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ROADS DEPARTMENT OF THE MINISTRY OF REGIONAL DEVELOPMENT
AND INFRASTRUCTURE OF GEORGIA

Environmental and Social Impact Assessment of works for upgrading E-60 East-West Highway section between Zemo Osiauri-Chumateleti (km 126 to km 143)

DRAFT ESIA REPORT

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LIST OF ACRONYMS

AASHTO	American Association of Highway and Transportation Officials
AH	Affected households
AP	Affected people
EA	Environmental Assessment
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
EWH	East - West Highway
FS	Feasibility Study
GoG	Government of Georgia
HGV	Heavy Goods Vehicle
HSE	Health, Safety, Environment
HS	Health and Safety
KP	Kilometre Post
LA	Land Acquisition
MCMP	Ministry of Culture and Monument Protection of Georgia
MESD	Ministry of Economy and Sustainable Development of Georgia
MENRP	Ministry of Environment and Natural Resources Protection of Georgia
NKUK	Nippon Koei UK
MLHSA	Ministry of Labour, Health and Social Affairs of Georgia
MRDI	Ministry of Regional Development and Infrastructure of Georgia
NGO	Non-Governmental Organization
OP/BP	World Bank's Operational Policy/Bank Policy
QC/QA	Quality Control and Quality Assurance
RAP	Resettlement Action Plan
RBG	Red Book of Georgia Protected Species
RD	Roads Department of the Ministry of Regional Development and Infrastructure of Georgia
RoW	Right of Way
SEP	Stakeholder Engagement Plan
SNIP	Construction norms and rules
TEM	Trans-European Motorway
ToR	Terms of Reference
WB	The World Bank
WHO	World Health Organisation

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1. NON-TECHNICAL SUMMARY

Introduction

The Government of Georgia is conducting a program to upgrade the major roads of the country, managed by the Roads Department (RD) of the Ministry of Regional Development and Infrastructure (MRDI). The program aims to improve transportation and transit of goods to surrounding countries, which is a significant and growing contributor to GDP. Transport of goods into and through Georgia has increased over the past 10-15 years as markets have expanded following the breakup of the Soviet Union, and Georgia is now a major transit country. Almost two-thirds of goods in Georgia are transported by road, and haulage by domestic and international truck companies is very evident on the country's highways. However many roads are poorly equipped to cope with the volume of traffic and the proportion of heavy vehicles, and factors such as insufficient dual carriageways, routing through inhabited areas and inadequate maintenance and repair, hinder throughputs and increase transit times. This creates difficulties for haulage companies and their clients, truck drivers, Georgian motorists and local residents.

The main target of the program for upgrading major roads in Georgia is the E-60 East-West highway (EWH) - the main route from neighbouring Azerbaijan and Russia, also connecting to Turkey and Armenia. For planning purposes, the EWH has been divided into sections of various lengths. The World Bank is providing series of loans to the Government of Georgia for upgrading this highway through East West Highway Improvement Projects (EWHIPs). Two projects of these series are now completed covering the highway section between Agaiani and Ruisi. EWHIP-3 and EWHIP-4 are under implementation covering the section between Ruisi and Agara. East-West Highway Corridor Improvement Project (EWHCIP) is under preparation. The project will finance upgrading of the highway from Zemo Osiauri through Chumateleti (shortly before Rikoti tunnel, which takes the East-West Highway from East Georgia to the West.

This Environmental and Social Impact Assessment (ESIA) was carried out for works planned in Zemo Osiauri-Chumateleti section of the Highway. According to the terms of reference (ToR), the present ESIA report includes an Environmental Management Plan (EMP).

Technical and Environmental Standards

Technical design of the highway improvement meets the Trans-European Motorway (TEM) standards. The project will be implemented in compliance with the Georgian legislation and environmental standards, as well as the World Bank's safeguard policies. The project triggers World Bank OP/BP 4.01 Environmental Assessment, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement; and OP/BP 4.20 Gender and Development.

Objective of the ESIA

Objective of the ESIA is to identify expected environmental and social impacts and risks of the project on construction and operation stages, to recommend measures for their mitigation, and to develop a plan for monitoring environmental compliance during construction and operation of the section under consideration.

Environmental Screening

The proposed works for the improvement of the EWH between Zemo Osiauri and Chumateleti include construction of a four-line section of the motor road with a range of bridges and tunnel on a new alignment bypassing Khashuri. According to the Georgian law, the proposed project is subject to environmental expertise and environmental permitting. Road works of the described scope and scale fall under Category A for environmental assessment purposes, requiring the conduct of a full scale ESIA and development of an EMP.

Public Participation

The Bank policies and the Georgian legislation require meaningful public participation and involvement in the process of ESIA and environmental management planning. The main principles of public consultation include:

- Conduct of at least two public consultation meetings for environmental Category A activities – on the ToR and scope of an environmental assessment, and on its draft report;
- Disclosure of the draft ESIA report to the public through the convenient media in a national language;
- Announcement of the venue and time of stakeholder consultation meetings through central and local means of public communication;
- Invitation for written comments/questions on the draft ESIA; and
- Incorporation of public feedback into the ESIA report and re-disclosure of the finalized document.

RD carried out the initial consultations on the environmental implications of the proposed project and the scope of the forthcoming ESIA at the early stage of its preparation. A stakeholder meeting was held on November 12, 2014 at the office of RD in Tbilisi. Information about terms of reference, alternatives under consideration, and the ESIA procedure and permitting issues were discussed.

The draft ESIA report will be posted on the web page of the MRDI. Hard copies of the document will be made available at the offices of Khashuri local self-governments located within the project implementation area, RD and the office of scientific research firm Gamma.

RD will organize a public consultation meeting to discuss the draft ESIA report as well as the draft Resettlement Action Plan (RAP). The meeting will be scheduled between the 50th and 60th day after disclosure of the draft document. Members of the communities in the project area, including elected officials, as well as representatives of the local small and medium businesses and other stakeholders will be invited. RD will seek questions and comments from the stakeholders and will incorporate received feedback into the ESIA report, as appropriate.

Sensitive Environmental Receptors and Potential Impacts

The Zemo Osiauri-Chumateleti section passes through rolling and hilly terrain. most challenging sections were identified through a comprehensive assessment of a wider corridor of EWH's possible alignment between Zemo Osiauri and Chumateleti. The landslide areas are scattered in the entire area. Other issues to

consider include a pine forest plantation, river Suramula, a residential area and a cemetery.

The main environmental impacts are expected at the construction phase and come from clearing of the right-of-way (RoW), establishment/operation of work camps and temporary access roads, operation/servicing of construction machinery, earth works works near waterway, construction of overpass bridges and tunnels.

Clearing of the RoW will be required in the new route sections. Establishment of construction camps and access roads is associated with generation of solid waste and wastewater, compression of soil, and noise related nuisance. Parking, operating and servicing of construction machinery will carry the risk of operational spills of oils and lubricants (i.e. the risk of soil pollution) and generation of noise, vibration, dust, and emissions. It is expected that the construction material will be purchased from suppliers licensed to operate quarries. License for use of natural resources - in case the contractor decides to use own quarries - will be obtained by the contractor from the National Environment Agency of the Ministry of Environment and Natural Resources Protection (MENRP). Construction works will also have implications for the occupational health and safety of workers/personnel.

Impacts of the new road during its operation phase are less diverse. Environmental aspects of the highway operation will be air pollution from automobile emissions, and pollution of soil with litter and drainage from the highway as well as water pollution with liquid/powder cargo and/or fuel and lubricants from the cars as a result of traffic accidents on the road section and runoff from the road. Project design brings the risks of negative impacts on environment to the feasible minimum. Provision for road safety and control over the traffic regulation will contribute to managing risks of accidents. Installation of noise barriers is not required. Diversion of the traffic from Surami-Rikoti section will affect businesses (shops, petrol stations, restaurants) and vendors along the road. Finally, traffic safety will be an important issue with health, social, and environmental implications.

Project Alternatives

Various alternatives of the highway alignment carry different levels of environmental risks, which has been critical in environmental analysis of project alternatives.

No “showstoppers” have been identified during ESIA and the anticipated impacts can be managed by application of adequate construction standards and good environmental practices. Nonetheless, a “do-nothing” option was considered as one of the project alternatives. While it has no environmental and social impacts resulting from construction works, operating the highway in its current poor condition has negative environmental and social impacts from traffic jams, noise, low speed, and high emission. In the future with consideration of increase traffic flow, the situation will worsen. On the global scale, under the "do-nothing" scenario, local communities would lose opportunity of benefiting from all positive effects associated with the highway improvement, including profits resulting from increased cargo turnover and tourism. Therefore, as the potential positive impacts

of the project surpass its possible negative impacts, the "do-othing" option was discarded.

Out of the four alternative alignments (eight different vertical alignment options) two were discarded due to the anticipated significant negative impacts. An alternative alignment with minimum impact on pine plantations and residential area, avoiding the sensitive areas such as pine forest, cemetery, and landslide sites and minimum impact on water environment has been selected as preferred option and was analysed in depth.

Project Description

The EWH section to be constrtucted under the project will connect Zemo Osiauri with Chumateleti. This will be a completely new section of the highway, bypassing Khashuri. The total road length will be 13.80km, maximum radius of curve – 700m. A central reservation will separate two pairs of the highway lanes. Paved shoulders will be provided for breakdown and emergency use. Surface water drains, safety barriers, lighting and signage will be arranged for safe operation of the upgraded section of the highway. Total width of the road will be 26.50m. The cross section parameters will comply with those of the previous sections of the highway, viz.: number of lanes – 4; lane width 3.75; carriageway width - 2x7.50m, width of shoulder - 3.75m (3 paved and 0.75m unpaved) and median width including barriers – 4m. The design speed of 100km/h and 80km/h is applied. The project includes 11 bridges (km126-km136) and 3 tunnels within the last 3 kilometres of the road . The new section runs through agricultural lands and coniferous plantations (so called Narvani forest), pass over Surami-Tsotskhnara local road, several residential buildings in village Urtkva, Shukghele stream.

Based on experience gained from the implementation of other similar road projects, it may be assumed that the construction may involve a total workforce of about 200. Out of these workers 60% to 70 % may be local workforce, which could be hired as semi-skilled or unskilled workers during the construction period.

Land acquisition needs are being studied by resettlement specialists of the design company *Pyunghwa Engineering Consultants*. Their report will be submitted separately. Summary of the land acquisition document will be incorporated in the final version of the ESIA report.

Environmental Impact Assessment Methodology

The ESIA processincluded the following activities (i) determination of the scope of the work; (ii) collection of the detailed baseline data; (iii) assessment of expected impacts; (iv) outlining of mitigation measures; and (v) development of environmental management and monitoring plans.

The ESIA process was a combination of desk work and field work, comprising literature review, data collection from various agencies, visual observation (flora and fauna survey) and fact finding along the RoW, noise and air modelling and analysis of the collected information. Results of engineering-geological and topographic survey and technical information related to the design were considered. Impacts of the project activities to be implemented outside the RoW - such as construction camps, temporary access roads, car stationing area - have

been considered as well. On the initial stage of the ESIA, spatial boundaries of the study area were defined to allow identification and assessment of the expected impacts and to enable comparative assessment of project alternatives in a given environment.

Environmental Baseline

The ESIA report presents information about the physical, biological, and socio-economic characteristics of the environment alongside the project alignment. The purpose of this description is to establish environmental baseline, to identify potential sensitivities, and to suggest adequate response through measures that are appropriate to avoid, minimize, or mitigate potential adverse impacts.

The new section of the highway passes through rural areas, where industrial pollution of environment is insignificant. No polluting or noise-intensive industries exist in the region nowadays. Physical environment around the subject section of the highway is not rich in biodiversity (species composition is meant). There are no designated protected areas near the project site. Critical habitatsfor Imeretian oak (*Quercus Imeretina, Georgian Red List VU category species*), chestnut (*Castanea sativa, Georgian Red List VU category species*), field elm (*Ulmus minor, Georgian Red List protected species*) and orchids (*Dactylorhiza romana subsp.georgica, Dactylorhiza urvileana, Caphalanthere damasonium, species protected under CITES)* which are registered within the broader project area, are bypassed by the selected alighment.. Small groves, ravines, Shukghele stream and Suramula River, which are crossed by the new alignment and fall under the project's direct impact zone, are ranked as sensitive receptors.

The baseline studies included the following components:

- Climate and meteorology;
- Geology, geomorphology;
- Hydrology, hydrogeology;
- Soils, landscape and land use;
- Air quality and noise;
- Seismic conditions and hazardous processes;
- Habitats, flora and fauna;
- Historical and archaeological sites; and
- Social environment.

Risks of the construction phase include impact on surface water, vegetation and soil, disturbance of terrestrial wildife, noise and emissions, physical relocation of five households, agricultural land take, and disruption of economic activity for several roadside traders. Keeping in mind the landslide risks in the area, this issue was carefully studied by the engineering team. The highway design has been developed so to bypass these sites as far as feasible, and mitigation measures have been suggested for the sensitive sections. All risks, including technical, environmental and social, were carefully examined in order to develop a safe and less damaging alterative. The risks related to the selected alternative are moderate. Most environmental impacts are manageable through the developed technical solutions, implementation of relevant mitigation measures and adherence to conventional good construction practice.

Research of the social baseline revealed several sensitive human aspects of the project implementation such as land alienation, relocation, and impact on the roadside businesses caused by diversion of the traffic flow to the new alignment. Subsistence of the majority of affected households considerably depends on the land plots and small businesses the ownership and use of which will be altered in the course of the project implementation. This finding emphasizes the importance of diligent planning and timely provision of adequate compensation and restoration of livelihoods by developing and implementing of a Resettlement Action Plan (RAP) in accordance with the guiding principles provided in the Resettlement Policy Framework (RFP) of EWHCIP.

Expected Impacts and Mitigation

Taking into account the location and sensitivity of human settlements and environmental receptors, the following mitigation measures were developed to mitigate the main risks associated with the project implementation:

- Impact on vegetative cover, fauna and habitats: Clearing of the RoW for the new alignment will imply removal of vegetation, including cutting of trees. Loss of vegetation will be kept at the possible minimum. Removal of trees for project needs will not cause functional damage to the ecosystem, however compensatory tree planting will be carried out within the EWH corridor at the ratio of 1:3 (except for the trees cleared from the privare land plots). Selection of species for planting will be based on the natural composition of local flora. Clearance from the National Forestry Agency will be obtained authorizing tree felling in the forested areas which are registered with the State Forest Fund. Greening of the construction sites along the RoW, as well as maintenance of the re-planted areas for three years will be included in the contractor works. RD will be responsible for further maintenance of plantations. Recultivation of distrurbed areas, including re-planting, will enable to mitigate disturbance of animal species. The selected alignment does not affect any critical habitat.
- Disturbance of local communities: Movement of construction machinery, location of the temporary work camps, and temporary storage of construction materials and waste will be planned to avoid or minimize barriers for a free movement of the local population. Deterioration of the air quality near populated areas will be controlled through oversight on the technical condition of construction machinery. Operation of engines in idle regime will be discouraged. Operation of construction machinery will be limited to the regular working hours. Local roads, if affected by movement of construction machinery and heavy vehicles, will be restored to the original condition or improved, as feasible, before contractor leaves the work site.
- Operation of work camps and access roads: Work camps and temporary access roads will be located preferably in the already transformed areas to minimize landscape and ecosystem degradation. The camps will be organized to have designated areas for storage of materials and waste, and will be equipped with septic tanks. Offsite maintenance/servicing and fuelling of machinery will be encouraged. In case not feasible, the areas designated for fuelling/servicing of machinery will be provided with ground lining and barriers preventing release of spillage. Similar precautions will be taken at the areas allocated for storing of hazardous substances. After completion of works contractor will be obliged to remove all temporary facilities from the site, clean

up and restore the area to the original state to the extent possible under the circumstances.

- Air pollution: Air pollution can appear during earthworks, gravel crashing, concrete mixing, and transportation in case of improper maintenance and operation of equipment, inadequate storage of fine-grained materials, and movement of vehicles on unpaved or dusty surfaces. To reduce generation of dust and emissions, construction equipment will be maintained in good working condition and mixing equipment will be sealed. Concrete mixing plants will be installed at least 300 m away from settlements windward. Speed limits will be set for construction vehicles and all loose material will be covered with tarpaulins when transported off-site with trucks. A wheel-washing facility will be provided and ensured that it is used by all vehicles before leaving all sites. All unpaved roads and significant areas of uncovered soil will be sprinkled during working hours in dry weather conditions.
- Operation of construction machinery: Technical condition of the construction machinery will be checked on regular basis to minimize air pollution from exhaust, and soil pollution from leakage of fuel/oil. The risk of operational and emergency spills of fuel and lubricants will be mitigated by designation of special parking and servicing sites, to be located away from waterways and other sensitive environmental receptors. The sites will be equipped with wastewater/spill capturing and treatment facilities.
- Impact on soil: Excavation works may cause loss of topsoil and trigger erosion if not properly managed. These impacts will be mitigated by removal and storage of topsoil separately for its use for later reinstatement of the area. Landscape restoration will be carried out to ensure stabilization of slopes. This would include seeding of grass and planting trees depending on location. Discharge of untreated waste water will be prohibited.
- Impact on surface water: The selected alternative alignment ensures minimum impact on surface water. No works will be carried out in waterways. However keeping in mind that the new alignment crosses ravines and the Shuaghele stream, which is a source of water supply to Surami settlement, special attention will be paid to operations in these sections of the road. Technical condition of machinery operated near/in the waterway will be checked on daily basis to avoid leakage and operational spills of fuel and lubricants. No stockpiling of construction materials and waste will be allowed in or nearby the waterways. According to the design drainage ditches will carry filters installed on both sides of the carriageway (including bridge) enabling to avoid surface water pollution with runoff from the road or in case of road accidents during operation.
- Accumulation of construction waste: Temporary storage of waste will be organized by separating construction debris, tunnelling spoil, household solid waste, and hazardous waste. The latter, comprising used filters, tires, and lubricants from machinery, will be kept in a closed and isolated storage. Transportation of waste from the construction sites will follow a time- bound schedule. Hazardous waste will be removed/utilized by licensed contractors. Formal instructions will be obtained from local authorities for the final disposal of inert waste. Sites for temporary storage of excess material will be agreed with local municipalites. Sites for permanent disposal of excess material – such of soil, rock and other non-hazardous materials – will be recommended by

local municipalities and cleared by the MENRP. Solid waste and household garbage will be disposed to the closest municipal landfill in Khashuri under agreement with Solid Waste Management Company. Volumes of disposable waste will be minimized to the extent possible through re-cycling/reuse and back-filling as feasible.

- Operation of quarries and borrow pits: Purchase of inert construction materials will be allowed only from the licensed legal and/or physical bodies. Contractor may also hold or wish to obtain a resource use license and operate own quarries. Opening of new borrow pits will be avoided if those already in operation can be used instead. Operation of quarries and borrow pits, as well as extraction of gravel from river terraces, will be carried out in accordance with the conditions of a license issued by the National Environment Agency of MENRP. Contractor will be responsible to develop, agree and strictly adhere to quarry/borrow pit operation and re-cultivation plan. Disturbed area must be re-cultivated after completion of material extraction activities. Performance of license holders will be subject to inspection by the Department of Environment Protection Oversight of the MENRP.
- Works near historical, cultural, and archaeological sites: All known historical and cultural monuments along the RoW were identified during the ESIA. The Highway alignment will not cause physical or aesthetical damage to these monuments. To avoid any damage to potential archaeological sites, chance find procedure will be enforced. If an artefact is encountered by a works contractor, all activities on site will be immediately taken on hold and cultural heritage protection authority will be urgently notified. Works will resume only upon receipt of written communication from the latter.
- Occupational health and safety: Work camps will be established and operated to ensure the maintenance of adequate hygiene and sanitation. Emissions, discharges and wastes generated by work camps will be controlled by the Department of Environment Protection Oversight. Workers and other personnel will be provided with personal protection equipment and gear. They will receive training on the safety rules and course of action in case of emergencies. Workers who operate heavy machinery must be licensed and insured.

Environmental Management Plan

This ESIA report includes the EMP with a full set of the proposed mitigation measures, as summarized above, and monitoring indicators. It also describes the role of the RD in overseeing adherence of construction works to the recommended mitigation measures and identifies the needs for the RD's technical and institutional capacity building for ensuring full environmental compliance of the project.

A supervision consultant will be hired by the RD to provide technical control and quality assurance of civil works. Environmental monitoring will be an integral part of the consultant's assignment and information on the compliance with the EMP will be included into the supervisor's regular reporting to the RD. The RD will have an overall responsibility for applying due environmental diligence. This will include ensuring quality of the supervision consultant's performance, site inspections, timely response to any issues identified by the consultant or by the RD inspectors, and record keeping on all environmental aspects of the project implementation. Various units of the MENRP will perform monitoring and control of key

environmental parameters within the project area as part of their general mandate and annual work plans. The Ministry will also exercise oversight on the adherence to the terms of environmental permit to be issued for the designed works on EWH.

Before commencement of works, the selected contractor will be asked to develop and to have agreed by the RD and the World Bank a works organisation plan, waste management plan (including spoil disposal), traffic management plan, health and safety plan, recultivation plan (including borrow pits/quarries (if any) and other disturbed areas) and emergency response plan as listed in technical specifications for bidders. The contractor will also develop and have agreed by the client a plan of greening and landscape reinstatement at a relevant stage of contract implementation.

Operation of the Highway

The improvement of the EWH aims at minimizing the need of interventions during its operation and maintenance. Ensuring safe and good environmental performance will be a high priority at the operations stage and will comply with the requirements of the national legislation and the best international practices.

Traffic related noise modelling carried out for operation stage of the project showed that noise level in the residential areas will not exceed allowable limits. Noise mitigation measures at the operation stage are not required.

RD, through an outsourcing arrangement, will permanently maintain and, in a longer term, improve greening along the RoW. Regular collection of solid waste along the highway will be organized by contractor identified by the RD. State technical control of the EWH through regular oversight and inspection by RD will be provided.

