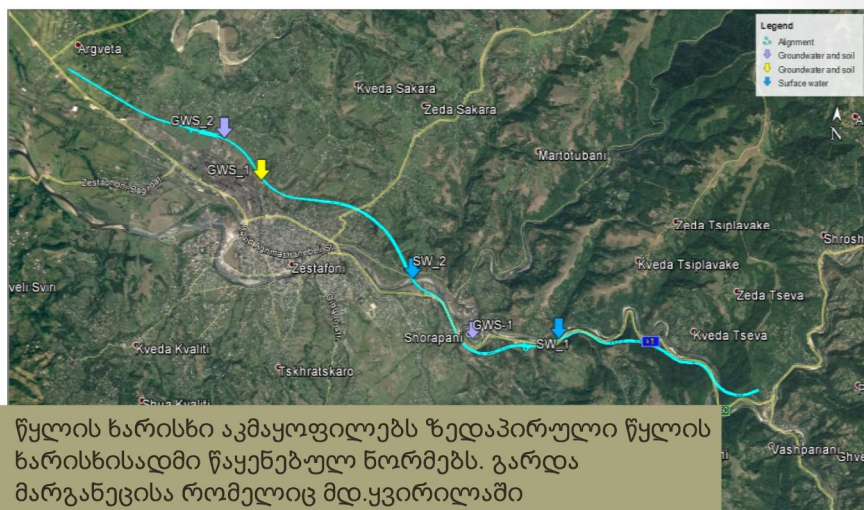
(33)

ნიადაგის ხარისხი



(34)

ზედაპირული წყლის ხარისხი



წყლის ხარისხი აკმაყოფილებს ზედაპირული წყლის ხარისხისადმი წაყენებულ ნორმებს. გარდა მარგანეცისა რომელიც მდ. ყვირილაში

ზედაპირული წყალი: pH, ელგამტარობა (EC), სიმღვრივე, ჟმჟ, ქქმ, გახსნილი ჟანგბადი (DO), TSS, ჯამური ფოსფორი, ჯამური აზოტი, ჯამური ამონიუმი, ჯამური თუთია, გახსნილი სპილენძი, მარგანეცი, სიმღვრივე, TPH, ტოტალური კოლიფორმები

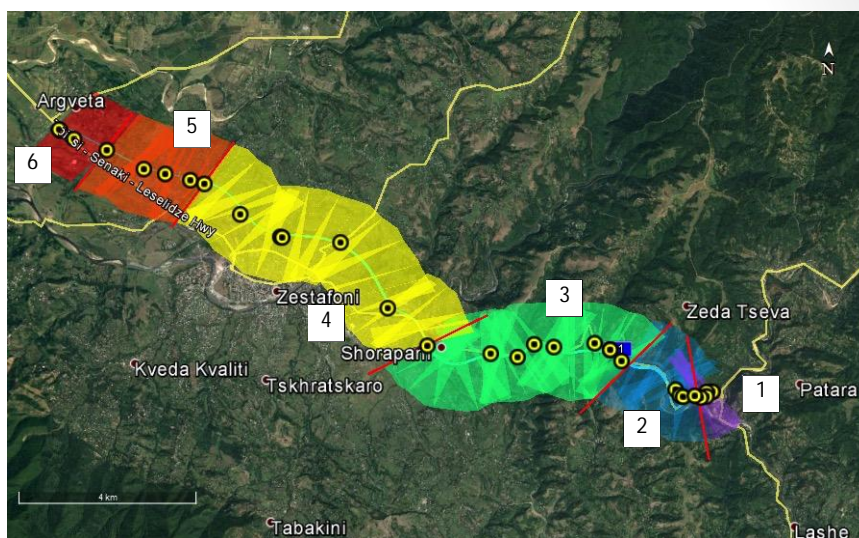
გრუნტის წყლის ხარისხი

pH

გახსნილი ჟანგბადი
ელგამტარობა
ტუტიანობა
სიხისტე
ჯამური შეტივანარებული ნაწილაკები
დარიშხანი
ქლორიდები
რკინა
ნიტრატები
ნატრიუმი
კალიუმი
კალციუმი
მაგნიუმი
მარგანეცი
ტყვია
სულფატები

წყლის ხარისხი აკმაყოფილებს საქართველოში მოქმედ მოთხოვნებს.