2. INTRODUCTION

The Georgian Government has embarked on a programme to upgrade the major roads of the country, managed by the Roads Department (RD) of the Ministry of Regional Development and Infrastructure (MRDI). The program aims to improve transportation and transit of goods to surrounding countries, which is a significant and growing contributor to GDP. Transport of goods into and through Georgia has increased over the past 10-15 years as markets have expanded following the breakup of the Soviet Union, and Georgia is now a major transit country. Almost two-thirds of goods in Georgia are being transported by road, and haulage by domestic and international truck companies is very evident on the country's highways. Many of the roads are however poorly equipped to cope with the volume of traffic and the proportion of heavy vehicles, and factors such as insufficient dual carriageways, routing through inhabited areas and inadequate maintenance and repair, hinder throughputs and increase transit times. This creates difficulties for haulage companies and their clients, truck drivers, Georgian motorists and local residents.

The initial studies focus on E-60 East-West Highway (EWH), which is the main route from the neighbouring Azerbaijan and Russia, with connections to Turkey and Armenia. For planning purposes, the EWH has been divided into sections of various lengths. The Georgian Government with its own budget completed the upgrade of the first 15 km of the EWH from outside of Tbilisi at Natakhtari to Agaiani. In 2006, the International Development Association (IDA) approved the First East-West Highway Improvement Project (FEWHIP), to upgrade the next section on the EWH from Agaiani to Igoeti (about 13 km) and additional financing for reconstruction of the Rikoti tunnel. Second East-West Highway Improvement Project (SEWHIP) prolonged the upgrade from Igoeti to Sveneti, a segment of about 24 km, and was also funded by the World Bank. The third East-West Highway Improvement Project (TEWHIP) was aimed at upgrading of the next consecutive section of the E60 East-West Highway from Sveneti to Ruisi (15 km). Additional financing for upgrading of the road segment between Ruisi and Agara bypass has been received. The Fourth East-West Highway Improvement Project is now in process. It covers the section of the highway between Agara West to the Gomi bypass, ending at village Zemo Osiauri, located at 114-126 km north-west of the capital Tbilisi (Figure 4.1). EWHCIP will finance upgrading of the highway from Zemo Osiauri through Chumateleti (shortly before Rikoti tunnel, which takes the EWH from East Georgia to the West). In 2008 and 2009 preliminary reports related to feasibility and environmental and social aspects of the E-60 highway rehabilitation project (Feasibility Study (FS), Kocks Consult, December 2008 -August 2009; Regional Environmental Assessment (km 80-km 144), Nippon Koei UK (NKUK), March-August 2009) were carried out. This was followed by individual ESIAs for various section of the highway.

Technical design of the planned highway improvement is in compliance with the Trans-European Motorway (TEM) standards. According to the Georgian law, the proposed project is subject to environmental expertise, and, as part of authorization to carry on with the planned development - a permit for impact on the environment. Road works of the described scope and scale belong to the Category A for environmental assessment purposes, requiring the conduct of a full

scale Environmental and Social Impact Assessment (ESIA) and development of the Environmental Management Plan (EMP).

The project will be implemented in compliance with the Georgian legislation and environmental standards, as well as the World Bank's safeguard policies. The outcome of the ESIA is a full scale analysis of the selected improvements, environmentally and socially sound and consistent with international practice.

The purposes of the ESIA are to:

- examine the project's potential negative and positive environmental and social impacts and recommend any measures needed to prevent, minimise, mitigate, or compensate adverse impacts and to improve environmental and social performance;
- analyse project alternatives;
- provide technical information and recommendations for selection and designing of the best option out of several alternatives;
- ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- develop an Environmental Management Plan, which will include a mitigation programme, a monitoring plan and assessment of institutional capacity for its implementation.

This report presents the impact assessment of the project on biophysical and social environment for Zemo Osiauri- Chumateleti (126 km 1o 143km) section of the road.

The present ESIA was carried out by COWI Lietiva and Scientific-research firm Gamma in cooperation with Pyunghwa Engineering Consultants . for the RD of the MRDI.

3. LEGAL AND POLICY FRAMEWORK

3.1. OVERVIEW OF GEORGIAN ENVIRONMENTAL LEGISLATION AND WB POLICY

The ESIA for the present project has been carried out with consideration of:

- the national environmental laws and regulations, the laws and regulations including environmental quality standards;
- the national laws and regulations related to social and land ownership issues;
- the World Bank Policy and operation procedures;
- road construction related regulations in force in Georgia;
- requirements of the EHS Guidelines for Toll Roads together with the General EHS Guidelines document (International Finance Corporation, WB group, April 30, 2007);
- recommendations given in the WB technical paper No. 376 "Roads and the Environment. A Handbook" (1997).

The World Bank environmental and social safeguards triggered by the project include:

- OP/BP 4.01 Environmental Assessment,
- OP/BP 4.04 Natural Habitats,
- OP/BP 4.11 Physical Cultural Resources,
- OP/BP 4.12 Involuntary Resettlement, and
- OP/BP 4.20 Gender and Development.

Environmental legislation of Georgia. Environmental legislation of Georgia comprises the Constitution, environmental laws, international agreements, by-laws, presidential decrees, ministerial orders, instructions, regulations. Georgia is a party to international conventions, including the environmental ones. A table below presents a list of Georgia's environmental legislation as it pertains to the proposed project.

Table 3.1. *List of environmental laws and regulations relevant to the project*

Year	Law / Regulation
1994	Law on Soil Protection (amend. 1997, 2002, 2010, 2011)
1996	Law on Entrails (amend. 1999, 2002, 2004, 2005, 2009, 2010, 2012, 2013, 2014)
1996	Law on Environmental Protection (amend. 1999, 2000, 2003, 2007, 2010, 2011, 2012, 2013, 2014)
1997	Law on Wildlife (amend. 2000, 2001, 2003, 2004, 2010, 2011, 2013)
1997	Law on Water (amend. 1999, 2000, 2003, 2004, 2005, 2008, 2010, 2012, 2013)
1997	Law on tourism and resorts (amend. 1998, 1999, 2000, 2011, 2013)
1998	Law on protection zone of resorts and recreation areas (amend. 1999, 2000, 2007, 2011, 2013)

1999	Law on Protection of Atmospheric Air (amend. 2000, 2007, 2010, 2011, 2012, 2013, 2014)
1999	Forestry Code of Georgia (amend 2000 2001, 2003, 2004, 2005, 2006, 2009, 2010, 2011, 2013)
1999	Law on Compensation of Damage from Hazardous Substances (amend 2002, 2003)
2003	Law on Red List and Red Book of Georgia (amend. 2006, 2009, 2010, 2011, 2012)
2005	Law on Licences and Permits (amend. 20092006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014)
2005	Governmental regulations (#132, dated 11 August 2008), on approval of rules and conditions for issuance of forest use licence
2007	Law on Environmental Impact Permit (amend. 2009, 2010, 2011, 2013, 2014)
2007	Law on Ecological Expertise (amend. 2009, 2010, 2011, 2013)
2007	Governmental regulations (#96, dated 10 May 2007) on approval of provisions for exclusion and inclusion of land from/into the state forest fund
2010	Governmental regulation (#242 dated 20 August 2010) on approval of forest use rules
2013	Government regulations (#424, dated 31 December, 2013) on topsoil removal, storage, use and recultivation
2014	Methodology for Estimation of Environmental Damage
2014	Resolution of the Government of Georgia (№271, 4 April,2014) on approval of technical regulations for reporting on compliance with licence conditions for use of natural resources, development of projects for use of natural resources, technological schemes for development of the deposits and mining plans and approval of statistical observation forms (№1-01, 1-02, 1-03 and 1-04)
2015	Waste Code

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

Table 3.2. List of social and land ownership related laws relevant to the project

Year	Law / Regulation
1996	Law on Agricultural Land Ownership (amend. 1997, 1998, 1999, 2000, 2003, 2004, 2007, 2010, 2012, 2014)
1997	Civil Code of Georgia (amend. 2000, 2002, 2003, 2004, 2005, 2006, 207, 2008, 2009, 2010, 2011, 2012, 2013, 2014)

1997	Law on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-Agricultural Purposes (amend. 2005, 2006, 2007, 2009, 2010, 2011, 2013, 2014)
1999	Law on Rules for Expropriation of Property for Public Needs (amend. 2005, 2007, 2010, 2013)
2007	Law on Cultural Heritage (amend. 2008, 2010, 2011, 2013)
2007	Law on Public Health (amend. 2009, 2010, 2011, 2012, 2013, 2014)
2007	Law on Entitlement of Ownership Rights to Lands Possessed (Employed) by Physical and Legal Persons of Private Law (amend. 2007, 2008, 2009, 2010, 2011, 2012)
2010	Law on state property (amend 20111, 2013)

Other laws and regulations relevant to the project include

- Law on Roads (amend. 1997, 2001, 2004,2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014);
- norms and rules 2.05.03-84 - Design of bridges, viaducts, overpasses and pipes;
- norms and rules II-44-78 - Design of road tunnels.
- norms and rules SNR 2.05.02-85 - Motor roads (regulate traffic safety, environmental issues, set forth main technical and traffic operation norms, crossings and intersections, paving aspects)
- SNIP 2.05.03-84* «Bridges and culverts»
- SNIP 2.03.01-84 «Concrete and reinforced concrete constructions»
- SNIP 2.05.07.91 «Industrial transport»
- SNIP 11-7-81* «Construction in seismic regions».
- TEM and AASHTO LRFD Bridge Design Specifications

According to this document for category I road[1] the following environmental aspects are distinguished:

- the distance to residential area must be at least 200m from the edge of the carriageway;
- along with technical and economic aspects environmental impacts must be taken into account;
- prior to set out of temporary infrastructure and preparation of road embankment, topsoil must be removed and stockpiled until subsequent use for recultivation 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.

[1] Road categories are attributed according to daily intesnsity of traffic: caregory I –7000 vpd; category II – 3000-7000 vpd; category III –1000-3000 vpd; IV – 100-1000 vpd; V-up to 100 vpd

3.2. ENVIRONMENTAL PERMITTING PROCEDURE – NATIONAL AND WB REGULATIONS

According to the national legislation, the project is subject to environmental impact permitting by the MENRP based on the ESIA report submitted by the proponent for the consideration of decision-makers. The permit application/issuance procedure for the planned development, including ESIA coordination and establishment of the timeframes for information disclosure and public review and discussion under ***The Law of Georgia on Environmental Impact Permits*** will include the following steps:

Step 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 ESIA can be reviewed and where comments may be submitted.

Step 2: Within one week after publishing the information in the newspapers, the proponent will submit the ESIA report (hard copy and electronic version) to the MENRP. A period of 45 days is allowed for receiving public comments on the ESIA. Between 50 and 60 days after publication, a series of meetings to receive comments from the stakeholder (which may include governmental agencies, local authorities, NGOs, community members) must be carried out. Within five days of the meetings, minutes of the meetings (summary of comments and discussions) are to be submitted to the MENRP.

Step 3: All comments received from the stakeholders at the meeting or in writing will be reviewed and addressed in the final version of the ESIA. A copy of all written comments, the minutes together with the comment-response section will be included in the final ESIA as an Annex. The final ESIA will be submitted to the MENRP and made available to the public, along with a project location map, an executive summary, of the planned development, reports on emissions and allowable limits. The permit will then be issued or denied within 20 days from registration of the submission.

According to the national regulations (Law on Construction Permit, 2004; Law on Licenses and Permits 2005), construction/ modernisation of highways requires the Construction Permit. (Procedures for obtaining the permit are described in the Law of Georgia on the Construction Permit.)

According to the national legislation, administrative body issuing the permit (the Ministry of Economy and Sustainable Development) ensures involvement of the other Ministries including the MENRP in the permitting process. For the project subjected to the construction permit, the authorisation (construction permit) incorporates elements of environmental impact permit.

Environmental impact permit is required for running an asphalt/concrete plant. License for use of natural resources, if decided to use own quarry, is required under the national legislation (Authority responsible for issuing the licence is MENRP). All other issues such as temporary disposal of inert construction waste and unusable asphalt are regulated based on agreement with local municipal authorities.

According to the World Bank safeguard policy, construction of the EWH section under consideration was classified as a Category A activity. According to the national regulations and requirements of the lender, a full-scale ESIA of the project was to be conducted.

3.3. COMPARISON OF THE NATIONAL ENVIRONMENTAL LEGISLATION AND WB REQUIREMENTS

The following considerations reveal the main differences between the World Bank guidelines and the national legislation:

- Screening and Classification: The Bank's guidelines provide detailed description of procedures for screening, scoping and conducting ESIA and explain a complete list of stages, which are not envisaged under the national legislation.
- Considering ecological risk, cultural heritage, resettlement and other factors, the Bank classifies projects supported by them under categories A, B and C. As mentioned, in the Georgian national legislation, ESIA is carried out only if a developer seeks to implement projects listed in the Governmental Decree on the Procedure and Terms of the Environmental Impact Permit. This list is compatible with the category A projects of the Bank classification. According to the Georgian legislation ESIA is not required in other instances, while the World Bank guidelines may require limited EA or Environmental Reviews for B category activities, as well.
- Environmental Management Plans: The Georgian legislation does not request EMPs for the projects not requiring ESIAs. The World Bank guidelines require EMPs for Category A and B projects and provide detailed instructions on the content.
- Involuntary Resettlement: The national legislation does not take into account the issue of involuntary resettlement at any stage of environmental permit issuance. 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 any other anthropogenic impact). Thus, the national legislation does not consider resettlement as an issue in the process of issuing environmental permits, unlike the Bank who takes a comprehensive approach to this subject. Also, the national legislation, in difference from the World Bank policy, does not provide for any compensation to informal users of land and other property.
- Responsibility for the ESIA: While the Bank's policy establishes the responsibility of a Borrower for conducting the environmental assessment, the national legislation provides for the responsibility of a project implementation unit to prepare the ESIA and ensure its consultation. According to the Georgian legislation, the MENRP is responsible for monitoring of project implementation and compliance with the standards and commitments provided in the ESIA with a less clearly defined role in relation to EMPs. The "Project Proponent" is responsible for implementing "self-monitoring" programs for the projects subject to the EIA. The WB guidelines stress the role of EMPs, which are important for all categories of projects and the Project

Proponent is requested to ensure inclusion of monitoring schemes and plans in the EMPs. Monitoring of performance compliance against the EMPs is an important element of the WB requirements.

Consultation: Based on the terms of legal agreements between the Government of Georgia and the World Bank, if safeguard requirements of the national legislation and the Bank policy pertaining a particular matter differ from each other, course of action shall follow requirements which are more stringent. Accordingly, (i) TOR for this ESIA was disclosed and stakeholders were consulted on its scope and methodology; (ii) EMP was prepared as part of this ESIA report, will be included into tender documents and will be made an integral part of a contract for the provision of works; (iii) project implementing agency will organize public consultation meetings on the present draft ESIA report and will re-disclose it after finalization based on the public feedback; (iv) project implementing agency will carry full responsibility for enforcing adherence to EMP and will report to the World Bank on the environmental performance of works ccntractor; and (v) involuntary resettlement will be handled by adequate payment for given up registered assets, as well as compensation for restricted access to and use of property, compensation for eligible informal use of assets, and restoration of livelihood of the affected people.

The present ESIA was carried out with consideration of both the national and the WB requirements on the complementary basis. Project implementation will comply with the requirements of both – the national legislation and the World Bank policies. If the two have differing requirements for a particular activity or procedure, more stringent requirements will apply.

3.4. INSTITUTIONAL FRAMEWORK

The GoG agencies undertaking supervisory, monitoring, project management, procurement or financial responsibilities are described below.

The RD responsibilities will include, at a minimum, accepting the feasibility study and final designs and accepting road sections after completion of rehabilitation. Maintenance also falls under the responsibility of the RD, but is sourced out to private enterprises. Maintenance includes winter maintenance, regular checks and repair of the road, including drainage facilities, bridges, guardrails, road signs. Garbage collection alongside the road also is among the duties of the RD through a contracted company.

The MENRP is in charge of issuing the Environmental Impact Permit for the Project, following the examination of the ESIA and the subsequent State ecological examination. The rights of the MNRP as the competent authority are the following:

- to intermit, limit or stop any activity which has or is likely to have adverse impact on the environment, as well as unreasonable use of natural resources;
- to issue a series of licenses (for natural resources use) and permits (for environmental pollution);
- to control the execution of mitigation measures by the developer;

- to receive free and unrestricted information from the developer about the utilization of natural resources, monitoring systems, waste management and explanations from authorities concerning the Project.

The Local Executive Bodies perform the main administrative functions in each district, including the local land-use issues and land allocation function.

4. DESCRIPTION OF THE PROJECT

4.1. BACKGROUND

The program to upgrade the major roads of the country initiated by the Government of Georgia aims to improve transportation and transit of goods to the neighbouring countries. The program is managed by the RD and focuses initially on the EWH which runs from Russia and Azerbaijan, with connections to Turkey and Armenia. (Figure 4.1.)

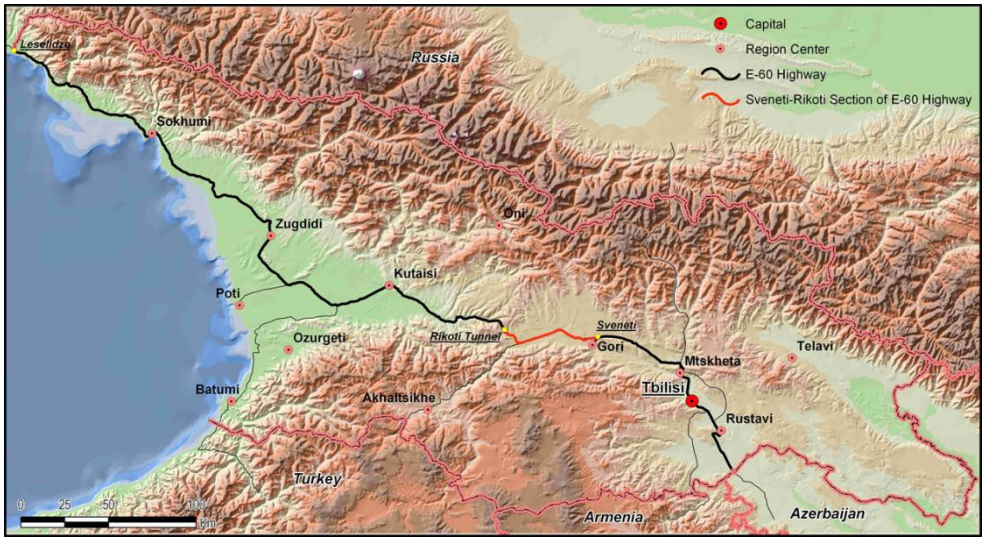


Figure 4.1. Location of the E-60 highway

Several sections of the road have already been upgraded. New alignment connecting Zemo Osiauri with Chumateleti bypassing Khashuri.

4.2. DESCRIPTION ALTERNATIVE ALIGNMENTS

Along with 'no action' alternative, one (1) alternative (Alternative A4) suggested in the P/FS and three (3) alternatives (Alternative A1, Alternative A2 and Alternative A3) analysed by the Consultant are shown in the Figure 4.2.

Figure 4.2. Alternative alignments

Alternatives A1 to A4 differ by length of the main structures.

Alternatives 1 and 2 within first 10 km have the same alignment. The difference is in the last several kilometres. For Alternative A2 three different ways (Alternatives A2-1, A2-2 and 1A2-1) to connect to existing (Tbilisi-Senaki-Leselidze) road are considered. Two options for ending sections of Alternatives A3 and A4 have been suggested for consideration. Respectively hereinafter for these alternatives Alternative alignments A3-1, A3-2 and A4-1, A4-2 are considered.

Table 4.1. Length of the main structures by alternative alignments (m)

	A 1	A 2-1	1A 2-1	A 2-2	A 3-1	A 3-2	A 4-1	A 4-2
Road	8372	10053	9983	8914	10100	9060	12173	10283
Bridge	2866	2632	2702	3766	2530	3580	2317	4207
Tunnel	2562	1495	1495	1500	1450	1440	0	0
Total	**13800**	**14180**	**14180**	**14180**	**14080**	**14080**	**14490**	**14490**

Description of the Alternative alignments is presented below.

Alternative A-1 starts at km 126 connecting with the Gomi Bypass alignment. The road goes in north-west direction crosses canal in 7 locations; ravine in 7 locations, Sukghele stream – once, overpass two roads of local importance (Surami Tsotskhnara and Surami-Bijnisi road) and a number of earth roads and paths, Additional interchange at km 8 is suggested.

Figure 4.3 Alternative alignment A1

The total road length is 13.80km. It mainly consists of road (L=8,372m), 11 bridges (L=2,866m) and 3 tunnels (L=2,562m).

Table 4.2. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	40	Bridge # 7	345
Bridge # 2	40	Bridge # 8	137
Bridge # 3	106	Bridge # 9	640
Bridge # 4	514	Bridge # 10	106
Bridge # 5	430	Bridge # 11	288
Bridge # 6	220		

Tunnels			
Tunnel # 1	1608	Tunnel #3	476
Tunnel # 2	478		

The minimum radius of curve is 700m, maximum gradient is 3.95% and the length of the grade with the maximum value is 1,760m. The design speed of 100km/h and 80km/h is applied, and lane width of the road is 3.75m. Construction of one interchange at km 9 is planned.

The road will connect to the Rikoti tunnel not affecting existing road. After the tunnel #3, four line highway splits into two, two-line 'branches'. One of them – connects to the existing road in front of east portal of the Rikoti tunnel, another – goes in direction of the new Rikoti tunnel. Alternative alignment A1 is the shortest, but rather expensive.

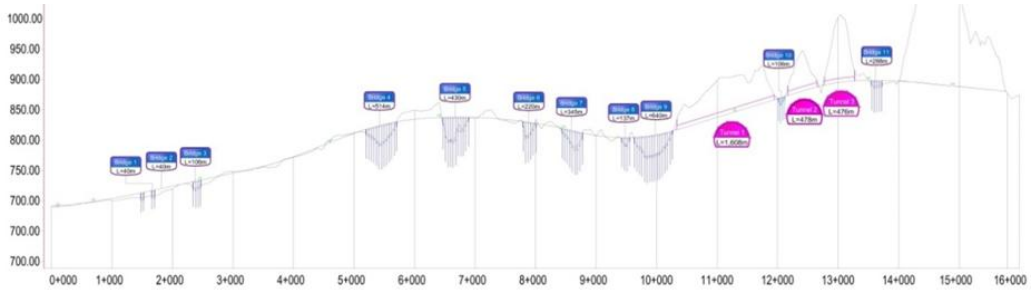


Figure 4.4 Vertical alignment – Alternative A1

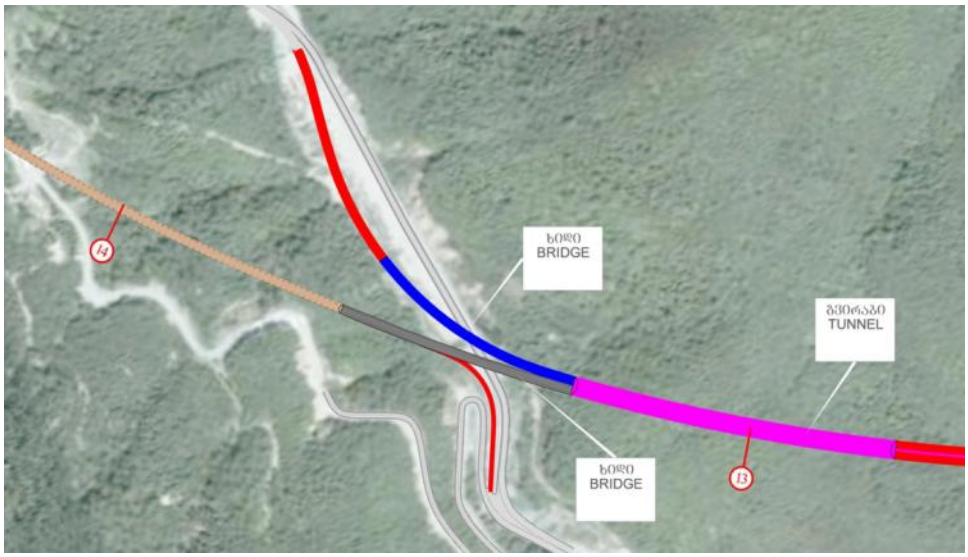


Figure 4.5 Connection to existing road – Alternative A1

Alternative A-2. This is an alternative to secure economics by reducing the length of the bridges and the number of the tunnels and easy connectivity to the existing road. Alternative A2 has the same alignment with Alternative A1 from beginning point to 10km point. It starts at km 126 connecting with the Gomi Bypass alignment. The road goes in north-west direction crosses canal in 7 locations; ravine in 7 locations, Shukghele stream – once, overpass two roads of local importance (Surami Tsotskhnara and Surami-Bijnisi road) and a number of earthen roads and paths. After km 11+200 point it directly connect to the existing E-60 highway. Additional interchange at km 8 is suggested. The interchange will allow for shorter

travel time from the new road to the centre of Khashuri and reduce the traffic via interchange at km 142.

Figure 4.6 Alternative alignment A2

Depending on the connection method, Alternative A2 is divided into three (3) alternatives as follows.

- Alternative Alignment A2-1 envisages covering the 600-800m long section of Suramula with carriageway. Construction of temporary handy interchange as shown below is necessary because the connectivity to neighbouring villages will be strictly reduced during constructing period. The bridge nearby Rikoti tunnel is planned for enhancement of connectivity. This alternative mainly consists of road (L=10,053m), 11 bridges (L=2,632m) and 1 tunnel (L=1,495m).

Table 4.3. Bridges and tunnels along the new alignment

	Length, m		**Length, m**
Bridge			
Bridge # 1	40	Bridge # 7	252
Bridge # 2	40	Bridge # 8	84
Bridge # 3	106	Bridge # 9	672
Bridge # 4	514	Bridge # 10	166
Bridge # 5	420	Bridge # 11	210
Bridge # 6	126		
Tunnels			
Tunnel # 1	1495		

The total road length is 14.18km. The minimum radius of curve is 540m. The maximum gradient is 5.8% and the length of the grade with maximum value is 770m. In the case of Alternative A2, the design speed of 100km/h and 80km/h is applied, and lane width of the road ranges is 3.75m to 3.50m.

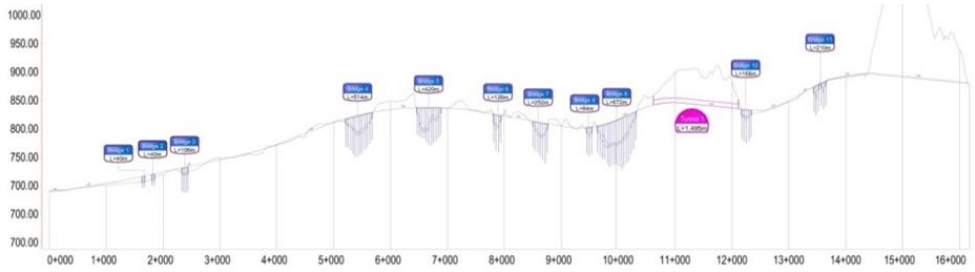
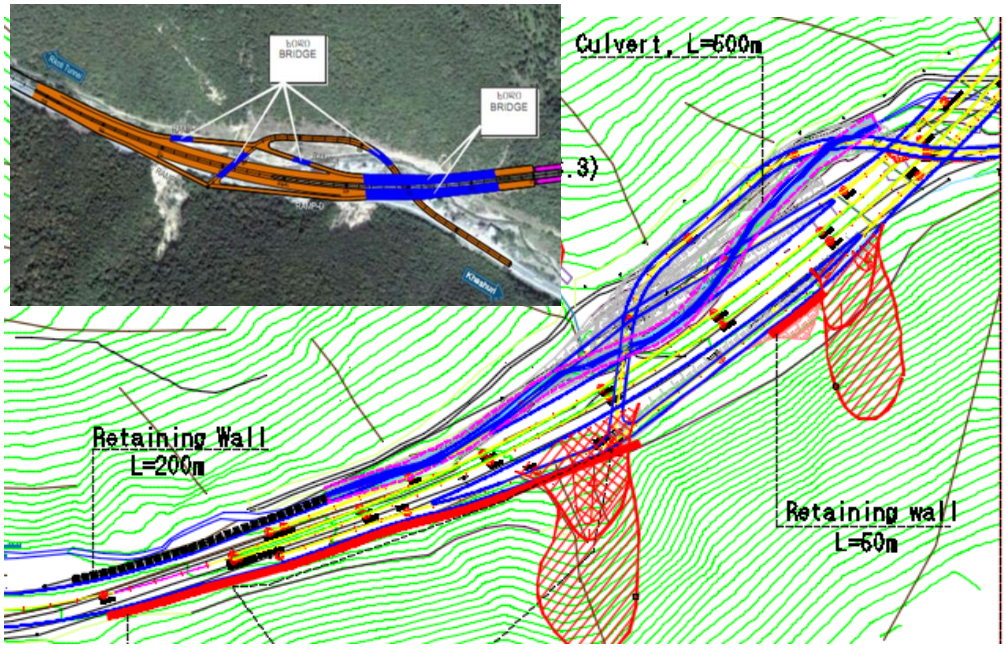


Figure 4.7 Vertical alignment – Alternative A2-1



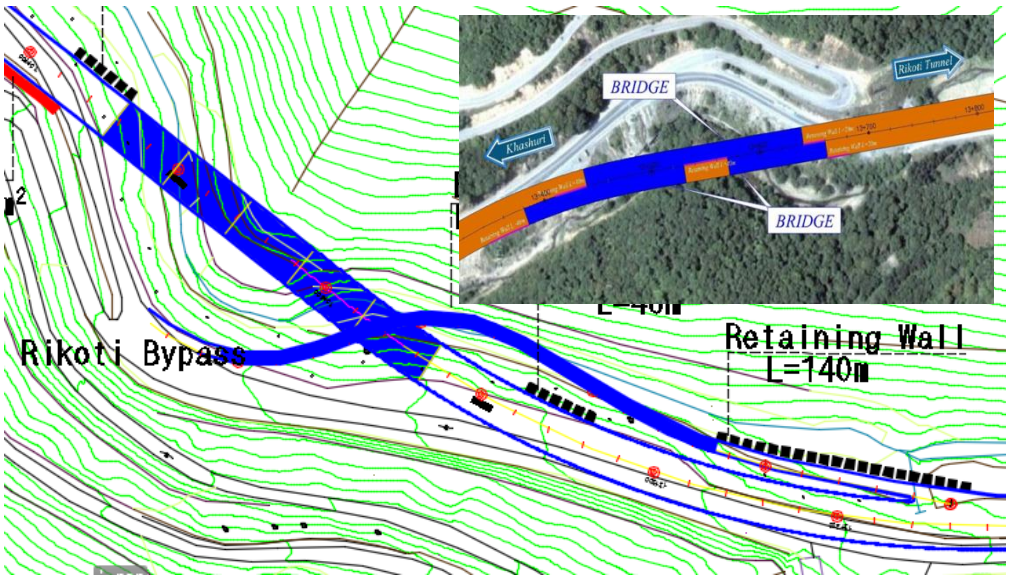
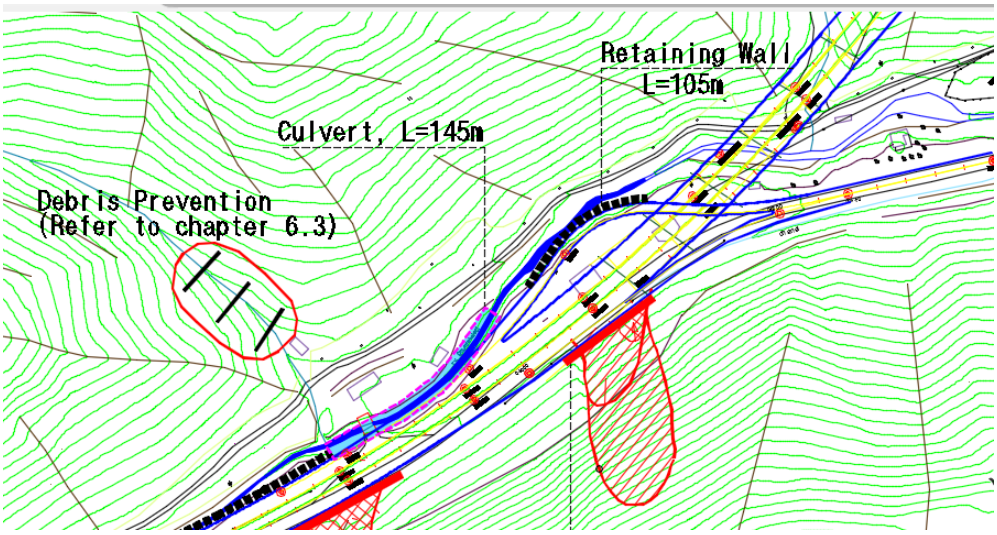


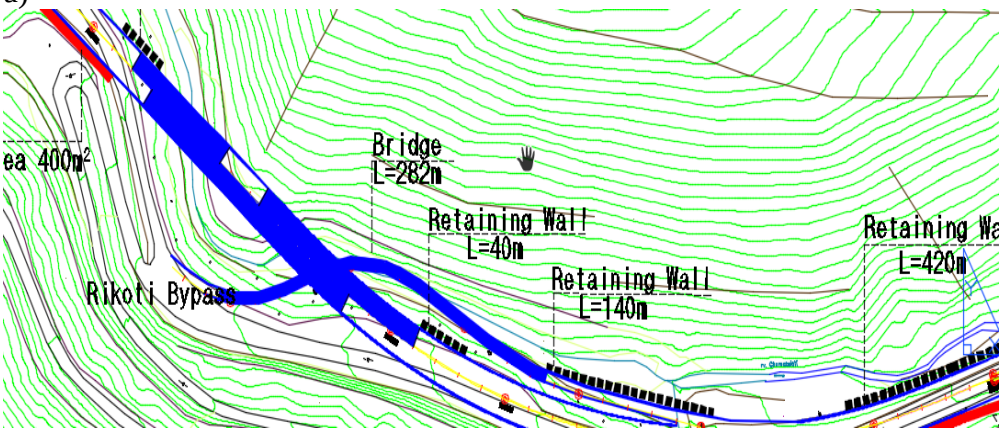
Figure 4.8 Connection to existing road – Alternatives (A2-1, A3-1, A4-1)

- Alternative 1A2-1. Is a modified version of A2-1 with 1 simplified junction to Tbilisi-Senaki-Leselidze road (interchange at km142), culvert (L=145m) at km12+455 – km 12+600, and 282m bridge at km 13+380 to km 13+660 overpassing the section of the road to Rikoti bypass. In two sections the

bridge the piers are located in the active riverbed.



a)



b)

Figure 4.9. Alternative 1A2-1 a) simple Junction (km12+300-km12+500), b) bridge (km 13+380-km13+660)

Table 4.4. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	40	Bridge # 7	252
Bridge # 2	40	Bridge # 8	84
Bridge # 3	106	Bridge # 9	672
Bridge # 4	514	Bridge # 10	166
Bridge # 5	420	Bridge # 11	282
Bridge # 6	126		
Tunnels			
Tunnel # 1	1495		

- Alternative Alignment A2-2 This alternative consists of road (L=8,914m), 10 bridges (L=3,766m) and 1 tunnel (L=1,500m) whose total length is 14.18km.

Table 4.5. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	40	Bridge # 6	126
Bridge # 2	40	Bridge # 7	252
Bridge # 3	106	Bridge # 8	84
Bridge # 4	514	Bridge # 9	672
Bridge # 5	420	Bridge # 10	1512
Tunnels			
Tunnel # 1	1500		

The maximum gradient is 4.5% and the length of the grade with maximum value is 1,200m. This alternative is designed based on the long-span bridge, which shall be connected with the existing road without covering the river with the carriageway. The construction cost will be high the planned alignment passes through the area of river and steep slope by installing the long bridge.

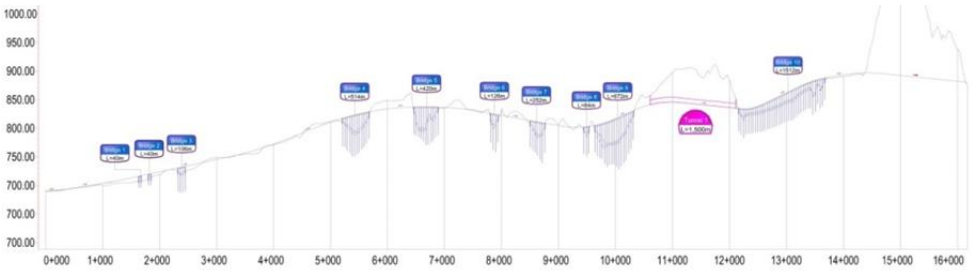


Figure 4.10 Vertical alignment – Alternative A2-2

Alternative A3 starts at km 126 connecting with the Gomi Bypass alignment. Up to km 2+900 alignment almost coincides with Alternative A1 and Alternative A2 option. From km2+900 alternative alignment goes north-west from Alignments A1 and A2. It crosses several fragments of riparian forest, forest area, runs close to the residential areas, crosses Surami-Tsotskhnara and Surami-Bijnisi roads, and a range of earthen roads and paths, Shuaghele stream, in one of the sections - separates residential area (Zekota) from cemetery. From km 10 alignment of Alternative A3 coincides with Alternative A2-2.

Alternative enables to reduce initial investment costs as minimizing the construction of the structure through adopting the low geometric parameter.

Figure 4.11 Alternative alignment A3

In the case of Alternative A3, the design speed of 100km/h and 80km/h is applied, and lane width of the road ranges 3.75m to 3.50m. The total road length is 14.08km and minimum radius of curve is 540m.

Depending on the connection method of the existing road, Alternative Alignment A3 is divided into two (2) alternatives as follows:

- Alternative Alignment A3-1 consists of road (L=10,100m), 12 bridges (L=2,530m) and 1 tunnel (L=1,450,m) whose total length is 14.08km.

Table 4.6. Bridges and tunnels along the new alignment

	Length, m		**Length, m**
Bridge			
Bridge # 1	40	Bridge # 7	336
Bridge # 2	40	Bridge # 8	168
Bridge # 3	70	Bridge # 9	126
Bridge # 4	70	Bridge # 10	672
Bridge # 5	294	Bridge # 11	210
Bridge # 6	294	Bridge # 12	210
Tunnels			
Tunnel # 1	1450		

The maximum gradient is 5.8% and the length of the grade with maximum value is 890m. Within this section covering of the river with carriageway is planned. Alternative envisages covering 600-800m long section of Suramula with carriageway. Construction of handy interchange as shown below is necessary because the connectivity to neighbouring villages will be strictly reduced during constructing period. The bridge near Rikoti tunnel is planned for enhancement of connectivity.

Alternative has an advantage of economics as utilizes the existing road through the connection between the existing road and the new road.

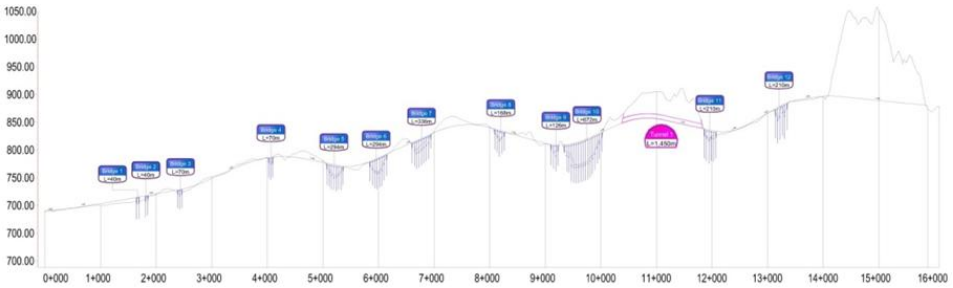


Figure 4.12 Vertical alignment – Alternative A3-1

- Alternative Alignment A3-2, except for the last section (starting from km11, coincides with option A3-1. This alignment consists of road (L=9,060m), 11 bridges (L=3,580m) and 1 tunnel (L=1,440,m) whose total length is 14.08km.

Table 4.7. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	40	Bridge # 7	336
Bridge # 2	40	Bridge # 8	168
Bridge # 3	70	Bridge # 9	126
Bridge # 4	70	Bridge # 10	672
Bridge # 5	294	Bridge # 11	1470
Bridge # 6	294		
Tunnels			
Tunnel # 1	1440		

The maximum gradient is 4.5% and the length of the grade with maximum value is 1,160m. It is an alternative to be designed based on the long-span bridge which shall be connected with the existing road.

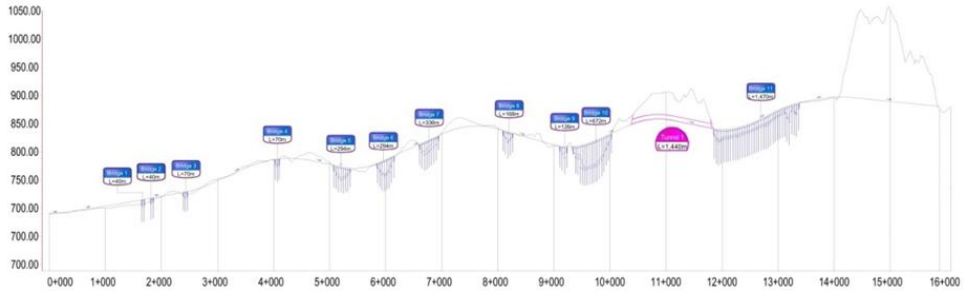


Figure 4.13 Vertical alignment – Alternative A3-2

Alternative A4. Alignment in first one kilometre coincides with other alternatives. From that point the road deviates south, crosses forest areas, Surami-Tsotskhnara road, from the section km 7+500 to km8+600 of Alternatives A1 and A2 - coincides with other alignments, crosses residential area, Surami-Bijnisi road, Shuaghele stream, cemetery and connects to existing road. Additional interchange at km 8 is suggested. The interchange will allow for shorter travel time from the new road to the centre of Khashuri and reduce the traffic via interchange at km 142. Alternative is an update of the preferred alignment in the previous feasibility study. This alternative has an advantage of the lowest initial investment cost.

In the case of Alternative A4, the design speed of 100km/h and 80km/h is applied, and lane width of the road ranges 3.75m to 3.50m. The total road length is 14.49km and minimum radius of curve is 540m.

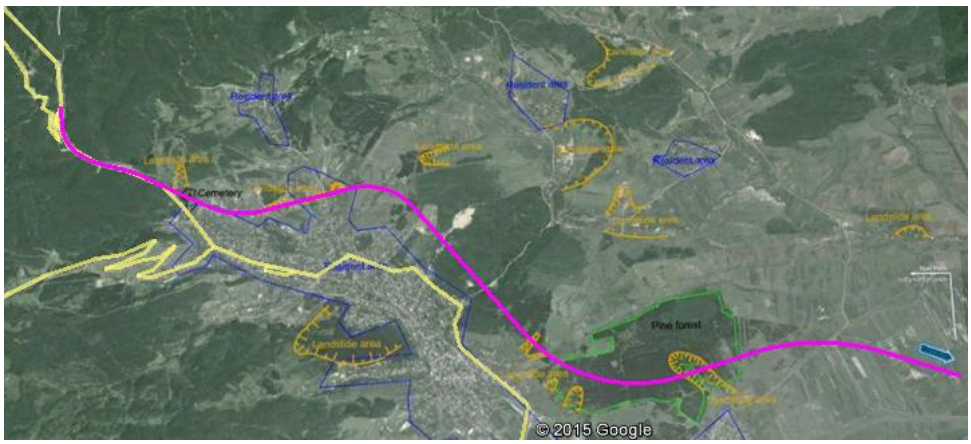


Figure 4.14 Alternative alignment A4

Depending on the connection method of the existing road, Alternative Alignment A4 is divided into two (2) alternatives as follows :

- Alternative Alignment A4-1 This alternative consists of road (L=12,173m) and 11 bridges (L=2,317m). Total length of the road is 14.49km.