. ! 0 &%"\$"* 8 , %0 \$#, . "

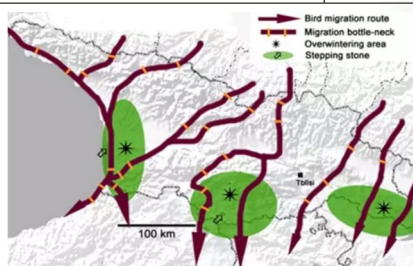


B'.!) ") ,.!(("30 #(\$%;! 0 9! %, . - * ,. "

1	2	3	4	5	6
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ცხოველთა სამყარო - დაცული სახეობები

სახეობა	წით. ნუსხა	IUCN	სხვა	Section N
კავკასიური ციცვი	VU	LC	EU ჰაბიტატების დირექტივა (92/43) IV 21/05/92; ბერნის კონვენცია 01/03/02,	1/2/3
წავი	VU	NT	CITES დანართი I, ბერნის კონვენცია დანართი II, ჰაბიტატების დირექტივა დანართი II და IV	4
ხმელთაშუა ზღვის კუ	VU	VU	-	1/4/

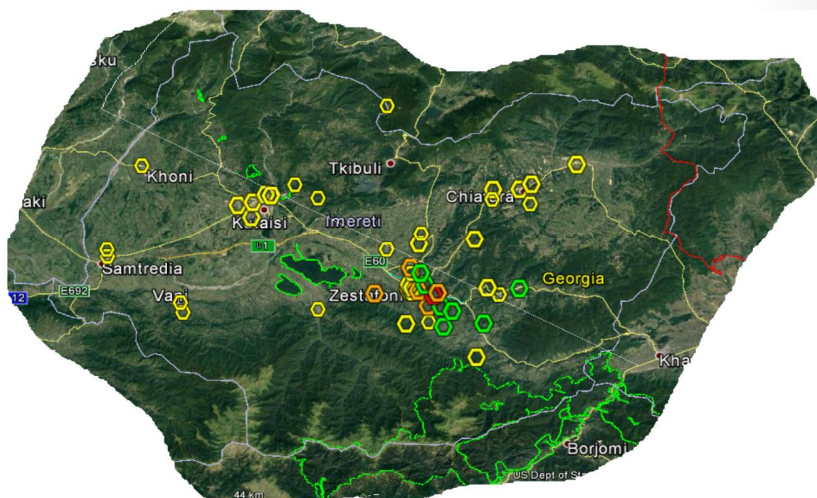


(39)

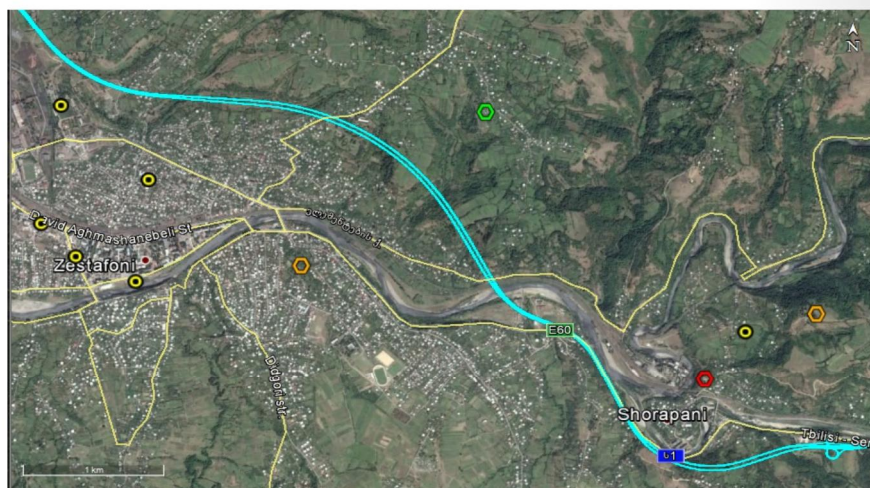
დაცული ტერიტორიები



კულტურული მემკვიდრეობა

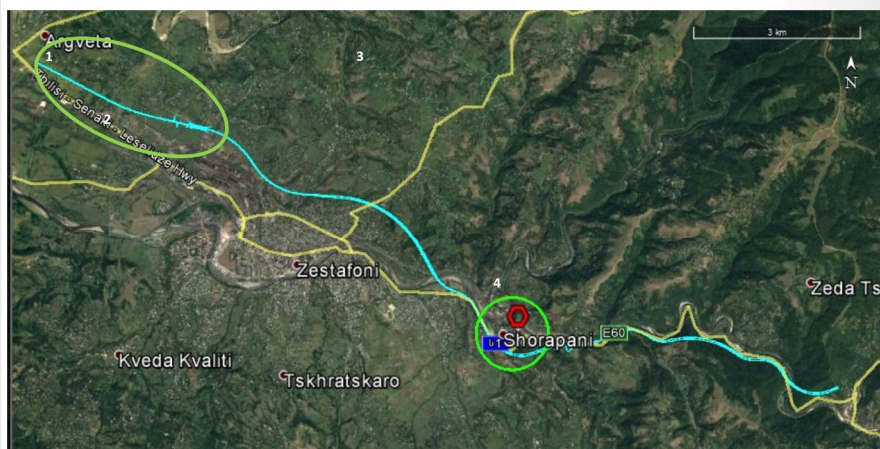


კულტურული მემკვიდრეობა



ყვითელი ექსლკუთხედი - ეკლესია; მწვანე ექსლკუთხედი - ეკლესია და სასაფლაო; წარინჯისფერი ექსლკუთხედი - სასაფლაო;
1 - წმ. ნინოს წკლესია, მიახლოებითი მანძილი 260m; 2 - წმ. ნიკოლოზის ეკლესია - მიახლო. მანძილი 650m. 3 - სასაფლაო - მიახლო. მანძილი 630m; 4 - შორპის ციხე - მიახლო. მანძილი 590მ

კულტურული მემკვიდრეობა - არქეოლოგია



შემოქმედება	რანგირება
მშენებლობა	
ხარისხის გაუარესება	L-M, S, R, ადგილობრივი.
ხმაური და ვიბრაცია	L-M.S, R, ადგილობრივი
წყლის ხარისხი	L-M, S, R, ადგილობრივი
ნიადაგის ხარისხის გაუარესება	L-M, S, R, ადგილობრივი
შემოქმედება ფლორაზე/მცენარეულობაზე	L-M, ადგილობრივი, ტერიტორიებზე, რომელიც გასხვსება არ ხდება მუდმივად - საშუალოდან ხანმოკლე (დროებითი), შექცევადი.
შემოქმედება ფაუნაზე	L-M, დამოკიდებულია სამარშრუტო მონაკვეთზე, S, R, ადგილობრივი. ეს იქნება - დარჩენილი ხმაურის გავრცელება, გამოწვევები ემისიები, შემოქმედების გარკვეული რისკი წყალქვეშა ცხოველებზე, დროებითი შემოქმედება წყლის ხარისხზე(ძირითადად სიმღვრივის მომატება), შეჯახება.
ლანდშაფტის და ვიზუალური ეკოლოგია	L-VL (დამოკიდებულია ადგილმდებარეობაზე), S, R, ადგილობრივი

ფუნქციონირება	
ჰაერის ხარისხის გაუარესება	დაბალიდან საშუალომდე, მოდელირების მონაცემების მიხედვით, ზემოქმედება არ არის მაღალი, შემამსუბუქებელი ზომები არ არის საჭირო
ხმაური და ვიბრაცია	დაბალიდან საშუალომდე .
წყლის ხარისხი	უმნიშვნელო - დაბინძურება ზედაპირული ჩამონარეცხით
ნიადაგის ხარისხის გაუარესება	დაბალიდან უმნიშვნელომდე - დაბინძურება ჩამონარეცხით
გეოლოგიური საშიშროებების განვითარება	უმნიშვნელო.
ზემოქმედება ფლორაზე/ მცენარეულობაზე	უმნიშვნელო.
ზემოქმედება ფაუნაზე	დაბალი. ხმაურის გავრცელება, გამონაბოლქვი ემისიები, ზემოქმედების გარკვეული რისკი წყლის ცხოველებზე წყლის ხარისხის გაუარესების გამო და კოლიზიის რისკი
ლანდშაფტის და ვიზუალური ცვლილება	მნიშვნელოვანი ცვლილება გზისა და ხიდების გამო