Table 4.8. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	84	Bridge # 7	210
Bridge # 2	336	Bridge # 8	588
Bridge # 3	168	Bridge # 9	126
Bridge # 4	105	Bridge # 10	210
Bridge # 5	210	Bridge # 11	210
Bridge # 6	70		
Tunnels			
Tunnel # 1	0		

The maximum gradient is 5.8% and the length of the grade with maximum value is 890m. Within this section covering of the river with carriageway is planned. Alternative has an advantage of economics as an alternative to utilize the existing road through the connection between the existing road and the new road.

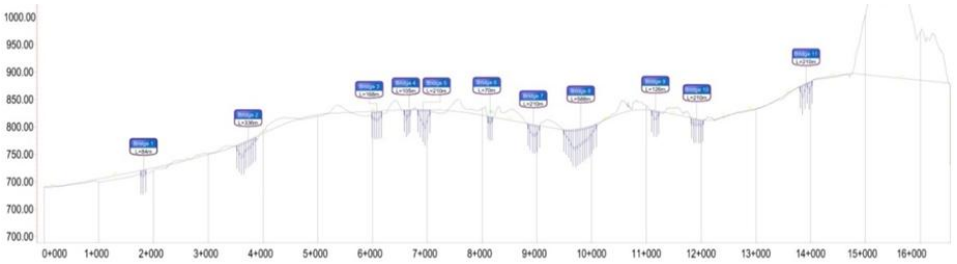


Figure 4.15 Vertical alignment – Alternative A4-1

- Alternative Alignment A4-2 This alternative consists of road (L=10,283m)

and 10 bridges (L=4,207m). Total length is 14.49km.

Table 4.9. Bridges and tunnels along the new alignment

	Length, m		Length, m
Bridge			
Bridge # 1	84	Bridge # 6	70
Bridge # 2	336	Bridge # 7	210
Bridge # 3	168	Bridge # 8	588
Bridge # 4	105	Bridge # 9	210
Bridge # 5	210	Bridge # 10	2226
Tunnels			
Tunnel # 1	0		

The maximum gradient is 4.5% and the length of the grade with maximum value is 1,420m. This is an alternative designed based on the long-span bridge which shall be connected with the existing road.

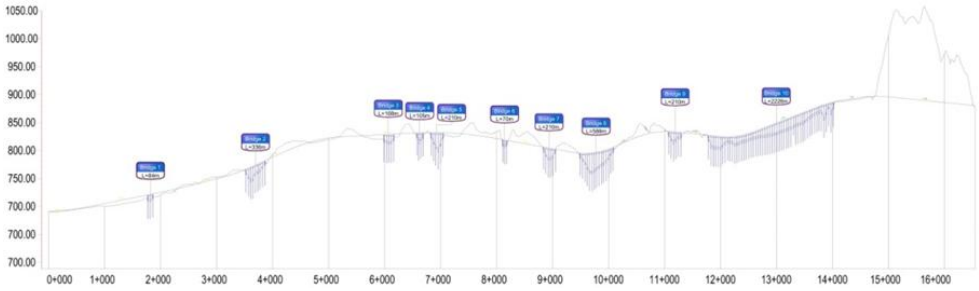


Figure 4.16 Vertical alignment – Alternative A4-2

Design speed and geometric standard.

The Georgian Design Standard for roads of international importance with daily traffic of more than 8,000 vehicles sets the following design speeds:

- Flat terrain 120 km/h
- Hilly terrain 100 km/h
- Mountainous terrain 80 km/h

With consideration of the landform of the area for Zemo Osiauri-Chumateleti section of the road the design speed is suggested as follows:

- STA. 0.000 ~ STA. 10.500km : V = 120~100km/h
- STA. 10.500 ~ STA. 13.800km : V = 80km/h

Geometric Standards as per design speeds are shown in Table 4.10.

Table 4.10 Comparison of Geometric Design Standards

Design Speed	**120 km/h**		**100 km/h**		**80 km/h**	
Design standard	**TEM**	**Georgian**	**TEM**	**Georgian**	**TEM**	**Georgian**
Min. horizontal radius	650 m	700 m	450 m	450 m	240 m	250 m
Max. super elevation	7 %	7 %	7 %	7 %	7 %	7 %
Normal cross-falls on curves greater than	3,500 m	3,300 m	2,500 m	2,300 m	2,000 m	1,200 m
Maximum grade (gradient)	4 %	4 %	5 %	5 %	6%	6 %

Min vertical crest curve	[2]	22,600 m[3]	[2]	10,000 m[3]	[2]	5,000 m[3]
Min. vertical vag curve	12,000 m	7,700 m[3]	6,000 m	4,900 m[3]	3,000 m	3,200 m[3]
Min. stopping sight distance	200 m[4]	250 m	150 m[4]	200 m	100 m[4]	140 m

Notes: 1) values allowed for mountainous terrain

2) conclave curves should have a vertical acceleration of no more than 0.25m/sec^2

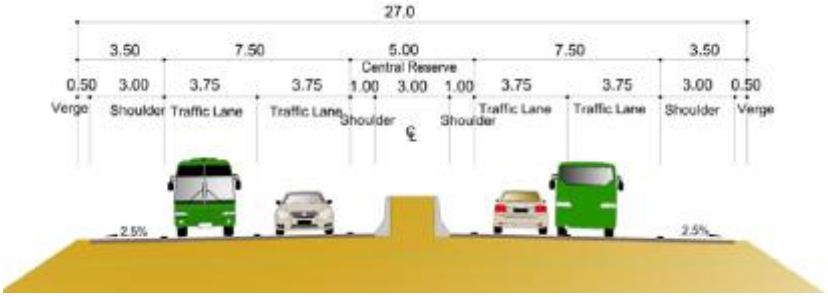
3) values for stopping sight distance

4) values for straight and level conditions

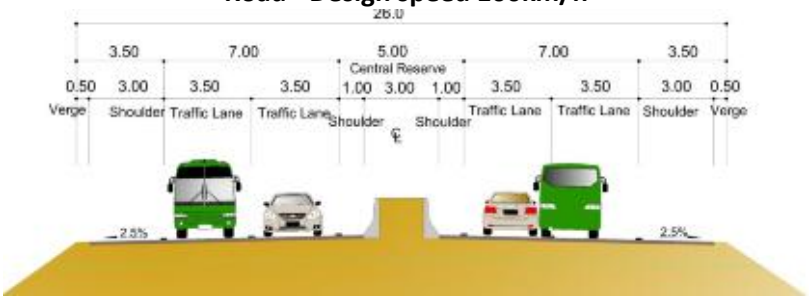
The typical cross-section of the road, bridge and tunnel has been selected by considering economic and safety as listed below.

Table 4.11. Cross-section Parameter Zemo Osiauri - Chumateleti

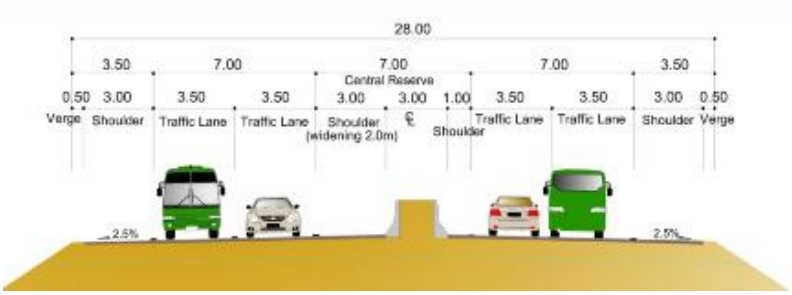
Classification	100 km/h	**80** km/h
Number of Lanes	4	4
Lane Width	3.75 m	3.50 m
Carriageway Width	2 x 7.50 m	2 x 7.00 m
Shoulder Width	3.00 m	3.00 m
Verge	0.50 m	0.50 m
Central Reserve (Include inside Shoulder)	5.00 m(1.00m)	5.00 m(1.00m)
Total Road Width	27.00 m	26.00 m



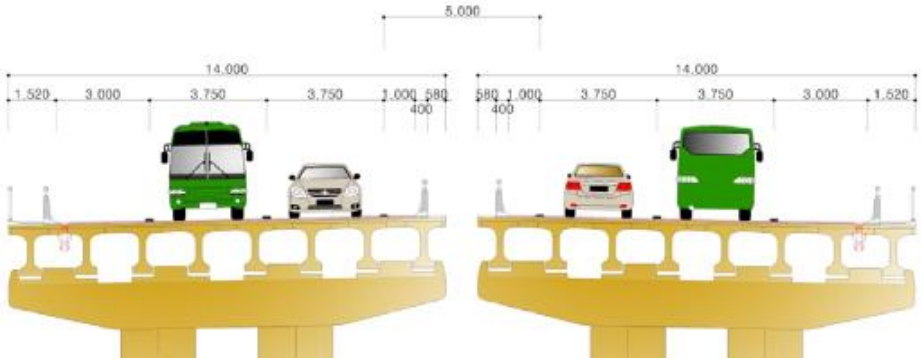
Road - Design speed 100km/h



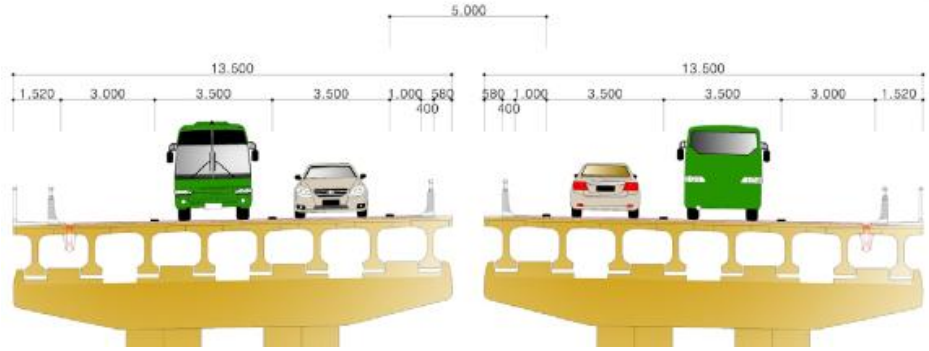
Road - Design speed 80 (Horizontal radius R>=450m)



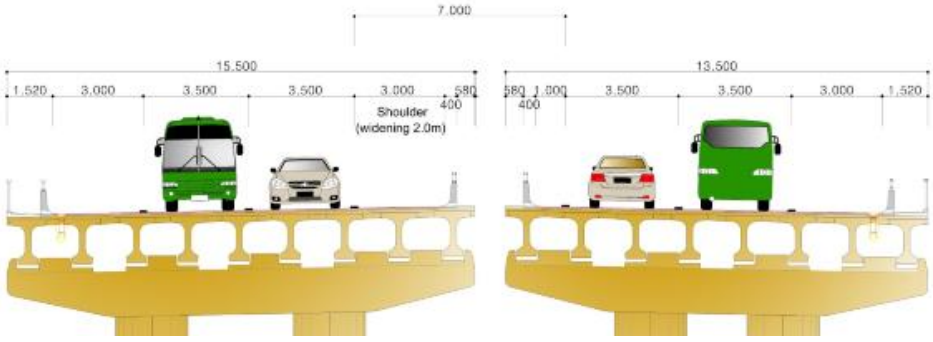
Road - Design speed 80 (Horizontal radius R<450m)



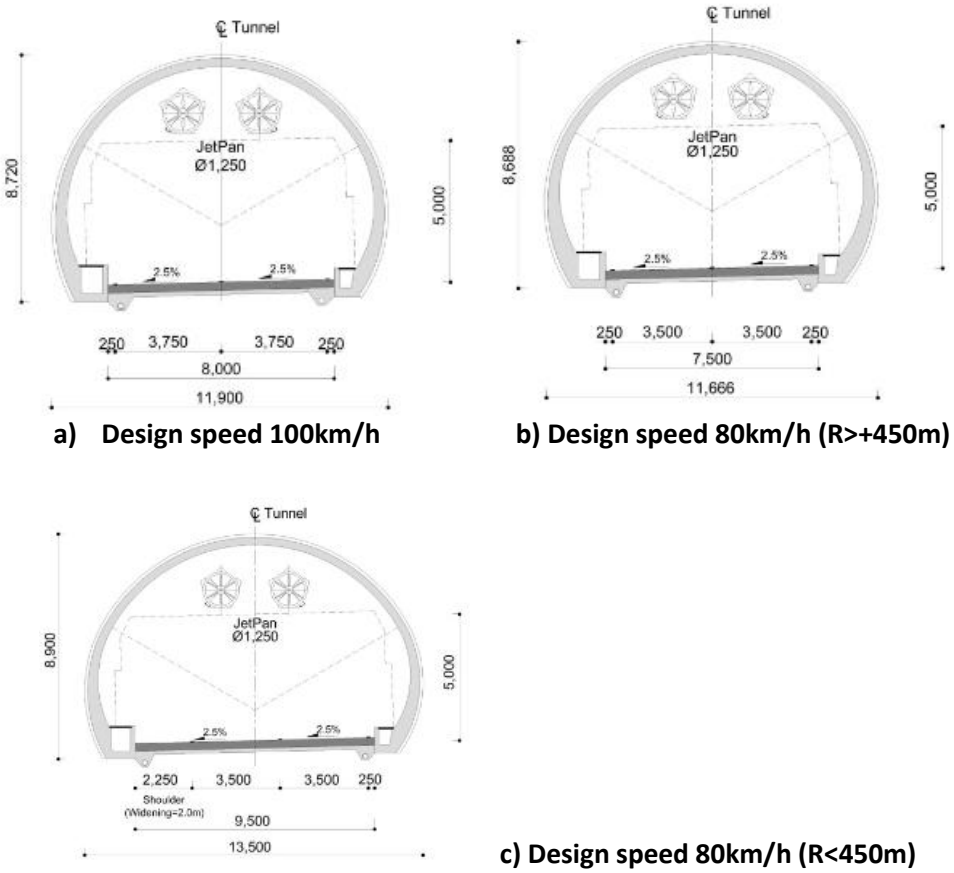
Bridge - Design speed 100km/h



Bridge - Design speed 80km/h (Horizontal radius R>=450m)



Bridge - Design speed 80km/h (Horizontal radius R<450m)



a) Design speed 100km/h

b) Design speed 80km/h (R>+450m)

c) Design speed 80km/h (R<450m)

Figure 4.17. Road, bridge and tunnel geometry

The minimum cross-section parameters of the tunnel are as follows in accordance with TEM and SNIP:
Vertical clearance: min. 5.0m
Lane width: 3.75m (100km), 3.50m (80km)
Shoulder width: min. 0.25m (edge line)
Walkway width: min. 0.75 m
An additional headroom (0.5m) for vertical clearance is added according to SNIP, considering that a lot of heavy trucks pass through E60highway.

4.3. TRAFFIC VOLUME

Traffic studies include:

- The existing traffic composition, occupancy and traffic volume counts
- Forecast of annual average daily traffic (AADT) composed of normal, attracted, generated and diverted flows by appropriate vehicle types
- Traffic survey will generally be of 1 week duration comprising day counts with at least one night count
- Where appropriate, the road will be divided into sections, and the relevant traffic analyses and studies will be conducted accordingly, and
- Identify, describe and quantify existing and potential traffic generating factors.

Three studies as below undertaken in the years of 2008 to 2010, have formed the basis for the traffic counting program to be undertaken:

- Feasibility Study and Alternative Analysis for Upgrading the Section between Sveneti and Rikoti, km 80 – km 144 of the E 60 Highway, Kocks Consult GmbH, May 2010;
- Feasibility Study and Environment Impact Assessment for Upgrading the Section between Rikoti Tunnel and Shorapani, km 144 km 188 of the E 60 Highway, Kocks Consult GmbH, December 2009; and
- Draft Final Report, JBIC Pilot Study for Project Formation for Highway Improvement Project, Georgia, EXe-Idea Ltd et. al. May 2008.

More recent information was obtained from RD (AADT of international roads of Georgia April 2014.)

Table 4.12. Daily traffic volume

Road Code	AADT of international roads of Georgia, April 2014					
	Road Name	**Car**	**Minibus<15 pickups**	**Buses and trucks**	**Trailers and >3 axels**	**Total**
E-60	Tbilisi-Senaki-Leselidze					
	Khashuri-Rikoti km 140	5932	1682	377	1069	9060

Source: RD

4.4. MOBILIZATION AND CONSTRUCTION PHASE

4.4.1. MOBILIZATION

Works will be carried out by the contractor selected through international tendering. Prior to the commencement of works, the contractor must identify the location of the camp, equipment stationing area and agree on/receive a permit for its use from the state or the land owner.

Preconstruction activities connected with the highway construction works specified in the project documentation include the following:

- Preparation of temporary camp sites in the vicinity of the road bed in accordance with environmental requirements;
- Selection of temporary disposal sites for construction debris of the highway and materials;
- Selection of temporary sites for separate stockpiling of productive (topsoil) and other excavated soil and obtaining approval from local administration and environmental authorities;
- Land acquisition/compensation;
- Obtaining permits (Environmental impact permit issued by the MENRP) for the operation of asphalt/concrete plants (in case contractor plans to run his own plants);
- Approval of quality characteristics of waste water by MENRP (part of Environmental impact permit) – if discharge into any water body is planned;
- Obtaining mining licenses by contractor or concluding sub-contracts for the supply of aggregate materials (use of licensed suppliers rather than development of new quarries is advisable);
- Developing waste management plan and having it approved by the client;
- Developing traffic management plan and having it approved by the client;
- Developing work camp or construction yard site map and having it agreed with the client;

- Concluding procedure of de-listing of areas required for RoW of the new section of EHW from the State Forest Fund, which includes conduct of forest inventory in the target area, transfer of land use rights to this area to the RD, and permitting tree felling within this area as required for construction/operation purposes.

4.4.2. ROAD CONSTRUCTION WORKS

The construction process involves a variety of activities, such as:

- Stripping and stockpiling of topsoil until reuse during reinstatement of temporarily disturbed sites (Note: a) the height of the stockpile should not exceed 2m, b) all sites temporarily disturbed/used for the needs of the project must be reinstated);
- RoW cleaning via excavators/bulldozers and removal of debris to agreed location;
- Tunell drilling – including drill and blast, removal of spoil to selected and agree spoil disposal area;
- Arrangement of water wells and ditches equipped with stone filters and intake wells. Grading operations and laying of cross-drain pipes/culverts. In fill areas, the grading is brought up in layers and compacted. In cuts, the excavation is carried on until the subgrade elevation is reached, and then the earth is compacted;
- Base course forming on the subgrade. Soil rolling with machinery. Import of inert materials with trucks, roll (around 500-800 mm) for bed formation.
- Surface course forming over the base. This material may be sand, asphalt, blacktop, concrete, or similar materials; Ready-made concrete filling with special vehicles for concrete pavement formation.
- Concrete works, arrangement of foundations and bridge structures;
- Construction of span bridges;
- Providing of road furniture and marking in accordance with international standards.
- Landscape harmonization and tree planting according to the reinstatement plan.

Construction works will be carried out in conformity with valid standards, norms, recommendations and instructions. The works shall be performed in accordance with typical technological diagrams as well as design specifications, following the Best Available Technology practice and provisions set forth in Technical Specifications (Section VI, Volume. III of the Bidding documents)

The construction phase is anticipated to take up to 24 months.

4.4.3. OFF-SITE WORKS

Off-site works will include extraction of construction materials. Purchase of material from already existing licensed quarries will be preferable as opposed to opening of new quarries by contractor. Material purchase will be allowed from an authorised, licensed providers only.

Table 4.13 List of quarries in the region

Municipality	Distance to the settlement, km		License	Owner	Material	Annual yield
Khashuri	Khashuri	10	00168	Gomi 98	Sand, gravel	38500
Khashuri	Khashuri	3	00326	Kama	Sand, gravel	180000
Khashuri	Agarebi	0.5	00368	Guram Kilaberidze. P.e	Sand, gravel	300000
Khashuri	Khashuri	5 - 10	00369	Guram Kilaberidze. P.e	Sand, gravel	400000
Khashuri	Station Gomi	3	00398	Akvariumi	Sand, gravel	220000
Khashuri	Khashuri	1.5	00693	Sergo Betashvili .	Sand, gravel	143550
Khashuri	Khashuri	5	00775	David Kharazishvili	Sand, gravel	30000
Khashuri	Station Gomi	2	00874	David Belidze	Sand, gravel	50000
Khashuri	Khashuri	4	00889	Teona Ltd	Sand, gravel	177900
Khashuri	Khashuri	12	00938	Gomi alkohol and spirit production	Sand, gravel	25000
Khashuri	Khtsisi	1	01009	Solomon Akhalkatsi	Sand, gravel	263700
Khashuri	Khashuri	2	01079	Teona Ltd	Sand, gravel	9300
Khashuri	Khashuri	5 - 6	01120	Akvariumi Ltd	Sand, gravel	84600
Khashuri	Khashuri	2.5	01181	Givi Mchedlidze	Sand, gravel	73800
Khashuri	Khtsisi	2	100133	Tamaz Shatirishvili	Sand, gravel	93900
Khashuri	Khashuri	4	100187	David Kiparoidze	Sand, gravel	137000
Khashuri	Tskhramukha	1	100397	Datuna 2006 Ltd	Sand, gravel	180000
Khashuri	Kriskkhevi	1,8	100465	Teona Ltd	Sand, gravel	160000
Khashuri	Khtsisi	1	100550	Progresi Ltd	Sand, gravel	86400
Khashuri	Khtsisi	1,7	100551	Progresi Ltd	Sand, gravel	151800
Khashuri	Khashuri	4 - 5	100816	JSP + Ltd	Sand, gravel	0
Khashuri	Tskhramukha	1.1 - 1.2	100901	Gza 2009 Ltd	Sand, gravel	26100
Khashuri	Kvishkheti	2 – 2.5	100965	Msheneblobis ganviTarebis kompania Ltd	Sand, gravel	131000
Khashuri	Khashuri	10	00290	Organizacia-beTania Ltd	Quartz Sand	50000
Khashuri	Khashuri	10	01188	Samsheneblo qvisha Ltd	Quartz Sand	310200
Khashuri	Odzisi	1,5 - 2	100771	Sak.Sasheni	Quartz Sand	274500
Khashuri	Kemperi	0	559	Alkazar Ltd	Quartz Sand	700000
Khashuri	Station Khashuri	5 - 6	01028	Levan Gelashvili	Sand	9000
Khashuri	Khashuri	5 - 5,5	100847	Guram Kilaberidze	Quartz Sand	77000

During the design stage licensed quarries were defined in 9-15 km from the site. Depending on the spoil rock characteristics some of the material can be used in construction. Material removed in cut section can be used for embanking.

According to the studies done for the previous section of the highway the inert material in the project area, in general, fits the requirements for fillers, pavements and base materials, but in most cases, needs sieving.

The contractor may run own quarry, but in this obtaining licence from the National Environment Agency of MENRP will be required. Only a licensed quarry may be used.

Licensing is regulated by the law of Georgia on Licences and Permits. The body responsible for licensing is the MENRP. Terms and rules of a license for material extraction are specified in the license along with the exact location of a site, volume of permitted extraction and maturity of a license. Licences are issued through auctioning. According to the law, the licence is granted to the proponent presenting the best proposal that shall meet the criteria stipulated for resources and environmental protection, and recognized as the most economical acceptable. The validity of the licence for abstraction of construction materials may be up to 30 years, while short term licences may vary from 2 to 5 years. A licence holder is obliged to ensure sustainable use of the resources with due regard of environmental and resource protection rules; guarantee safety of works with consideration of ambient air, water, soil, forest, protected areas, protection norms for historical and cultural monuments and buildings. A licence holder is obliged to stop operation if any rare plant or object of aesthetic value is found. The fact must be immediately communicated to relevant governmental authorities.

The licence holder is responsible for restoration and reinstatement of the used plot. The licence can be terminated in case of non-compliance with licence conditions, including environmental requirements. Liquidation or conservation costs are covered by the resource user. In case of licence termination the owner automatically loses right to the land plot.

If the contractor decides to use own borrow pit/quarry the following requirements must be met:

- Sufficient resource in the proposed quarry must be insured to make a site financially viable; including rehabilitation expenses.
- Topsoil must be removed and stockpiled until reintroduction. The topsoil should not be buried, driven on, excessively handled, contaminated or stockpiled so as to hinder final land-use.
- If required, erosion protection must be provided.
- To ensure safe operation the access tracks must be of adequate width: the track should be twice the width of the widest vehicle in the case of one-way traffic and three times the width of the widest vehicle in the case of two-way traffic.
- Gates and fences should be designed, regularly inspected and repaired to prevent unauthorised entry; signs at any insecure locations on a site indicating the risk must be provided.

- Operation and decommissioning of the quarry/borrow pit must be performed in compliance with the conditions of the quarrying license and with due regard to environmental standards.
- Upon completion of the licence term, the quarry/borrow pit area affected by the development should be re-cultivated: the topsoil reinstated, the status of the site restored to the state close to the initial state (for instance, the site may be planted with vegetation).

Should material be abstracted from the riverbed, the riverbed and the landform may not be adversely affected. Abstraction of gravel should not be carried out in high water period. The operation site must be protected by a gravel mound (up to 2m wide). In compliance with the national legislation (Law on Natural Resources) abstraction of inert material from a riverbed is prohibited in case the activity violates stability of any hydro technical structures (a dam, a retaining wall). Sourcing is not allowed from sections where solid drift is not sufficient for 'feeding' the banks. In such areas, inert material abstraction from the river terrace within 50 m strip from the riverbed and directly from the stream is strictly prohibited.

Risks associated with the licensing legislation currently in force are that it allows (i) extraction of material from the water stream given that sedimenatation pattern is believed to be sufficient for natural reinstatement of the deformed river bed, and (ii) postponing site reinstatement of any part of the site till expiration of the license term. At the same time, constructin machinery is not allowed to enter water stream, and license holders are not allowed to keep borrowing on hold for extended periods of time without resinstating a site and giving up the license even if its term has not expired. Department of Environment Protection Supervision exercises control over the performance of extractive license holders and there are many precedents of the Department having fined operators of quarries for inadequate performance.

5. METHODOLOGY

The ESIA process consisted of six main activities that are common to most ESIA studies conducted to international standards comprising the following:

1 Collection of baseline data describing the existing environment impact (physical, biological and anthropogenic aspects) within the area of the proposed project; desk studies and field surveys conducted to address important gaps in the existing data, update of information on topics and areas where significant negative impacts are expected.
2 Identification of impacts, assessment of their significance and development of mitigation measures (avoidance of impacts is preferred over mitigation by both Bank safeguards and Roads Department policy.)
3 Analysis of alternatives in terms of location, technology, design and operation, including the "zero" alternative.
4 Development of the environmental management plan (EMP) according to the World Bank OP 4.01 Annex C.
5 Stakeholder consultation and disclosure (conducted according to national law and the World Bank policy).
6 Drafting of the ESIA report.

5.1. BOTANICAL AND FAUNISTIC SURVEYS

The assignment consisted of a review of primary and secondary data (government and consultant reports, etc.). Botanical and fauna surveys were made. Field works were performed by biodiversity team (botanists and fauna specialists) in November – December 2014.

The objective of the botanical study was to identify plant communities within the section of interest, reveal sensitive populations and, if found, provide quantitative characteristics thereof. With consideration of expected direct and indirect impact, the corridor of 100 m on each side of the centreline was surveyed. The method of survey was walkover.

The main types of plants, as well as composition, distribution, dominant species, biome sensitivity and commercial value of plants were assessed. The presence of endemic, rare and other protected species in the project impact zone was identified.

Fauna field survey was organised with the purpose of verifying the data obtained from the literature on the animal species composition and areas of occurrence. A simple methodology of surveying animal footprints, droppings and dwellings was applied to collect information on key species of mammals and birds.

Negative impacts of road construction and operation were evaluated according to the main principles indicated in the Law on the Wildlife, the Law on the Red List and the Red Book of Georgia. Along with the national legislation/ regulations, international requirements (the EBRD policy and the World Bank operation procedures), and the EU Directives to which Georgia is a party were taken into account.

5.2. SOIL POLLUTION

Evaluation of adverse impacts on soil and soil pollution was performed according to the Georgian laws and regulations (the law applicable to the largest extent is the Law on the Soil Protection, 1994 (amended in 1997 and 2002).

For identification of the background quality of the soil along the road samples were collected (10 December 2014). Taking into account that the area is mostly rural and no significant sources of pollution, except for the road itself are available, four average samples were collected. The samples were collected from the sampling depth of 0-10cm. The total amount of soil collected from one site was 1 kg. Prior to sampling, the sampling spots were cleared of grass and stones. Samples were collected in plastic bags, labelled and delivered to the lab for testing. The samples are dried, averaged and sieved.

Table 5.1. Methods of soil analysis

Cu, Zn, Pb, Ni, Co, Co, Cd	ISO 11047, ISO 11466 - Aqua Regia extract Determination of Cu, Mn, Fe, Mn, Co, Pb, Cd, Ni, Zn, Cr, Ni. Al
As	ISO 2590 - General method for the determination of arsenic – Silver diethildithiocarbamate photometric method

The sample analysis revealed that concentration of all metals is below relevant maximum allowable concentrations adopted in the EU.

5.3. WATER SAMPLING

Water from Suramula River was sampled for identification of the background water quality. The samples were collected in 1.5-liter capacity plastic bottles. 1 litter glass bottles were used for Total Petroleum Hydrocarbon analysis of water. Samples were labelled and delivered to the lab the same day. Analyses were performed in compliance with the ISO and EPA standards.

Table 5.2. Methods of surface water analysis

Parameter	Method
pH	ISO 10523-2008
Conductivity	ISO7888:1985
Cl	GOST 23268.17-1978
HCO3	GOST 23268.1-91
SO4	ISO 9280-1990
K	ISO 9964-3-1993
Ca	GOST 23268.5-1978

Parameter	Method
Mg	GOST 23268.5-1978
Na	ISO 9964-3-1990
DO	ISO 5814-72
Total N	ISO 7890-82
Total P	ISO 6878-04
TPH	EPA 418.1-1997

Samples were analysed by Gamma lab.

5.4. AIR POLLUTION MODELLING

Long-term pollution levels were calculated using modelling software CALRoads View. It is an air dispersion-modelling package for predicting air quality impacts of pollutants near roadways. CALRoads View combines the following mobile source air dispersion models into one integrated graphical inter-face: CALINE4, CAL3QHC, and CAL3QHCR. Combining features of these models enables predicting concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter (PM) and other pollutants near roadways and highways. Options are available for modelling near intersections, parking lots, elevated or depressed freeways, and canyons. It is also possible to evaluate air pollution caused by both moving and idling vehicles and to estimate the length of queues formed by idling vehicles at controlled crossings. CALRoads View can process up to a year of hourly meteorological data, but if the data is missing, it is recommended to use the worst-case scenario, which is described by the worst-case wind direction.

Five scenarios were evaluated for Zemo Osiauri – Chumateleti road section:

- Modelling of CO, NO_2 and PM dispersion using forecasted traffic data, assuming that the project was not implemented and the road was not upgraded (the "zero" alternative);
- Modelling of CO, NO_2 and PM dispersion using forecasted traffic data, assuming that the Alternative A1,A 2, A3 or A4 was implemented;
- In addition to meteorological conditions in air pollution modelling, the main parameters are emission factors.

All the five scenarios for Zemo Osiauri – Chumateleti road section were modelled using the same forecasted traffic flow data for 2037 year (according to *Traffic Analysis*, prepared by *PYUNGHWA Engineering Consultants* and included in *Update of Feasibility Studies for E-60 Highway Section from Zemo Osiauri to Argveta and Undertaking Detailed Design for E-60 Highway Section from Zemo Osiauri to Chumateleti*, 2014). Emission factors were estimated considering traffic fleet composition, type of road and speed. Traffic fleet composition was assumed to be the same for all scenarios, but speed limits were different as it is expected to have 100 km/h (hilly terrain) and 80 km/h (mountainous terrain) speed limit on the upgraded road (alternatives A1, A2, 3 and A4) and 80 km/h (60 km/h in settlements) for both types of vehicles on the existing road, if the project is not implemented.

Table 5.3. Initial data for air pollution and noise dispersion modelling

		Year of prognosis	Composition of traffic flow				Speed limit, km/h
			Cars, vehicles/day	HGV*, vehicles/day	% of heavy transport in flow	Total number of vehicles/day	
"Zero" Alternative	From Zemo Osiauri (km 128 of existing road) to inter-section with Batumi road	2037	***41 731***	***9 161***	***18***	***50 892***	80 km/h 60 km/h in settlements
	From intersection with Batumi road, to Rikoti Tunnel (km 142)		***27 715***	***6 084***	***18***	***33 799***	
Alternatives A1, A2, A3, A4 *(new alignment north from Khashuri)*	Zemo Osiauri (0 km of new alignment) to Rikoti Tunnel on new alignment (14 km of new alignment) (91 % of traffic)	2037	***25 214***	***5 535***	***18***	***30 749***	0 to 10.5 km of new alignment – 100 km/h 10.5 km to the end of section – 80 km/h
	Existing alignment from intersection with Batumi road to Rikoti Tunnel (9 % of remaining traffic)		***2 500***	***549***	***18***	***3 049***	80 km/h 60 km/h in settlements)

*Heavy Goods Vehicles

Pollution modelling was performed considering worst-case meteorological conditions mainly described by wind direction, wind speed and atmospheric stability. Higher wind speed and unstable atmospheric conditions enable faster pollutant dispersion and lower concentrations. Therefore modelling was performed under stable atmospheric and worst meteorological conditions, estimated relying on the data obtained by the Gori meteorological observation post (lowest wind speed of 2.9 m/s; temperature reflecting winter period of - 1ºC). To model maximum possible pollutant concentrations, the worst-case wind angle was chosen as a run type.

30 min onetime maximum concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter up to 10 micrometres in size (PM_{10}) were calculated. Pollution dispersion maps are presented in Annex *1*.

According to the WB policy, the air pollution impact assessment should be performed relying on guidelines and standards of both the WB and of the borrowing country; in cases they differ, the stricter ones should be applied. Maximum allowable pollutant concentrations according to the Georgian regulations (*Georgian Ministry of Labour, Health Care and Social Welfare (2003) Order 38/n "On approval of qualitative environmental standards: Acceptable limit concentrations of pollutants in atmospheric air of residential areas"*) and the WB recommendations (*EHS guidelines "Air Emissions and Ambient Air Quality"* based on WHO guidelines) are given in Table 5.4. 30 min onetime maximum concentration under the Georgian standard is assumed the strictest and therefore applicable in the evaluation.

Table 5.4. Maximum Allowable Concentrations (MAC) according to the Georgian standards and WHO guidelines

		EHS Guidelines*	Georgian standard
CO	*1 hour*	30 mg/m^3 (25 ppm)	-
	8 hour daily maximum	10 mg/m^3 (10 ppm)	-
	30 min onetime max.	-	5 mg/m^3
	24 hour	-	3 mg/m^3
NO_2	*1 hour*	200 µg/m^3(0.11 ppm)	-
	Annual	40 µg/m^3 (0.026 ppm)	-
	30 min onetime max.	-	85 µg/m^3
	24 hour	-	40 µg/m^3
PM_{10}	*24 hour*	50 µg/m^3	300 µg/m^3
	Annual	20 µg/m^3	-
	30 min onetime max.	-	500 µg/m^3

* EHS Guidelines are based on WHO Air quality guidelines for Europe

5.5. NOISE DISPERSION MODELLING

Long-term noise levels were calculated using the modelling software CadnaA (*Computer Aided Noise Abatement*). It allows calculation and evaluation of different scenarios by choosing and managing different types of noise sources (mobile sources, i.e. roads, railways, aircraft; point sources, i.e. industrial enterprises), estimating complex structures of roads, bridges, and other structures. Calculation algorithms included in *CadnaA* estimate topography, traffic intensity, speed of vehicles, percentage of heavy transport in traffic flow, road elevation and incline, number of building floors. Moreover, it helps to design noise barriers. *CadnaA* calculates day, evening and night noise levels according to traffic intensity, speed and percentage of

cars and heavy goods vehicles in the traffic flow. Topography and other obstacles (for example, tree arrays) are also estimated. *CadnaA* uses numerical maps in calculation, and gives noise maps as calculation output, where noise levels are attributed to different colours - one colour covers 5 dBA noise level and is divided by isolines at every 1 dBA.

All the five scenarios for Zemo Osiauri – Chumateleti road section were modelled using the same forecasted traffic flow data for 2037 year (according to *Traffic Analysis*, prepared by *PYUNGHWA Engineering Consultants* and included in *Update of Feasibility Studies for E-60 Highway Section from Zemo Osiauri to Argveta and Undertaking Detailed Design for E-60 Highway Section from Zemo Osiauri to Chumateleti*, 2014). Traffic fleet composition was assumed to be the same for all scenarios, but speed limits were different as it is expected to have 100 km/h (hilly terrain) and 80 km/h (mountainous terrain) speed limit on the upgraded road (alternatives A1, A2, A3 and A4) and 80 km/h (60 km/h in settlements) for both types of vehicles on the existing road, if the project is not implemented (Section 6)

The Georgian standards for traffic noise control are regulated by the Decree of the Minister of Health, Labour and Social Affairs (297n of August 16, 2001) on the „Approval of Environmental Quality Standards", which, among other things, specify the tolerable levels of traffic noise for different zones. According to the WB policy, noise and vibration issues during road operation should be evaluated relying on the General EHS Guidelines "Environmental noise management" (issued by International Finance Corporation, 2007). Acceptable noise levels by both Georgian standards and EHS guidelines are presented in Table below.

Table 5.5. Limit noise levels according the Georgian Noise Quality Standards and EHS Guidelines

	Georgian Noise Standards		**EHS noise guidelines**	
	7 am - 11 pm	**11 pm - 7 am**	**7 am - 10 pm**	**10 pm - 7 am**
	dBA	dBA	Equivalent, LA_{EQ}, 1 h, dBA	Equivalent, LA_{EQ}, 1 h, dBA
Areas bordering residential houses, schools, and other educational institution buildings	55	45	55	45
Areas bordering hospitals	45	35	-	-
Inside living environment - residential, rest home, hostels, dormitories in kindergartens and boarding schools	40	30	35	30
Inside hotel, hostel rooms	45	35	-	-

Neither Georgian standards nor the EHS guidelines are indicating maximum allowable noise levels in the environment influenced by traffic noise. According to good international practise and standards used in Europe, the maximum noise level for urban areas, mainly influenced by traffic noise, is 65 dBA during the day and 55 dBA at night. These values were used in noise impact evaluation.

5.6. METHODOLOGY FOR ANALYSIS (RANKING) OF ALTERNATIVES

The project alternatives have been assessed using a methodology that transforms qualitative assessments in quantitative numbers, which are then summed up in a final score that expresses the overall impact of each alternatives and allows their comparison.

In order to encompass potential impacts 7 different components have been selected and analysed. These components were: landscape, soil, air quality, noise, water environment, biodiversity, geotechnical risks, resettlement (physical, economical resettlement) needs and infrastructure. Rank was assigned to each component:

Impact on landscape	15
Impact on soil	5
Impact on air quality	5
Noise	10
Impact on biodiversity	15
Impact on water	10
Geotechnical risks	15
Resettlement	20
Impact on infrastructure	5
TOTAL	100

These ranking criteria have been differentiated in order to reflect the peculiarity of the areas interested by the project. The criteria are key questions, to which closed answers and scores are associated. A score is ascribed to each answer:

No or negligible impact	0
Medium impact	0.3
Medium impact	0.5
High impact	1

For each criterion, a score is obtained by multiplying the component rank (based on potential impact) by the score of the criterion (criterion score). The final score value for alternative is obtained as a sum of the component scores. Alternative that shows the lowest score a value is assumed to have the best environmental and social performance.

6. BASELINE DATA

6.1. PHYSICAL CONDITIONS

6.1.1. CLIMATE AND METEOROLOGY

Eastern Georgia has prevailing subtropical climate, influenced mainly by dry air masses from the Caspian and Central Asia in the east, and humid air from the Black Sea in the west, and largely protected from the colder air in the north by the Greater Caucasus Mountains. According to construction-climatic characterizations the project region belongs to II-b climatic sub-region.

The main characteristics are hot summers and relatively cold winters, and significantly lower precipitation than in western Georgia. In the lower parts of the study area average air temperatures peak at around 23°C in July and August, when daytime temperatures often reach 33-35°C, but fall below 20 °C at night. In winter the average air temperature is around 1-2 °C between December and February, and regularly falls below -10 °C throughout this period.

Temperatures are significantly lower on the higher ground to the West of the study area, and around the Rikoti tunnel the average winter temperature is -1°C to -3 °C between December and February and only rises to around 17 °C in summer.

Precipitation is also much higher in this area, reaching 1100 mm per year, and the annual pattern is different as winter is much wetter than summer, and the average snow cover is between 80 and 100 days per year. Winds are also stronger than in the lowlands, averaging 8-10 m/sec in most months, blowing mainly from the East.

Maximum daily precipitation level in the area totals 80mm. Annual precipitation on the plain is around 500-644 mm, and Figure 6.3 shows that spring and autumn are the wettest periods, and that winter is generally drier.

Snowfall is moderate in most winters and the average snow cover on the plain is between 34 to 52 days. Wind speeds are generally quite low, averaging between 1.0 and 1.6 m/s in most months, and winds blow mainly from the north-east or south-west.

Relative air humidity (according to Khashuri observation post) ranges from 69% in August to 82% in December Minimum humidity is observed in April and August. Prevailing wind direction and wind speed according to Khashuri observation post and wind speed data are presented below in Tables 6.1 and 6.2.

Table 6.1. Distribution of wind direction, %

	N	NE	E	SE	S	SW	W	NW	Calm
Khashuri	2	13	28	1	1	3	48	7	46

Table 6.2. Wind speed

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
m/sec	3.2	4	4.9	5.1	4.6	4.3	4.6	4.3	4.2	3.5	3.4	2.9	4.1

Average soil temperature is registered in July-August (around 27C), lowest average temperature , -2C is observed in January.

Table 6.3. Normative depth of soil seasonal freezing by fraction

Clay and clayey soils	38 cm
Fine grain sand, sandstones	46 cm
Coarse and medium grain sand	49 cm
Coarse fragmental soils	57 cm

6.1.2. GEOMORPHOLOGY AND GEOLOGY

The E-60 highway runs from northwest to southeast of Georgia . The section under consideration is located 126 km to 143km northwest of the capital Tbilisi, in the River Mtkvari valley immediately east of the Likhi Ridge, which is the natural boundary between the Eastern and Western Georgia. The highway runs roughly parallel to the river on its northern side through the Khashuri-Doghlauri flat accumulation plain with undulating terraced surface in some places.

The geomorphologic peculiarity of the study territory, like its landscape and climatic peculiarity, is distinguished for two different characteristics. Most of the eastern part of the area is an accumulation plain relief of Shida Kartli, formed under the influence of the erosive-accumulative processes of the river Mtkvari and its left tributaries.

Within the Upper Kartli flatlands the northern and the southern sections can be distinguished. The north is represented by Tiriphoni-Saguramo, the south 'coincides' with the Mtkvari gorge. Tiriphoni-Saguramo is built of the Liakhvi, Lekhura, Ksani and Aragvi river sediments. The highest part, near Tskhinvali is 800m above sea level, the lowest, near Natakhtari is 500m above sea level. The Tiriphony flatland from Tskhinvali to Gori is slanting southward. Other parts (Saamilakhvro, Mukhran-Saguramo) are flat.

The relief of the study territory clearly shows four terrace surfaces of the Mtkvari River with two inserted terrace steps developed under the influence of the Mtkvari tributaries forming an accumulation plain hilly relief. The accumulation plain surface is intensely crossed by meridian oriented left tributaries of the river Mtkvari and channels of the irrigation system. The terrace slants from the north to the south.

In the ancient times, the slopes were covered with riparian forest. Now, remains of the forest may be found only near Khashuri (Osiauri area). On the slopes of Trialeti ridge vegetation is better preserved.

According to the tectonic zoning map the project region belongs to the east section of the central part of Adjara-Trialeti folded system. It is built of Upper Palaeogene (P3) and Lower Neocene (N1) sedimentary and volcanogenic rocks. The 'older' rocks are topped with 10-20m thick modern and Quaternary (Q3+4) rocks represented by clay, sandstones, sand and cobbles.