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#	ჰჰ (θ)	#	ჰჰ (θ)
01-AT	10,293	03-AT	13,222
01-TA	10,269	03-TA	13,200
02-AT	12,770	04-AT	13,636
02-TA	12,749	04-TA	13,614

კულვერტები

#	პკ (მ)	#	პკ (მ)	#	პკ (მ)	#	პკ (მ)
01-AT	50	14-AT	5,408	28-TA	11,223	40-AT	13,259
01-TA	50	16-TA	8,333	28-AT	11,245	42-TA	13,405
04-AT	190	16-AT	8,344	30-TA	11,567	42-AT	13,427
04-TA	190	18-TA	8,683	30-AT	11,579	44-TA	13,568
06-TA	620	18-AT	8,694	32-TA	12,183	44-AT	13,591
08-AT	755	20-TA	9,923	32-AT	12,204	46-TA	13,818
08-TA	760	20-AT	9,954	34-TA	12,428	46-AT	13,842
06-AT	615	22-TA	10,172	34-AT	12,449	48-TA	13,955
10-TA	4,639	22-AT	10,197	36-TA	12,489	48-AT	13,979
10-AT	4,661	24-TA	10,534	36-AT	12,510	50-TA	14,188
12-TA	5,021	24-AT	10,558	38-TA	12,975	50-AT	14,213
12-AT	5,049	26-TA	10,794	38-AT	12,997	52-TA	14,349
14-TA	5,391	26-AT	10,817	40-TA	13,236	52-AT	14,274

დამცავი კედლები

- კმ 0.00 to კმ 0.25
- კმ 4.36 to კმ 4.43 (შორაპანი-არგვეთა)
- კმ 8.63 to კმ 8.71
- კმ 8.84 to კმ 8.94

APPENDIX E

Chance Find Procedure

Purpose of the chance find procedure

The chance find procedure is a project-specific procedure that outlines actions required if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation. A Chance Find Procedure, as described in IFC Performance Standard 8 and EBRD Performance Requirement 8 and law on Cultural Heritage of Georgia, is a process that prevents chance finds from being disturbed until an assessment by a competent specialist is made and actions consistent with the requirements are implemented.

Scope of the chance find procedure

This procedure is applicable to all activities conducted by the personnel, including contractors, that have the potential to uncover a heritage item/site. The procedure details the actions to be taken when a previously unidentified and potential heritage item/site is found during construction activities. Procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority.

Induction/Training

All personnel, especially those working on earth movements and excavations, are to be inducted on the identification of potential heritage items/sites and the relevant actions for them with regards to this procedure during the Project induction and regular toolbox talks.

Chance find procedure

If any person discovers a physical cultural resource, such as (but not limited to) archaeological sites, historical sites, remains and objects, or a cemetery and/or individual graves during excavation or construction, the following steps shall be taken:

1. Stop all works in the vicinity of the find, until a solution is found for the preservation of these artefacts, or advice from the relevant authorities is obtained;
2. Immediately notify a foreman. The foreman will then notify the Construction Manager and the Environment Officer (EO)/Environmental Manager (EM);
3. Record details in Incident Report and take photos of the find;
4. Delineate the discovered site or area; secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities take over;
5. Preliminary evaluation of the findings by archaeologists. The archaeologist must make a rapid assessment of the site or find to determine its importance. Based on this assessment the appropriate strategy can be implemented. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage such as aesthetic, historic, scientific or research, social and economic values of the find;
6. Sites of minor significance (such as isolated or unclear features, and isolated finds) should be recorded immediately by the archaeologist, thus causing a minimum disruption to the work schedule of the Contractor. The results of all archaeological work must be reported to the Ministry/Agency, once completed.
7. In case of significant find the Agency/Ministry (Agency for Protection of National Heritage or Archaeological Research Centre, hereinafter referred to as Heritage

- team) should be informed immediately and in writing within 7 days from the find (ref.law on heritage protection).
8. The onsite archaeologist provides the Heritage team with photos, other information as relevant for identification and assessment of the significance of heritage items.
 9. The Ministry must investigate the fact within 2 weeks from the date of notification and provide response in writing.
 10. Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
 11. Construction works could resume only after permission is granted from the responsible authorities.
 12. In case no response received within the 2 weeks period mentioned above, this is considered as authorisation to proceed with suspended construction works.

One of the main requirements of the procedure is record keeping. All finds must be registered. Photolog, copies of communication with decision making authorities, conclusions and recommendations/guidance, implementation reports – kept.

Additional information

Management options for archaeological site

- **Site avoidance.** If the boundaries of the site have been delineated attempt must be made to redesign the proposed development to avoid the site. (The fastest and most cost-effective management option)
- **Mitigation.** If it is not feasible to avoid the site through redesign, it will be necessary to sample it using data collection program prior to its loss. This could include surface collection and/or excavation. (The most expensive and time-consuming management option.)
- **Site Protection.** It may be possible to protect the site through the installation of barriers during the time of the development and/or possibly for a longer term. This could include the erection of high visibility fencing around the site or covering the site area with a geotextile and then capping it with fill. The exact prescription would be site- specific.

Management of replicable and non-replicable heritage

Different approaches for the finds apply to replicable and non-replicable heritage.

Replicable heritage

Where tangible cultural heritage that is replicable²⁴ and not critical is encountered, mitigation measures will be applied.

The mitigation hierarchy is as follows:

- Avoidance;
- Minimization of adverse impacts and implementation of restoration measures, in situ;
- Restoration of the functionality of the cultural heritage, in a different location;

²⁴ Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.

- Permanent removal of historical and archaeological artefacts and structures ;
- Compensation of loss - where minimization of adverse impacts and restoration not feasible.

Non-replicable heritage

Most cultural heritage is best protected by in situ preservation, since removal is likely to result in irreparable damage or even destruction of the cultural heritage.

Nonreplicable cultural heritage²⁵ must not be removed unless all of the following conditions are met:

- There are no technically or financially feasible alternatives to removal;
- The overall benefits of the project conclusively outweigh the anticipated cultural heritage loss from removal; and

Any removal of cultural heritage must be conducted using the best available technique advised by relevant authority and supervised by archaeologist.

Human Remains Management Options

The handling of human remains believed to be archaeological in nature requires communication according to the same procedure described above.

There are two possible courses of action:

- **Avoid.** The development project is redesigned to completely avoid the found remains. An assessment should be made as to whether the remains may be affected by residual or accumulative impacts associated with the development, and properly addressed by a comprehensive management plan.
- **Exhume.** Exhumation of the remains in a manner considered appropriate by decision makers. This will involve the predetermination of a site suitable for the reburial of the remains. Certain ceremonies or procedures may need to be followed before development activities can recommence in the area of the discovery.

EMERGENCY CONTACTS

Ministry of Culture and Monument Protection

Address: 4 Sanapiro Street, 0105, Tbilisi, Georgia; Fax: 995 32 2999966, 2932235;
E-Mail: culturegovge@gmail.com

National Agency for Cultural Heritage of Georgia

27 Atoneli street, 0105 Tbilisi, Georgia: tel/fax: +(99532) 2932411
E mail: info@heritagesites.ge

Archaeological Research Centre under the Georgian National Museum

3, Rustaveli Avenue 0105 Tbilisi, Georgia
Tel: +(995 32) 2998022; Fax: +(995 32) 2982133
E-Mail: info@museum.ge

²⁵ Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site. Examples of non-replicable cultural heritage may include an ancient city or temple, or a site unique in the period that it represents.

APPENDIX F

State Forest Fund

Summary Tables (Trees over 8cm in Diameter)

		Carpinus Caucasica	Quercus Iberica	Acer Campestre	Tilia Caucasica	Alnus Barbata	Castanea Sativa	Pyrus Communis	Carpinus Orientalis
Area (m2)	Sub- section	Hornbeam	Georgian Oak	Maple	Lime	Alder (LC)	Chestnut (GEO Redlist)	European Pear	Oriental Hornbeam
11,185.00	1	53	51	32	34				
891.00	2	25	10	4	14				
26,902.00	3	472	7		5	34	116	2	41
11,179.00	4	24	1	2		3	23	4	10
19,823.00	5	120	54	6	4	96		3	303
28,514.00	6	164	68		6	59		2	471
4,068.00	7	20			16		22	2	23
673.00	8						3		
62,875.00	9	226	12	11	15	4	340	82	1374
9,974.00	10	20	9	7	8		57		588
10,005.00	11	32	13	12	15	8	42	1	50
186,089		1,156	225	74	117	204	603	96	2,860