The surface of the plain is composed of Quaternary fluvial alluvium (loosely cemented conglomerates, clays and sand) deposited by the rivers; and deluvial-proluvial material (coarse gravel, shingle, clay and sand), washed from the mountains by rainfall or ephemeral streams.

The project region is built of:

- Oligocene and Lower Miocene (Maikop series). carbonaceous clays (Khadum horizon), gypsiferous clays with thin coating of jarosite, fish scales and

septaria, intercalations of quartzmicaceous sandstones. On the Dzirula massif-sandstone-spongolite strata with beds of manganese ore. (E_3+N_1^1)

- Aptian and Albian stages. shallow - water marine marls, limestones, carbonaceous clays, glauconitic sandstones. In places--lavas and volcanic tuffs of mainly calc-alcalic basalts, andesite-basalts andesites, tuffites (K_{1a}+al)
- Upper Cretaceous (undismembered): glauconitic sandstones,bedded limestones (pelitomorplic, lithographic, crystalline, brecciated), marly limestones, marls, in places--sheets and volcanic tuffs of alkalic basaltoids, trachyandesites, trachytes and phonolites with intercalations and lenses of limestones and marls K2)
- Barremian stage. Georgian block and Gagra-Djava zone (Dzirula and Kelasuri massifs): Shallow-water-marine deposits: quartz-arcose sandstones and conglomerates, limestones, dolomites (K1br)

Geotechnical survey of the project area carried out by Geoengineering revealed that up to around 12m clay dominated. The area is structured of slightly humid and humid dark brown to light brown, stiff silty clay underlaied by weathered mudstone with sandstone interlayers. The topsoil is from 0.3 to 0.5m thick.

Chumateleti river valley is formed by Palaeozoic granitoids. At the slope of the valley the rocks are covered with various capacity colluvial-deluvial and eluvial loose, fragmented and clayey formations, whereas at its bottom part both natural alluvial and proluvial deposits and man-made (technogenic) soils, in forms of road bed fill and other types of fill are observed. This section of the valley represents a contact zone between Palaeozoic granites and Jurassic rocks deposits (clay slates, sandstones and other). The right slope of the valley is represented by granitoids. On the surface granitoids are fissured. The fissures transform eluvial part of the granites into dense, in some places loose, angular gravel-angular cobbles fraction, reducing stability of the right slope of the valley. Due to that, the slopes o in this section are unstable. . At the same time, it shall be mentioned that there are some weakened and broken areas in the body of the granitoid massif (as revealed during construction of Rikoti Pass tunnel), where rigidity of rock is reduced. Such areas may trigger large scale landslides and landslide-avalanches during which sudden breakage of rock mass and rock fall from the slopes is expected.

On the right slope two small and one large erosion gully have been developed. The latter is 2 km long. The small gullies are 10-30m deep. The small gullies are dry. The slopes are vegetated. Vegetation prevents formation of mudflows . The large gully is torrential.

The left slope of the valley, the base of which has been cut for the needs an oil pipeline construction project is stable. The slope is covered with shallow colluvial-deluvial and eluvial sediments (mix of angular gravel-angular cobbles and clayey soils) overlaid with 0.5m thick topsoil. The slope is vegetated. Rocks crop out at the base of the slope and within the bottom of the erosion ravines. Compared to the right slope the rocks of the left slope are less fissured.

6.1.3. HYDROGEOLOGY

The main hydro-geological region in the study area is Kartli Artesian Basin of porous, fissured and fissured-karst water, which underlies most of the Plain. The Kartli artesian basin is formed in the depression between the Caucasus Mountains in the north, the Trialeti Range in the south and Likhi Ridge in the west.

Major geomorphologic units are the Tiriphoni and Mukhrani syncline depressions, overlain by the Quaternary formations and accumulative terraced terrain of river valleys. The depression is filled with a thick molassa series (up to 2 km) of the Miocene – Pliocene period, consisting of alternating conglomerates, sandstones and clays. This series underlies similarly thick (>200 m) non-dissected Early Quaternary and recent alluvial formations, composed of boulders, shingle and loam, with inter-layers of clay.

The groundwater associated with these formations is pressurized and frequently self-flowing in boreholes, and is classified as hydrocarbonate-sulphate calcic-sodium type with low mineralization up to 1 g/l. This complies with potable water requirements and the groundwater is widely used for water supply to settlements. The deeper Miopliocene lagoon-continental sediments are only sporadically water-bearing, in layers of loose conglomerates. Here the majority of boreholes are sub-artesian, with water levels at 30-40 m below the ground. Consequently, borehole yields are low and rarely exceed 1 l/s. The groundwater from this stratum is mainly of low mineralisation (0.4 – 1.0 g/l) and hydro carbonate calcic magnesium type, and is used for local decentralized water supply.

The Pressurised Water System of the Folded Zone of the southern slopes of the Caucasus Mountains underlies the northern and north-western part of the plain. The hilly/mountainous terrain is dissected, especially north-west of Chumateleti, where the E-60 crosses a complex series of exposed strata, comprising (from south to north) Neocene, Palaeogene, Upper and Lower Cretaceous, Bajocian (Middle Jurassic), Lias (Lower Jurassic), and Palaeozoic granites of Dzirula crystal massif around the Rikoti tunnel. Some of these have high water content, particularly the Bajocian porphyritic series of tuff breccias and sandstones with andesite layers, and the Cretaceous formations of limestone, sandstone, tuff breccias and dolomitised limestone. This area is characterized by abundant springs, which frequently appear during excavation work.

The ground water level the new alignment area was found to vary from 1.0 to 6.5m.

6.1.4. HYDROLOGY

The main surface water body in the region under consideration is Mtkvari. The tributaries of the Mtkvari are the Suramula near Khashuri, the West and East Prone near Agara and Aradeti, and the Didi Liakhvi, Mejuda and West Tortla near Gori, Ksani, Aragvi, etc. Most of these streams flow roughly north to south into the Mtkvari, except the Suramula, which runs parallel with the Mtkvari on the northern side of the E-60 and drains into the Prone east of Agara.

The Mtkvari is the largest river in the South Caucasus and is the dominant hydrological feature in the study area. It originates from springs at 2,720 m asl on the northern slopes of Mount Kizil-Giadik in Turkey, and runs for 1,364 km through Turkey, Georgia and Azerbaijan, before discharging into the Caspian Sea south of Baku. The Mtkvari basin covers 188,000 km2 of mountains (mainly the Greater and Lesser Caucasus) and intermountain tectonic lowlands like the Gori Plain; and the river is recharged by glaciers, snow-melt, rain and groundwater. Around 50% of the annual discharge occurs in spring and 25% in summer, and flash floods can result when heavy rain coincides with the peak of the spring snow-melt.

The river system is polluted (organically and bacteriologically) by the discharge of poorly treated or untreated wastewater; irrigated agriculture and industry (however since 1990s industrial pollution decreased considerably).

Deforestation in the upper part of the basin has led to poor soil protection with damaging mudslides as a result. Moreover, deforestation and overgrazing have led to erosion causing high turbidity of river water.

In the area between Didi Akhalsopeli and Agara the floodplain is used by community as a pasture. In spring water in the floodplain may rise by 1- 1.8m. Flood width varies from 125m near Urbnisi to 650m near Didi Akhalsopeli. In the section from Kvishkheti to Tskhramukhe water may rise to 3.8 m. The river bed meanders and branches.

Small islands within the riverbed are 30-60m long and 20-40m wide. The largest are 0.4-2.2 km long and 150-800m wide and are located near Damchkhreula, Rbona, Didi Akhalsopeli, Agara, Kareli, Kvemo-Khvedureti and near Gori. The largest island is in 3 km downstream Khashuri, near Osiauri village (width 2.1km, length 1km, height 2m). Vegetation of the islands is deciduous, both trees and bushes are available.

The banks in the Kvishkheti-Khashuri section are low (0.1-0.3m), moderately washed away and covered with wetland and sparse bush vegetation.

Figure 6.1. Map with indication of main water bodies in the project area

The rivers/streams closest to the project area water bodies are Suramula, Shuaghele , Tsotskhnaraskhevi and Chkherimela river.

Suramula - The river flows into the Ptsa near vil.Kvenatkotsa, while the latter flows into the Mtkvari south to vil.Doglauri. Suramula takes origin from Likhi ridge at 1200m asl. The river is 42 km long with the total fall of 578 m and the recharge area of 719 km2. It recharges with snow, rain and ground water. Water regime is stable in summer. Unstable low water regime is typical of winter season. The river may freeze for 3-4 days, however this happens rather seldom. Water is used for irrigation. River network is distributed unevenly. The tributaries include the Shukghele (10km), the Tiliana (17km), the Choratkhevi (27km), the Western Prone (38km); the Shola (18km). The density of the river network is about 0.73km/km2. The width of the floodplain of Suramula varies from 20-25m (near vil.Itiria) to 200m (near Patara Sative). The

floodplain is flat, around 0.5m deep. During high water, the water level increases by 0.1-0.4m. Average head is 630 in 6-7 km from the source. Downstream Surami to the confluence the head decreases. The character of the river changes from mountain to lowland stream. The river is 3m wide, varying to maximum of 25m and minimum of 1m. Its depth exceeds 0.3m. The flow ranges from 0.9-1.5 m/sec (near Khashuri) to 0.5-0.6 m/sec (downstream).

The river bottom is flat, stone-sandy in the upper stream sandstone-gravel in the lower stream. The banks merge into the slopes of the gorge, in some area fragmented terraces are observed. Flow monitoring data are available for two stations: Surami (1926-1955) and Kvemo Tkotsa (1930-1935). High water is observed in spring to the end of June. Maximum flow was registered end of March. Low water is observed from end of June until October. Hazardous hydrological events are not observed. Flow near Surami varies from 0.002m3/sec to 31.6 m3/sec. Annual flow distribution is not uniform. In spring, summer, autumn and winter the flow makes up 64.7%, 16.2%, 3.1% and 16% of the annual value. Freezing is observed from December to the end of February. Water upstream Surami is clean and suitable for water supply. Downstream water is polluted with wastewater, litter. Water is used for irrigation.

Chkherimela: length – 39 km; catchment – 490 km2, average annual flow - 13.6 m3/sec. The Chkherimela watershed includes Chkherimela, Sakraula, Dzirula, and Dumala. The watershed is located in - Kharagauli municipality and occupies more than half of its area. There are 15 communities in the Chkherimela watershed. Large part of the Chkherimela catchment area belongs to the Borjomi-Kharagauli National Park. The watershed and its resources are predominantly used for industrial purposes, for drinking and domestic purposes. There are several spa and healing resorts in the municipality (e.g. Nunisi, Zvare). There are currently no commercial logging operations in the municipality, the waters are not used for HPP generation and irrigation. The area has high aesthetic/recreational and cultural values. In terms of the number of ecosystem services provided by the watershed, they are limited to ecosystem conservation, DRR, health protection, commercial use, livelihood support and recreational services. There is no water quality monitoring data available for the river, however, it can be assumed that the river is considerably clean due to low anthropogenic pressures.

For the ESIA studies of the surface water quality in Surami, Rikotula Rivers have been carried out. The samples were collected near Rikoti tunnel . The analysis of the waters include: total nitrogen (TN), total phosphorus (TP), analysis for the total petroleum hydrocarbons (TPH) . In addition physicochemical parameters such as temperature, pH, conductivity have been measured. Results are presented below.

Table 6.4. Water quality data (Suramula, neat tunnel)

Parameter	Value	Parameter	Value
pH	7.2	Mg, mg/l	3.9
Turbidity, FTU	0.35	Na, mg/l	4.4
Ec, mS.cm	0.08	K, mg/l	0.4
Cl, mg/l	5.1	DO, mg/l	7.9
HCO3, mg/l	41.0	TDS, mg/l	75
SO4, mg/l	10	TN, mg/l	8
Ca, mg/l	13	TPH, mg/l	<0.2

6.1.5. LANDSCAPE AND LAND USE

The landscape of this region is generally natural or semi-natural in the uplands of the north, south and west, and mainly anthropogenic in the lowlands of the centre and east, where most of the natural vegetation was removed many years ago to provide land for agriculture.

Under the combined influence of geology and anthropogenic change, the Kartli plain today is a large, flat expanse of arable land, with few hedgerows and little natural vegetation. The land is mainly subdivided into small plots, which are primarily individually-owned and occupied by orchards, vineyards, vegetable gardens, corn fields, hay meadows and pastures. There are also small scattered settlements, and some overgrown secondary meadows in the places that are unfavourable for agriculture.

In the west the Likhi Ridge provides a more rugged and natural landscape of steep hillsides dissected by narrow plunging gorges, covered by yellow brown soils, which support relatively large areas of mixed deciduous forest, mainly oak, beech and hornbeam. The landscape is modified near the towns and villages, where the forest is replaced by meadows and shrub-land, which has grown after forest clearing. In such areas near settlements the arable landscape predominates. In the east, West Kvernaki hill presents a semi-natural landscape, with steep slopes dissected by gorges and gullies through which runoff drains into the Didi Liakhvi River. These are interspersed with thorny shrubbery and areas of grassland on the mainly cinnamonic soils. There is little cultivation in this area, although the grassland is used quite extensively for grazing.

The floodplain of the River Mtkvari was also greatly altered by human activities, including flood protection, enterprise development (manufacture of building materials, fish ponds, etc), and agriculture. Some natural vegetation remains, but this is limited to isolated fragments of riparian forest, amongst thorny shrubbery and grassland.

The area from Zemo Osiauri to Chumateleti is represented by arable lands, pastured, small groves. The landform is flat, in the areas closer to Chumateleti – hilly. The landscape in the RoW can be characterised as follows:

1. hilly foothills with oriental hornbeam and oak – oriental hornbeam on brown forest soil;
2. undulating hilly foothills with shrubs and steppes, brown forest soil
3. terraced flatland with oriental hornbeam and steppe vegetation, alluvial and brown soil.

6.1.6. SOILS

Soils in the project area belong to the Eastern Georgia forest-meadow soil zone. The soil is mostly cinnamonic, cinnamonic-calcareous and alluvial loamy, fertile, hence the predominance of agriculture.

Alluvial-carbonate soils are widespread along the banks of the rivers. This type of soil is rather diverse. Their basic mass, thickness of the profile, mechanical composition and concentration of carbonates, nitrogen and carbon as well as other characteristics often vary within a wide range. This is natural, since those parameters that determine the type of soil depend on river dynamics, the type of materials brought by rivers, lithological and mechanical (size, weight) composition of these materials

and many other processes. These soils are characterized by the diversity of alluvial materials and high concentration of carbonates. Alluvial-carbonate soils of young terraces have weak profile and are less stable, while old terraces are more stable because of fine and coarse fractions present. Analysis of field lab data and reference material revealed the presence of the following engineering-geological elements:

Cinnamonic soils are formed in conditions of relatively mild and humid climate with little influence of underground waters. Soils are characterized by high level of differentiation. The concentration of humus varies between 3-10%. Their geochemical potential is characterized by acid reaction, which decreases with depth and ultimately becomes neutral. Therefore, these soils are characterized by a rather high coefficient of washing.

Cinnamonic-calcareous soils occupy rather large areas within the corridor. Lithological composition of these soils is similar to those of brown soils, but with higher content of carbonate materials. These soils are formed mainly of deluvial sediments.

Within the eastern part of the Dzirula Gorge where the project area is located three types of soil formation are met. These are: grey soils, yellow grey soils and humus grey soils.

Within the areas adjoining the Chumateleti, podzolic grey and carbonate soils are formed. Pozdolic 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-coloured 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 a illuvial-metamorhic 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 colour 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.

Table 6.5. Water quality data

	SP- 1	**SP- 2**	**SP -3**	**SP -4**	**Allowable limit, mg/kg**
Cu, mg/kg	40	35	33.2	40	2-50
Zn, mg/kg	170	100	73.1	130	10-300
Pb, mg/kg	50	30	22	26	0.1-20
Ni, mg/kg	30	30	40	30	1-100
Co, mg/kg	30	30	25	30	1-50
As, mg/kg	0.9	0.8	0.8	0.7	1-50

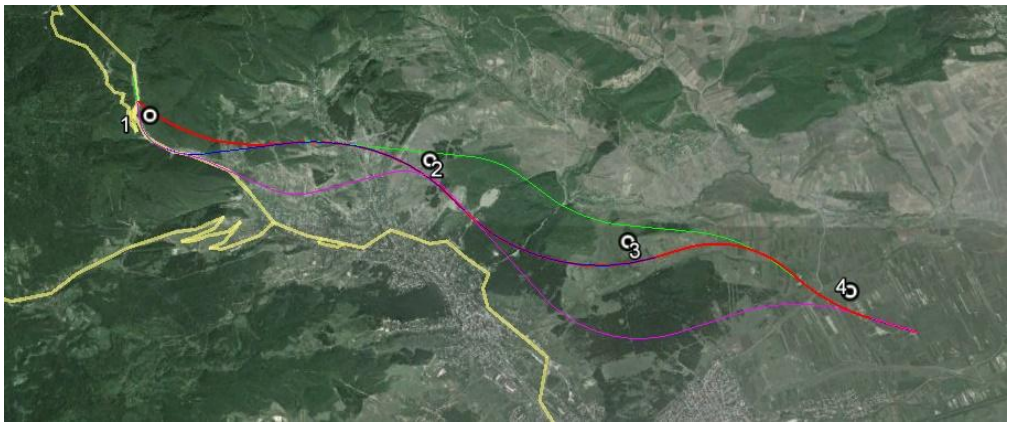


Figure 6.2. Location of sampling points

Besides the high values of lead (Pb) registered in the soil samples, all other elements are in concentration of other elements meet the requirements of international standards. All values are within allowable limits. High lead content is believed to be due to traffic related pollution.

Physical-mechanical properties of the soil have been studied by Geoengineering, Results are presented in the report developed by the design team.

6.1.7. AIR QUALITY

The air quality is likely to be generally good in the study area, given its rural character, the predominance of agriculture as the major land use, and the absence of heavy industry. Vehicle emissions are comparatively low because of low traffic volumes, and air pollution is rapidly dispersed due to winds. However, the residents of the settlement closest to the highway may be exposed to elevated levels of pollutants from vehicle emissions.

During rehabilitated road operation it is expected to have increased traffic flow resulting in higher vehicle emissions.

There are no permanent air quality observation points near Zemo Osiauri–Chumateleti section of the highway. Therefore, background air quality is set according to methodological instructions given in "Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held". According to this document possible concentrations of harmful substances in the ambient air are linked to the population.

Table 6.6. Background concentration rate (Source: "Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held")

Population, '000	Background Concentration Rate, mg/m3			
	Nitrogen dioxide, NO2	Sulphur dioxide, SO2	Carbon monoxide, CO	Dust, PM10
250-125	0.03	0.05	1.5	0.2
125-50	0.015	0.05	0.8	0.15
50-10	0.008	0.02	0.4	0.1
<10	0	0	0	0

The traffic on EWH is probably the main source of air pollution, as traffic is assumed to be significant contributor to atmospheric levels of certain substances worldwide, mainly from the burning of fuel. These include carbon monoxide (CO), nitrous oxides

(NOx), volatile organic compounds (VOC) particulate matter (PM), and sulphur dioxide (SO_2).

The study area is remote from the major traffic routes, limited traffic is lighter and generally moves more freely, and winds blow throughout the year, so pollutants produced by vehicles on the EWH and other roads should be rapidly dispersed in most circumstances. However, people living alongside the road may be exposed to elevated levels of traffic pollutants given their proximity to the source. Overall air quality may decrease somewhat during the winter when many people burn wood to heat their houses.

6.1.8. NOISE

The rural character of the study area also means that the noise environment is generally quiescent, and there are few sources of anthropogenic noise in and around most villages, apart from the relatively light road traffic, and occasional farm machinery. As was the case for air pollution, the EWH is also likely to be the main source of noise in the study area, again produced by traffic. In some sections of the highway in condition of increase traffic the noise level may exceed acceptable daytime/night-time noise level in adjacent residential areas, but keeping in mind that sound is attenuated rapidly by intervening buildings and vegetation, and levels generally decrease quite quickly with distance from the source, exposure to elevated levels will probably limited to people living within a few hundred meters of the road.

6.1.9. SEISMIC CONDITIONS AND HAZARDOUS PROCESSES

The area of Georgia represents a part of the active seismic zone of the Caucasus. It belongs to the Mediterranean seismic belt. Its architectonical movement and activity is connected with the movement of the neighbouring Eurasian and Afro-Arabic rocks.

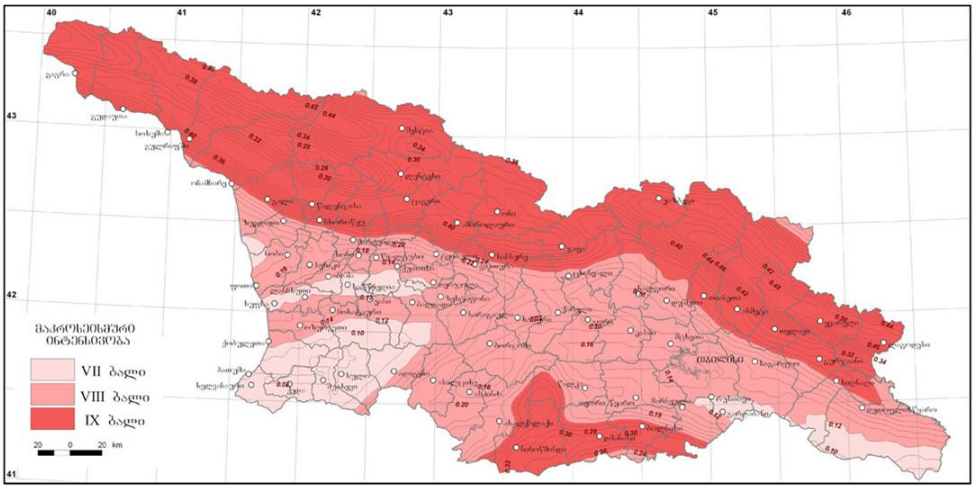


Figure 6.3 Seismic intensiveness map of Georgia (Source: Construction norms and rules – Seismic stable construction, pn 36.0101-09)

The project is located in the high intensiveness seismic zone - the Richter scale (VIII). The main hazardous processes in the project region are related to physiography and climate, seismicity in the area, landslide, mudflows, flooding and snowfall.

Dangerous processes show certain periodicity. Erosion is intense, in particular in the riverbeds. Landslides are observed in the areas with steep slopes, loose composition

of some of the exposed strata, seismic activity and precipitation. Particular areas of concern are the Likhi and the South Caucasus ridges.

Feasibility study and survey of the area by engineering geological team on design development stage of the project revealed 11 landslide bodies in the first 10km of the new alignment and a range of sensitive locations along the Suramula riverbed. (see Figures 6.4.a and b)

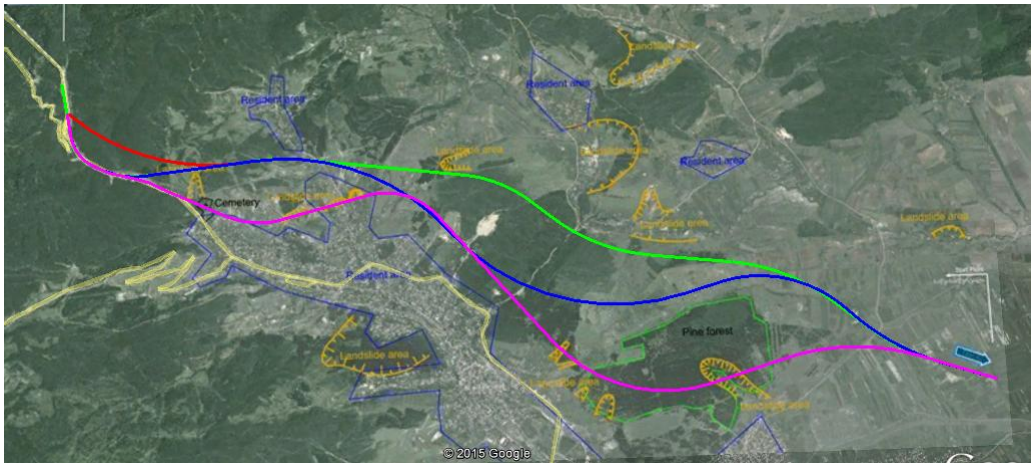


Figure 6.4.a Landslide areas according to feasibility study

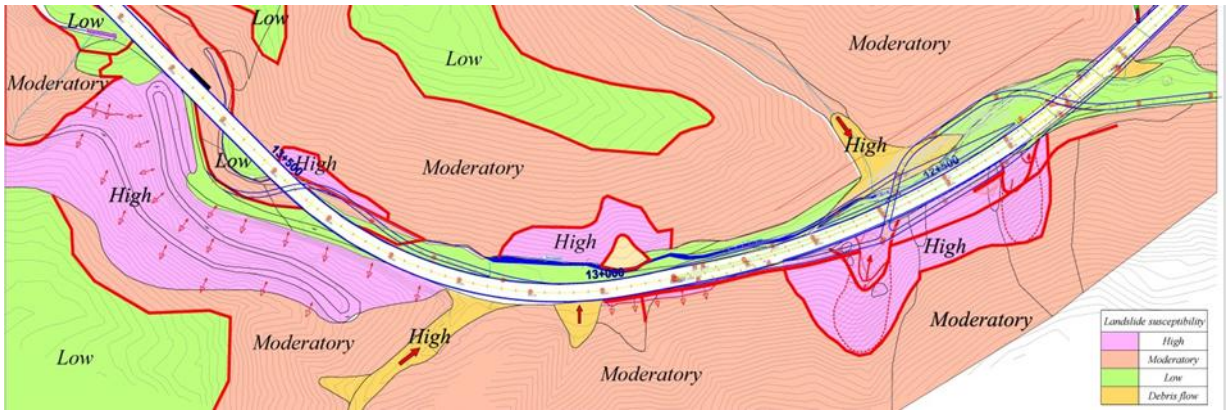


Figure 6.4.b Landslide susceptibility map (km 12 - km14 section)

Section km12+360 – km12+420.

The left side and central part of the landslide body has already flown down and is fully cleared. At the right side - small part of landslide body in temporarily stabilized condition still exists. Thickness of remaining landslide mass is about 5-6 meters. Lithologically it is represented by gravel-shingle, boulder inclusions and sandstone - loam matrix. It is friable, slightly wet. Height of the main step is 5-10m, inclination - 60-80^0. Collapse of the ground and formation of the next new step above existing one is expected. This process may happen instaneously. Degree of humidity determines the character of the sliding process. In case of high humidity the soil may become very soft , slide down rapidly and accumulate along the road. This process of slope denudation is expected to continue over the years.

Section in km12+640 – km12+720.

The left side of the landslide body has already flown down to the road and is totally cleared. The central part and right side parts of landslide are currently stable. The basis of the landslide body boarders to highway. Thickness of remaining 'material' is

about 5-8 meters. Lithologically it is represented by gravel-shingle with boulder inclusions and by sandstone-loam matrix. The landslide body may slide if saturation with water reaches some critical limit.

Section km12+840 – km13+000.
Slope is forested except it's base part. The height of the slope is 5-10m, inclination 35-45^0. Lithologically it is built of gravel and shingles. Loam accounts for 35-40% of the soil. The lower section, were the slope is devoid of vegetation, is sliding slowly. Periodic cleaning of the road is required. The slope is steep (30-35^0). In order to keep it stable, arrangement of 2-3m high reinforced concrete pillar wall in the base of the slope is required.

Section km13+140-13+200.
Worth to mention is a deep ravine within the right slope of the Chumateleti River gorge that caused significant damage several years ago, when a landslide in the ravine caused ponding of water and formation of strong mudflow. Other important geodynamic events, in this section are rock fall and gradually sliding debris along the existing road.

Section km13+500-13+580.
Edge of river Chumateleti left side slope is cut into the ravine bottom by 20-30m like arc. Project road crosses the base of the mentioned side slope. Visual observation does not reveal geodynamic events in this area. Slope is forested, doesn't have a large gradient and is stable. The surface is covered by diluvial formation and 1-3m thick soil layers and it's likely formed by fissured granites. (Engineering-geological survey is requires to define a detailed condition of the slope.)

Section km13+680 –km 13+780.
Area is located in the base part of the Chumateleti ravine slope, at the I serpentine to Rikoti mountain pass. Bedrocks are fissured, rock falls at the steep slopes of factious sections are observed. Surplus soil dump at the right bank of the river is located at the steep slope, which is formed by the colluviual-diluvial formations and rock soils-granites. No signs of deformations are detected. However, the soil bulk is not compacted properly, so probable ongoing process of ground consolidation in to the body of bulk is not excluded. Therefore in case of constructing the highway here, bulk soils should be removed from the construction line, or in case of using it in the roadbed, all the necessary measures should be applied for total consolidation of the ground. Lateral erosion control measures shall be applied from river Chumateleti side (construction of protective retaining wall, or others). After the bulk, the slope, in general is sustainable. At the existing steep gully bottom there is slight process of deep erosion.

6.2. BIOLOGICAL ENVIRONMENT

This section presents general description of flora and fauna species available in the project region. However, not all of the listed species may be present in the project impact zone. Information about the species directly/indirectly affected by the project is given in Section 7.6. of the report.

6.2.1. FLORA

Vegetation in Shida Kartli region has been altered because of antopogenic impact. Majority of these newly established vegetation is secondary. Nowadays arable lands dominate the region. Prior to rapid development of cultivation in the region the

dominant tree species in the area were Oak (*Quercus iberica*), Hornbeam (*Carpinus caucasica*), Beech (*Fagus orientalis*). Clearing of forests for agricultural development, construction of roads and trails, timber production and tree felling for harvesting fire wood gradualy led to degradation of forests. In many places, mainly in the plains, the forest was completely destroyed. The trees were ousted by shrubs such as *Paliurus spina christi, Spiraea hypericifolia, Carpinus orientalis*. Of polydominant shrubs widely met are in the project are are: *Rhamnus pallasii; Spiraea hypericifolia; Cotinus coggygria*; Juniper species - *Juniperus oblonga, J.oxycedrus, J.polycarpos, J.foetidissma; Rosa canina: Crataegus kyrtostyla; Lonicera caucasica; Prunus spinosa; Rhus coriaria; Cotoneaster racemiflora*. The habitat of the dry, rocky slopes with thin, badly eroded soils and xerophylic shrubs (*Astragalus* and *Acanthalimon*) dominate.

Along with hemixerophite shrubs grassy steppe formations are widely presented. Among the first to mention *is Botriochloa ischaemum* now flourishing in the areas were oak and hornbeam riparian firests use to grow. Within the steppes *Festuca sulcata, Agropyron repens, Stipa sp.*, and other are dominating. In spring, on the driest and often saline soils, mostly in small coenoses, ephemers and ephemeroid synusia develops. Within the first terraces of the Mtkvari and its tributaries narrow strip riparian forest (mostly intermittent) is observed. The plant species here include: *Populus nigra, Populus hybrida, Quercus pedunculiflora, Ulmus foliacea, Salix excelsa, Alnus barbata* and others. Next to the groves the floodplain vegetation - *Phragmites comunis, Typha latifolia* and others is registered.

Within the first 10km the new alignment crosses arable lands, pastures, small gorges, sparse forest undergrowth sections, pine plantings. From floristic and phytosociological view this area can be divided into three sections: Section 1. Arable lands; Section 2. Pine plantations; Section 3. Low value oriental hornbeam stand, secondary scrubs and pine plantation; Section 4. Individual shrubs and trees. Natural forest - at higher elevation from the project area (not affected by the project); Section 5. Planted pine trees, young Alder trees and shrubs.

In the section from Zemo Osiauri (X-0386443 Y-4652960 H-706m) up to pine plantation area (X-0382549 Y-4653237 H-888m. Conventional Section 1) the habitat is modified**.** The vegetation is altered, due to the fact that the area is under 'anthropogenized'. Therefore, registered plant species are not diverse. In the past dominant biomes in the area were Oak and Hornbeam. With time, because of intensive man-caused impact these species were ousted by thorns. Although these plants have some erosion control function and may provide shelter for birds and small animals, they are less interesting from floristic view and have no commercial value. Within this section of the corridor, the area is mostly used for agricultural purposes, in the peripheral meadows are used as pastures. There plots are fenced. The areas are used as orchards (plum, prune). Most of the land is cultivated and ready for cereal (corn, wheat and barley) seeding. Large areas are underdeveloped and covered with weeds, such as *Cirsium sp*. Along the section (X-0385482 Y-4653478 H-774 m) dog rose bushes are spread. Symmetry of plantation allows to assume that these bushes were planted for commercial (as a medicinal plan) use.

In some areas, within the boundaries of steppe and agricultural land plots small fragments of shrubs are registered (blackthorn - *Prunus spinosa*, Buckthorn *Rhamnus pallasii*; spirea - *Spiraea hypericifolia*, smoketree - Cotinus coggygria; dogrose - *Rosa canina*; hawthorn - *Crataegus kyrtostyla*). In the bushes *Helleborus caucasicus* and *Cyklamen vernum* are found.

The areas less suitable for cultivation are used as pastures (for cattle grazing). On these meadows and slopes diverse cereal-legumes communities are registered. These list of the species inter alia includes: *Achillea millefolium, Echium rubrum, Onobrychis sp., Koeleria caucasica, Phleum, Avena versicolor, Trifolium sp., Medicago sativa*. In alkaline soil areas endemic varieties - *Astragalus carthlicus, A. Cyri, Galium verum, Ornithogalum pyrenaicum, Falcaria vulgaris, Agropyron repens, Melilotus officinalis, Euphorbia, Glaucum corniculatum, Calendula Senecio sp., Astrodaucus orientalis, Dipsacus laciniatus* are widely presented.

Pine plantations (start point: X-0382549 Y-4653237 H-888m; end point: X-0381831 Y-4653733 H-807m. Conventional Section 2). The section crosses pine plantations. The only tree species in this area is Caucasian pine *Pinus sosnowskyi*. In 50-ies of the last century, Surami area and adjacent slopes were planted with pine trees. Average age of the trees is 70-80 years. The undergrowth in the section of interest is represented by various cenosis, in particular shrubs like *Cotoneaster racemiflora*, *Rubus chamaemorus*, *Rosa canina*.

Oak and oriental hornbeam with secondary scrub and pine plantation. (start point X-0381831 Y-4653733 H-807 m; end point X- 0380578 Y-4654788 H-842 m; X-0379430 Y-4655370 H-811 m. Conventional Section 3). Vegetation on the slopes within this strip, is represented by degraded oak-hornbeam forest. In the boundaries of the ROW vegetation is represented by: Caucasus pine - *Pinus sosnowskyi*, hornbeam - *Carpinus orientalis*, Georgian oak - *Quercus iberica* (single trees), Nut trees - *Corylus avellana*, Hawthorn species - C*rataegus sp., Chitavashla Pyracantha coccinea*, Medlar - *Mespilus germanica*, Cornels - *Cornus mas*, Dog rose - *Rosa sp.*; Honeysuckle - *Lonicera caucasica*; other species, such as *Prunus spinosa, Rhamnus pallasii, Cotinus coggygria*. In the thickets widespread are: *Fragaria vesca, Asparagus officinalis, Melilotus officinalis, Polygonatum glaberrinum, Viola sp. Scilla, Pedicularis caucasica, Cyclamen vernum*. The withered oak trees represent remains of the 'natural' forest. The 'spread' of the pine trees planted in the area is sparse. The status of the landscape has changed drastically. In the recent past the area was covered by forests. Anthropogenic influence and tree felling the forest was ousted by secondary bushes. Vegetation is represented by thorn shrubs only. Species composition identified by visual inspection of dry grasses in the area south-west to the coniferous forest the species composition includes: *Taraxacum officinale*, *Falcaria vulgaris*, *Astrodaucus orientalis*, *Cynodon dactylon*, *Agropyron repens*, *Cirsium* sp. In the area several individual shrubs (*Cotoneaster racemiflora)* were registered.

Foothill area (X-03784230, Y-4656320, H-790m. Conventional Section 4). Natural vegetation is represented by individual shrubs and trees. The sensitive area - forest is at higher elevation and is not affected by the project. Dominant plant species in the forest area are: Alder (*Alnus barbata*), at higher elevations Georgian oak (*Quercus iberica*, Imeretian oal (*Quercus Imeretina Georgian Red List VU category species),* Chestnut *(Castanea sativa, Georgian Red List VU category species),* Hornbeam (*Carpinus caucasica*), Maple (*Acer campestre*), Poplar (*Populus nigra*;). In some places undergrowth is formed by broadleaf trees and shrubs such as: Hawthorn (*Crataegus sp*.), Cornel (*Cornus mas*), Common hazel (*Corylus avellana*), plum (Prunus divaricata), dogrose (*Rosa canina*), Blackberry – (*Rubus sp.).* Colchic relicts - like Rhododendron (*Rhododendron ponticum*), Azalea (*Rhododendron flavum*), Cherry laurel (*Laurocerasus officinalis*), Colchis ivy (*Hedera colchica*), Colchic holly

(*Ruscus ponticus*) can be also met Visually the undergrowth is best visible in winter. Along with deciduous plants pine trees (*Pinus sosnowskyi*) are also registered.

Area along the left bank of the Suramula River (X-0376526 Y-4655348 H-831 m. Conventional Section 5) . Vegetation is presented by planted pine trees, young Alder trees and shrubs.

6.2.2. FAUNA

Fauna in the region of interest is represented by steppe wildlife. The species composition and abundance have changes significantly. The reason of that was shrinking of the forest areas and loss of connectivity between the stands. The main fauna species present in the area of interest are not diverse.

Objective of the survey was registration of animal species in the RoW. The review is mainly based on available scientific publication, information gathered during previous surveys (in particular the surveys carried out in 2009-2011 and 2014) in the region, reference and secondary date as well as interviews with local residents. According to the mentioned sources the following species are typical and can be met in the project area.

Mammals are represented by: fox (*Vulpes vulpes*), jackal (*Canis aureus*), badger (*Meles meles*), weasel (*Mustela nivalis*), wild cat (*Felis silvestris*), Caucasian squirrel (*Sciurus anomalius*), European hare (*Lepus europaeus*) and some other small mammal populations; Vole (*Apodemus agrarius*), Caucasian Forest Mouse (*Sylvaemus fulvipectus*), a small Forest mouse (*Apodemus uralensis*), Scrub vole (*Terricola major*), Water vole (*Arvicola terrestris*), Mole (*Talpa caucasica*);
Bats (*Vespertilionidae*) - Common pipistrelle (*Pipistrellus pipistrellus*), Brandt's Bat (*Myotis brandti*), Whiskered bat (*Myotis mystacinus*), Natterer's bat (*Myotis nattereri*).

Within the RoW, numerous vole burrows have been detected. Keeping in mind the land use pattern in the area (land is used for cereal cultivation), this was expected to be the case. In the orchards/gardens and shrubs European hedgehog (*Erinaceus europaeus*) is registered. According to local residents, wolves (*Canis lupus*) are often met in forest and steppe areas. The herders complain about frequent attacks of wolves on livestock.

Biodiversity in the forest in the Rikoti area, according to available data includes:

Table 6.7. Mammals of the forest area near Rikoti tunnel

Common name	Latin name	Biotype	Protection status
Roe Deer	*Capreolus capreolus*	Forest	
Black bear	*Ursus arctos*	Forest	Red List of Georgia
Wolf	*Canis lupus*	Forest	
Jackal	*Canis aureus*	Forests - shrubs	
Fox	*Vulpes vulpes*	Forests - shrubs	
Lynx	*Lynx lynx*	Forest	
Jungle-cat	*Felis chaus*	Forests	
Marten	*Martes spp*	Forests - shrubs	
Caucasian squirrel	*Sciurus anomalus*	Forest	

Birds: the area is notable for abundance of bird species. During the autumn site visit the following species have been registered: rooks (*Corvus frugilegus*), Carrion crow (*Corvus corone*), Tit (*Parus sp*.), black-headed bunting (*Emberiza melanocephala*), Eurasian tree sparrow (*Passer montanus*), rock dove (*Columba livia*), common chaffinch (*Fringilla coelebs*), Eurasian skylark (*Alauda arvensis*), magpie (*Pica pica*), Common blackbird (*Turdus merula*), Eurasian wren (*Troglodites troglodites*). All species listed above are 'resident'.

In spring the nesting bird species frequently seen in the area include: Hoopoe (*Upupa epops*), European bee-eater (*Merops apiaster*), Cuckoo (*Cuculus canorus*), isabelline wheatear (*Oenanthe isabellina*), common redstart (*Phoenicurus phoenicurus),* golden oriole (*Oriolus oriolus),* red-backed shrike (*Lanius collurio*), Common nightingale (*Luscinia megarhynchos)*, white wagtail (*Motacilla alba*), barn swallow (*Hirundo rustica*), Common kestrel (*Falco tinnunculus*). In spring – autumn practically everywhere quail *Coturnix coturnix*) coveys use to be found.

During the walkover, similar species were found along the corridor of interest. Birds prevail. White wagtail (*Motacilla alba*), blackbird (*Turdus merula*), whitethroat (*Sylvia communis*), magpie (*Pica pica*) and carrion crow (*Corvus corone*) were found to be dominant species in the area. Buzzard (*Buteo buteo*), hoopoe (*Upupa epops*), nightingale (*Luscinia megarhynchos*), red-backed shrike (*Lanius collurio*), black-headed bunting (*Emberiza melanocephala*), corn bunting (*Miliaria calandra*), quail (*Coturnix coturnix*); as well as - house sparrows (*Passer domesticus*), common redstart (*Phoenicurus phoenicurus)*, goldfinch (*Carduelis carduelis* and *Carduelis chloris*) near the residential areas - are met. None of the bird species listed under the Red List category (predators) have permanent presence in the project area. They do not dwell/nest in the area of interest and can be seen in the area only occasionally, while chasing the prey.

The habitats are mainly modified. No particular locations where animals regularly move from/to the river were identified.

None of protected animal species were encountered.

Reptiles are well presented. Among all the most notable are: Sheltopusik (*Pseudopus apodus*), Javelin sand boa (*Eryx jaculus*), Grass snake (*Natrix natrix*), Coluber (*Coluber shmidti, Coluber najadum*), Slow worm (*Anguis fragilis*), Caucasian rock agama (*Laudakia caucasica*) , a lizard (*Lacerta media*), Greek tortoise (*Testudo graeca*).

Amphibians - Green toad (*Bufo viridis*), Marsh frog (*Rana ridibunda*), Legged frog (*Rana macrocnemis*), Common Tree frog (*Hyla arborea*).

Fish. Fish species in Mtkvari river and its tributaries include: Khramylya (*Capoeta capaeta*), Caucasian chub (*Leuciscus cephalus orientalis*), on barbell (*Barbus lacerta cyri*), Kura loach (*Nemachilus brandti*) and others. Suramula River is less diverse in species composition. The main species are Stone loach (*Nemacheilus brandti*) and Bleak (*Alburnus filippi*). None of the species is protected.

Invertebrates. Common invertebrate species in the area are: nematodes (*Nematoda*), spiders (*Arachnida*), earthworms and freshwater worms (*Oligochaeta*), dragonflies (*Odonata*), cockroaches (*Blattodea*), moths and butterflies (*Lepidoptera*), orthopterous insects (*Orthoptera*), Beetles (*Coleoptera*), bees, wasps and ants

(*Hymenoptera*), two-winged flies - mosquitoes, flies (*Diptera*), shrimp's eye (*Mantodea*).

Among species met in the forest area near the Rikoti tunnel, worth to mentioned is snail (*Helis buchi*) – relict, vulnerable because of fragmented habitat taxon (VU, Georgian Red List species), endemic for the South Caucasus. Invertevrate fauna of the mountain forest, edge of the forest zone and cutover areas is represented by mesophylic species of herbaceous and woody plants. High mountain species typical for Greater and Lower Caucasus are also met. Batterflies of the high mountain zone are particularly interesting and include endemic, relic, rare species, such as nearly threatened *Parnassius apollo* VU and *Allancastria caucasica* VU.