	Salix Magnifica	Fraxinus Exelsior	Taxus Baccata	Accacia Dealbata	Morus Alba	Ficus Carica	Diospyros Lotus	Crataegus Microphylus
Area (m2)	Willow (VU)	European Ash	English Yew (GEO Redlist / LC)	Acacia	White Mulberry	Common Fig	Date Plum	Crataegus Microphylus
11,185.00								
891.00								
26,902.00	1	2	5	1	1	1	2	3
11,179.00				68				
19,823.00		1		241			18	
28,514.00	1	1		362	6	10	28	
4,068.00				1			51	
673.00				1				
62,875.00				1318			153	1072
9,974.00		1		14				
10,005.00		1		7	3	2	8	
186,089	2	6	5	2,013	10	13	260	1,075

	Umus Foliacea	Cupressus Semperviruns	Prunus Insitia	Cerasus Avium	Maulus Sylvestris	Gleditsia Triacanthos	Pinus Nigra	Ailanthus Altissima	Corylus Avellana	Zelkova Carpinifolia
Area (m2)	Field Elm	Mediterranean Cypress (LC)	Damson Plum	Sweet Cherry	European Crab Apple	Honey Locust	Austrian Pine (LC)	Tree of heaven	Common Hazel (LC)	Caucasian Elm (NT / GEO Redlist)
11,185.00										
891.00										
26,902.00										
11,179.00										
19,823.00	2	12	1	1						
28,514.00	6		10	2	7	9	6	14		
4,068.00										
673.00										
62,875.00			10	12	35				795	49
9,974.00										
10,005.00				1					18	
186,089	8	12	21	16	42	9	6	14	813	49

Trees under 8cm in Diameter

Area (m2)	Sub-section	Total Number
11,185.00	1	2,375
891.00	2	229
26,902.00	3	9,791
11,179.00	4	1,421
19,823.00	5	18,495
28,514.00	6	21,543
4,068.00	7	2,263
673.00	8	150
62,875.00	9	45,078
9,974.00	10	2,370
10,005.00	11	4,820

APPENDIX G

Noise Barrier Cost Estimate

description of works	Unit price		quantity for meter					cost/m
	UNIT	\$	L	I	h	n.	q.ty	
"B A R R I E R AND ANTI-NOISE BARRIERS ANTIRUMOR BARRIER COMPOSED BY ALUMINUM PANELS- SUPPLY AND INSTALLATION OF THE COMPLETE BARRIER "	mq	\$ 338,02			4		4	\$1.352,08
WORKS OF ART FOUNDATIONS - DIAPHRAGMS - PALI MEDIEPALI TRIVELLATI IN CEMENTITIOUS CONGLOMERATE - WITH TUBE SHAPE OF 600 MM EXTERNAL DIAMETER	mc	\$ 78,32	10	0,2826		0,25	0,7065	\$ 55,33
"WORKS OF ART MURATURES - CONGLOMERATES CEMENT - STRUCTURAL CONCRETE FOR FONDAZIONE WORKS IN C.A. O C.A.P. - C28 / 35 RESISTANCE CLASS (RCK> = 35 N / mmq) "	mc	\$ 136,18	10	0,2826		0,25	0,7065	\$ 96,21
"ARTWORK STEELS AND STEEL STRUCTURES STEEL IN ROUND BARS B450C IMPROVED BARS "	kg	\$ 1,18			56,52	0,25	14,13	\$ 16,74
"ARTWORK FORMWORK - ARMORIES - CENTI NATURE HORIZONTAL OR VERTICAL PLAN COREBOXES FOR CEMENTIZED CONGLOMERATES "	mq	\$ 24,43	0,8		4	0,25	0,8	\$ 19,54
"WORKS OF ART MURATURES - CONGLOMERATES CEMENT - STRUCTURAL CONCRETE FOR FONDAZIONE WORKS IN C.A. O C.A.P. - C28 / 35 RESISTANCE CLASS (RCK> = 35 N / mmq) "	mc	\$ 136,18	0,8	0,8	0,5	0,25	0,08	\$ 10,89
"ARTWORK STEELS AND STEEL STRUCTURES STEEL IN ROUND BARS B450C IMPROVED BARS "	kg	\$ 1,18			6,4	0,25	1,6	\$ 1,90
total cost for 1m noise barrier for funfation considering one pile each 4 meters								\$ 200,61