6.2.3. PROTECTED AREAS AND CRITICAL HABITATS

There are no designated protected areas or critical habitats in the project impact zone.

6.3. THE SOCIOECONOMIC AND CULTURAL ENVIRONMENT

Shida Kartli consists of six administrative districts: Gori, Kaspi, Kareli, Khashuri, Tskhinvali, Java, two of which (Tskhinvali, Java) at the moment are de facto out of the jurisdiction of Georgia. The economic and social situation in Shida Kartli deteriorated considerably as a result of the war, as local residents have had to cope with the loss of homes, transport, livestock, agricultural equipment and land.

6.3.1. POPULATION.

According to the census of 2014, by the state of January the 1st, population in Shida Kartli region was 313.8 thousand. Majority of population is rural

Table 6.8. Population (2008-2014 data), thou

	2008	2009	2010	2011	2012	2013	2014
Georgia	**4 382.1**	**4 385.4**	**4 436.4**	**4 469.2**	**4 497.6**	**4483.8**	**4490.5**
Shida Kartli	**312.8**	**313.0**	**310.6**	**313.0**	**314.6**	**313.5**	**313.8**
Tskhinvali	...	...	...	...	...	...	...
Municipalities							
Gori	135.6	135.8	144.1	145.3	146.1	145.7	145.8
Eredvi	5.9	5.9	...	...	...	...	...
Tigva	1.5	1.5	...	...	...	...	...
Kaspi	51.8	51.8	52.6	52.9	53.0	52.6	52.6
Kareli	49.5	49.5	51.6	52.3	52.9	52.8	52.9
Kurta	7.1	7.1	...	...	...	...	...
Khashuri	61.4	61.4	62.3	62.5	62.6	62.4	62.5
Java	...	...	...	...	...	...	...

Source: National Statistics Office of Georgia

6.3.2. EMPLOYMENT.

Uneployment rate is estimated as 9.8%

Table 6.9. Employment rate (2013 data)

	Shida Kartli, thou	Georgia, thou
Number of workforce	152.8	2003.9
Employed	137.8	1712.1
hired	35.5	658.2
Self-employed	102.0	1043.8
unclear	0.3	10.0

Unemployed	15.0	291.8
Other population	58.6	1022.3
Unemployment rate (%)	**9.8**	**14.6**
Activity rate (%)	**72.3**	**66.2**
Employment rate (%)	**65.2**	**56.6**

Source: National Statistics Office of Georgia

6.3.3. BUSINESS AND AGRICULTURE

According to available statistics the number of businesses Shida Kartli region ranks 7th after Tbilisi and by regions (2014 data) .

Table 6.10. Businesses

	Qty, units	%
Total		100
Tbilisi	257084	43.7
Imereti	81195	13.8
Adjara	47812	8.1
Samegrelo-Zemo Svaneti	47221	8.0
Kvemo Kartli	44042	7.5
Kakheti	35986	6.1
Shida Kartli	26241	4.5
Samtskhe-Javakheti	15844	2.7
Guria	14636	2.5
Mtskheta-Mtianeti	10898	1.9
Racha Lechkhumi-Kvemo Svaneti	4531	0.8
Abkhazeti	3292	0.6

Source: National Statistics Office of Georgia

Majority of population is employed in agriculture. However, the region is among top 5 regions by number of employed in industry

Table 6.11. Employment in industry (persons)

Year	Georgia	Including										
		Tbilisi	Adjara	Guria	Imereti	Kakheti	Mtskheta-Mtianeti	Racha-Lechkhumi and Kvemo Svaneti	Samegrelo-Zemo Svaneti	Samtskhe-Javakheti	Kvemo Kartli	Shida Kartli
2011	109158	49708	6437	1638	15208	5214	2188	372	4646	1761	15326	5588
2012	114843	51922	8281	1350	16981	5582	2820	407	4128	2020	15162	5078
2013	112752	51611	7710	1153	15219	6273	2739	211	4530	1935	15598	4619

Source: National Statistics Office of Georgia

As in the region In general, agriculture is the major economic activity in Khashuri municipality. Trade and transport take up the same share, followed by industry and construction business. Processing accounts to 3% only, while administration, education, health care and services account for remaining 28%.

Main enterprises in Khashuri municipality include:

- Elita Ltd – fruit and vegetable processing factory in Surami
- Georgian Timber International – wood processing plant in Tskhramukha
- Gomi spirit and alcohol company in village Gomi

- Magistrali Ltd – road construction, vil.Osiauri
- Georgian Railways division

Local small businesses include bakeries (tone), essential goods outlets, chemist's shop, fuelling and maintenance stations. Other possibilities of employment are administration offices, shops, Gomi spirit production, Agara sugar processing enterprise, etc. In all villages of the region schools and kindergartens, shops, bakeries, pharmacies, fuelling stations, car maintenance shops, mills are available. Ambulance stations operate in most of the villages.

Average monthly salary of industry employees in the region, in 2013, was 558.5 GEL. The value is lower than the country average by 196 GEL.

Agriculture. In 2013, sown area of crops in Shida Kartli was 34.5 thou.ha

Table 6.12. Sown areas by regions of Georgia (thou. ha)

	2009	2010	2011	2012	2013
Georgia	289.7	256.7	262.4	259.6	310.7
Of which:					
Imereti	49.1	41.1	42.9	38.9	46.7
Samegrelo and Zemo Svaneti	46.2	36.5	38.6	32.8	41.5
Shida Kartli	33.4	24.3	31.6	27.2	34.5
Kakheti	79.5	68.8	60.6	74.5	97.6
Kvemo Kartli	34.8	33.3	42.1	39.4	40.9
Samtskhe-Javakheti	21.9	25.1	26.2	27.3	25.6
The remaining regions	24.8	27.6	20.4	19.5	23.9

Source: National Statistics Office of Georgia

Shida Kartli ranked 3rd by sown and harvested area of wheat; 2nd - by sown and harvested areas of barley and vegetables and 1st - by sown and harvested areas of beans. The main crops cultivated in region include:

- annual crops- beans, corn, wheat, sainfoin, alfalfa;
- fruit - apple, pear, quince, walnut, cherry, cherry-plum;
- vegetable and greens- pumpkin, cucumbers, tomatoes, carrots, cabbage, beetroot, onion, garlic, pepper

The region is the leader in apple and plum production.

Table 6.13. Production of fruit and vegetables

	2009	**2010**	**2011**	**2012**	**2013**
Production of apples by regions (thou t)					
Georgia	80.7	21.1	64.3	45	68.6
Of which:					
Imereti	2.6	2.9	2.1	3.7	2.8
Samegrelo-Zemo Svaneti	1.4	3.8	2.4	4.6	5.9
Shida Kartli	52.6	7.8	43.5	25.2	44.1
Kvemo Kartli	2	0.9	2.8	2	1.2
Samtskhe-Javakheti	14.3	1.1	6.5	1.6	4.2
Other regions	7.8	4.6	7	7.9	10.6
Production of pear by regions (thou t)					
Georgia	11.1	13.7	17.6	16.1	17
Of which:					
Adjara	0.9	1	1	2.1	1.8

Imereti	1.4	3.1	2.1	2.8	2.4
Samegrelo-Zemo Svaneti	2.5	6.1	4.4	6	6.2
Guria	0.9	1.7	1.7	2.4	2.5
Shida Kartli	2.1	0.3	5.1	0.6	0.8
Other regions	3.301.5	6.6	3.3	2.2	3.5
Production of plum by regions (thou t)					
Georgia	6.3	6.7	7.2	10.7	8.7
Of which:					
Imereti	0.3	0.8	0.4	0.5	1
Shida Kartli	2.7	2.1	2.3	51	3.2
Mtskheta-Mtianeti	1	0.4	1.6	0.9	0.6
Kakheti	0.3	0.2	0.7	0.5	0.7
Kvemo Kartli	0.4	0.3	0.4	0.8	0.6
Samtskhe-Javakheti	1.2	2	1.3	2.4	1.5
Other regions	0.4	0.9	0.5	0.6	1
Production of cherry by regions (thou t)					
Georgia	17.6	6.9	19.1	7.1	23.7
Of which:					
Imereti	0.3	0.2	0.3	0.3	0.4
Samegrelo-Zemo Svaneti	0.2	0.3	0.2	0.4	0.5
Shida Kartli	4.8	0	4.4	1.1	4.9
Kakheti	11.9	5.3	13.7	4.2	16.7
Kvemo Kartli	0.1	0.1	0.2	0.4	0.1
Other regions	0.3	0.3	0.3	0.6	1.1
Production of walnuts by regions (thou t)					
Georgia	8.2	6.1	5.7	4.8	10.8
Of which:					
Adjara	0.4	0.5	0.7	0.6	1.4
Imereti	2.1	1.6	1.3	0.9	2.2
Samegrelo-Zemo Svaneti	0.3	0.5	0.2	0.4	0.4
Racha-Lechkhumi Kvemo Svaneti	0.8	1.2	0.5	0.3	1
Shida Kartli	1.1	0.7	1	0.7	1.5
Mtskheta-Mtianeti	1	0.3	0.3	0.3	0.9
Kakheti	1	0.7	0.5	0.8	1.5
Kvemo Kartli	0.3	0.3	0.5	0.2	0.5
Other regions	1.2	0.3	0.7	0.6	1.4
Production of grapes by regions (thou t)					
Georgia	150.1	120.7	159.6	144	222.8
Of which:					
Imereti	30.3	25	26.3	36.2	36.6
Shida Kartli	16.4	8.6	10.2	13.6	18.7
Kakheti	82.7	64.7	98.1	70.8	129.5
Other regions	20.7	22.4	25	23.3	38.1

Source: National Statistics Office of Georgia

In Ali community, Khashuri municipality, grapes are cultivated. The main varieties are: Pino, Goruli Mtsvane, Chinuri Tavkveri, Aligote. Agricultural land in Khashuri municipality accounts for 20.3 thousand hectares, including 10.9 thousand ha of tillage plots. Distribution by crop variety is as follows: wheat 41%, barley 4%, vegetables (corn, beans) 54%. 2,800 ha is irrigated land, however due to high water fee only 20% of these plots are used. Products are sold by sub purchaser at the farmers markets in the region (Khashuri, Gori) and in Tbilisi.

Access to technical facilities and machinery is limited. In regional centres microfinance organisations are available.

The majority of arable land is private. Land registration process finished in 2002, when relevant certificates were handed over to the owners. Pastures were no privatized and are under common ownership. Besides, farmers were allowed to lease or buy land from the state. Annual rental fee per hectare of pasture and arable land has been set as 15 GEL and 77 GEL respectively.

Land reform started in 1991, later on in 1992 resolution allowing privatization of land was enacted. In 1996 the Parliament of Georgia passed the law on the proprietary rights on agricultural land. Each household, permanent resident of the rural area, was allowed to privatise 1.25ha plot, while the quota for employees was set as 0.75ha. However, in some villages, because of the shortage of land, households received smaller plots (around 0.7ha). Information on registered plots can be obtained from the offices of the national agency of the state register.

6.3.4. SURAMI COMMUNITY. [2]

The closest to the project area is Surami community of Khashuri municipality. It includes Surami borough and five villages: Urtkhva, Bijnisi, Zekota, Didi Bekami and Patara Bekami. Population in Surami borough is 11132, 59% and women, 41% - men. Majority are Georgians (68%). Density of population in community is not uniform, majority (86.9%) lives in Surami. Labour force (working population) is 6050, of them 8% are unemployed. 80.2% of population is employed in agriculture.

Table 6.14. Households and residents by settlements (2014 data)

Settlement (Surami community)	Households, qty (units)	% households	Qty of residents (persons)	% of residents
Surami borough	2739	876	9656	86.7
Urtkva	56	18	250	2.2
Bijnisi	91	2.9	356	3.2
Zekota	68	2.2	266	2.4
Didi Bekami	76	2.4	209	1.9
Patara Bekami	95	3	395	3.5
Total	3125	100	11132	100

The main source of income of the rural residents in Surami community is related to agriculture (51%), businesses account for about 30%. Around 16.7% of residents' income is from pensions and social assistance payments. In the towns, wage labour and business (about 70%) dominate with pensions/social assistance at the level of 15%. About 62% seasonally rents accommodation (family hotels). Various shops (food, hardware) are operating. Along the road there are bakeries, cafes and several restaurants.

Table 6.15. Distribution of employment by sectors in Surami community

Sector	Total employed	% share
Agriculture (production)	4500	80,2

[2] Source: AYEG - Association of young Economists of Georgia

Agriculture (processing)	_	_
Forestry	_	_
Mining	_	_
Public service	196	3,5
Education	106	1,9
Health care and social	28	0,5
Rent, food and drink	_	_
Building materials	50	0,9
Transport +communication	250	4,5
Trade	400	7,1
Total	**5612**	**100**

Of active population 90% is self-employed, other 10% is engaged in trade (shop, fuelling station, pharmacy); education (school, pre-school); healthcare; administration; fish farming; inert material production; sugar production (vil.Agara); reinforced concrete production (Gori); mill (Ali, Nabakhtevi); restaurants. Employment in road construction, Hipp Georgia (Agara) and BTC (Didi Plevi) is worth to mention. Average monthly income varied from 100 GEL to around 800-1000 GEL.

Total area of Surami community equates 3151 half them 61.4% are arable lands (1935 ha).

Table 6.16. Land plots in Surami municipality

Type	**Private ha)**	**State (ha)**	**Total, ha**
Pasture	51	866	917
Arable land, not watered	978	-	978
Arable land, watered	40	-	40
Land distribution		**Households**	**% of total**
Household without ownership of the land		1730	55.4
<1ha:		1203	38.5
1–5 ha		188	6.0
5–10 ha		3	0.1
>10 ha		1	0.03

Main activity of local farmers is fruit and vegetable growing. Total area used for orchards is 100ha, 144ha – is used for grape growing. 50% of fruit and grapes harvest is sold at the market, for perennial crops (corn, barley, oats, beans, wheat) this percentage varies between 60% and 80%.

Table 6.17. Annual and perennial crops cultivated in Surami community

Main crops	**Ha**	**Yield per ha (kg)**	**Cultivation time (month)**	**Total yield (kg)**	**% for sale**
Annual crops					
Fruits (cherry, plum)	880	12 000	8	10 560 000	95%
Vineyard (grapes)	445	6 000	8	2 670 000	90%
Perennial crops					
Corm	200	5 000	6-7	1 000 000	60%
Beans	200	1 000	5	200 000	70%
Barley	100	1800	6	180 000	80%
Oats	100	1 500	6	150 000	80%
Wheat	150	2 000	6	300 000	80%

Cattle-breeding is well developed. 95% of population is involved in stock-raising. Main varieties of cattle are cow, buffalo, pig, sheep. Dairy products, including cheese,

matsoni and meat, are produced for sale and own use. Poultry farming is general practice. Poultry (chicken, turkey) is available in all households. Honey production is limited.

Table 6.18. Cattle and poultry production in the Surami community

Type	Qty	Annual production (l, kg, unit)	Qty of months	Total production (l, kg, unit)	% for sale
Dairy cattle	750	127 500	9	1 147 500	35
Cattle	128	1280	10	12 800	50
Pig	82	902	9	8 000	10
Poultry	4227	_	_	_	10
Sheep	165	275	12	3 300	30
Goat	45	75	12	900	10

6.3.5. HEATH SERVICES

Public health services in the region are provided by hospitals, dispensaries, ambulances. Along with the public health establishments, private medical hospitals and clinics also exist. Hospitals are located in municipal centres Kareli and Khashuri. There is a military hospital in Gori. Medical services in the project region include: Khashuri Administrative District Hospital; Polyclinic of Khashuri Station; Khashuri Children's Polyclinic; Khashuri Ambulance Station & Polyclinic; Sanitary Supervision Service; Khashuri Public Health Centre; Khashuri Maternity Hospital; Khashuri Women's Consultation Centre; Surami Polyclinic; Tezeri Ambulance Station; Surami Psychiatric Hospital ; Kvishkheti Ambulance Station; Surami Trauma Clinic; Khashuri Clinic for Venereal Diseases; Khashuri Ambulance Service

Table 6.19. Healthcare (2013 data)

	Georgia	Shida Kartli
Number of doctors, thou*	22.5	0.8
Middle level medical staff, thou	15.5	0.7
Number of hospitals, units	237	10
Number of beds, thou	11.6	0.4
Number of dispensaries, unit	1990	143
Number of call ins (including prophylaxis)	10974.5	635.6

Source: Ministry of Labour, Health and Social affairs

6.3.6. EDUCATION

In Khashuri municipality there are 34 schools (including 9 in Khashuri, 4 in Surami) and 12 kindergartens. Schools are available in most of the villages -Sative, Kvishkheti, Kemperi, Kindzati, Khtsisi, Tkotsa, Vaka, Osiauri, Nabakhtevi, Brolosani, Tsagveri, Tskhtamukha, Bekami, Gomi, Tsromi, Tezeri, Odzisi and Ali . There are three music schools are in Khasuri.

Table 6.20. Number of schools and students in the region (2014 data)

	Number of schools, units		Number of students, units	
	2012/13	2013/14	2012/13	2013/14
Georgia	**2320**	**2328**	**559415**	**553016**
Shida Kartli	**172**	**172**	**38906**	**38095**
Municipalities				
Gori	72	72	18672	18439
Kaspi	30	30	5676	5510

Kareli	36	36	6046	5900
Khashuri	34	34	8512	8246

Source: National Statistics Office of Georgia

Average number of students in schools and kindergartens is 100-150 and 22-25 respectively. The number of teachers is 1200.

Some of the schools in the region were rehabilitated within the framework of school aid projects. Some still require renovation and upgrading of technical base. Sanitary facilities and sport grounds were built.

Table 6.21. Number of public and private higher education establishments by regions (2014 data)

	State, units		Private, units	
	2012/13	**2013/14**	**2012/13**	**2013/14**
Georgia	19	19	38	47
Tbilisi	8	8	28	34
Abkhazeti	1	1	-	-
Adjara	3	3	3	3
Guria	-	-	-	-
Imereti	2	2	1	2
Kakheti	1	1	1	2
Mtskheta –Mtianeti	-	-	1	1
Racha-Lechkhumi Kvemo Svaneti	-	-	-	1
Samegrelo Zemo Svaneti	1	1	1	1
Samtskhe-Javakheti	1	1	-	-
Kvemo Kartli	-	-	2	2
Shida Kartli	2	2	1	1

Source: National Statistics Office of Georgia

6.3.7. MIGRATION

Statistical data on migration from the region are not available. Migration includes economical migration to other regions/towns and abroad, migration of youth for education. Main destinations for migrants are Turkey, Greece, Spain, etc. Some seasonal migration is also observed.

6.3.8. GENDER ISSUES

In the study area, female earnings are approximately 50% lower than male. Households are headed predominantly by males. On the other hand, in general in the region the number of female household heads is higher (16%) in towns than in villages (11.5%). Women are mainly employed in shops, education establishments, and administration offices. Share of women in agriculture is also high.

6.3.9. INFRASTRUCTURE

There is 1 theatre, 3 museums, 25 libraries in Khashuri municipality. Sport grounds are available in Otarasheni, Kvenatkotsa, Ruisi, Didi Plevi and Tkotsi. No clubs/community centres and libraries are available. In regional centres banks and microfinance institutions operate. Water supply is mostly centralised. The system includes boreholes, storage tanks and distribution system delivering water to the users. Disadvantage of the system is the need in pumping. This makes service rather expensive and unaffordable. Water supply is restricted. River water is used for irrigation. Irrigation infrastructure consists of over-ground concrete water conduits.

Most of the sections are damaged. The network was partly repaired in Breti and Mokhisi. Sewerage system in villages is not available.

Villages are connected to the national energy distribution grid. Individually, in some districts cumulative meters are installed. High voltage electricity transmission line runs following the EWH alignment along the left bank of the Mtkvari River. Gasification of the region is almost finished. Centralized gas supply is already provided to most of the villages in the area (Ruisi, Saglasheni, Aradeti, Kvenatkotsa, Vakha, Otarasheni, Tedotminda, etc) individual gas meters installed. In those villages where gas supply is not available firewood is used for cooking and heating. In villages waste collection service is not available. There is no waste collection except for regional centres. The nearest landfills are in Agara and Khashuri.

The main roads in Gori, Khashuri and Kareli are in proper state of maintenance. Regular seasonal rehabilitation after snow or heavy showers is required. The quality of internal roads in Aradeti, Sagolasheni, Kindzati, Mtskhetisjvari, Didi Plevi, Akhaldaba, Tedotsminda, Otarasheni is poor. Roads to pastures are in particularly bad state of maintenance. These roads are completely destroyed in winter and rehabilitated by local communities after the snowmelt.

Railway line with stations in Khashuri, Kareli and Gori, connecting east and west Georgia runs through the region. The line runs west from Gori on the south bank of the Mtkvari and then crosses to the north bank between Kareli and Agara. It crosses below the EWH immediately west of Agara and then proceeds to follow closely the alignment of the EWH (just to the north) until Khashuri. The nearest airports are in Kutaisi and Tbilisi. Communication and information sources accessible in the area are the nationwide TV broadcasting channels and local TV companies Dia (coverage - Khashuri municipality), Trialeti (coverage – Shida Kartli region). Satellite antennas are widely available and not too expensive. Along with these sources of information radio channels are offered. Printed media is accessible. The region is within the coverage area of the mobile operator companies Magti, Geosell, Beeline.

6.3.10. VULNERABLE GROUPS

(individuals below poverty level, women (widows, single mothers) led families, IDP). In 2014, there are about 8825 individuals below poverty line in the region.

Table 6.22. Registered households below the poverty line and those receiving financial aid (By the end of the year, units)

	Registered households	Households receiving financial aid	Registered households	Households receiving financial aid
	2012		2013	
Georgia	**525137**	**163183**	**524482**	**150607**
Tbilisi	93460	26002	95985	26651
Abkhazeti	191	95	60	-
Adjara	42834	9137	43790	7872
Guria	22699	6372	22490	5231
Imereti	99309	35578	97172	31000
Kakheti	60138	21775	59534	20450
Mtskheta-Mtianeti	17467	7627	18210	7058
Racha-Lechkhumi, Kvemo Svaneti	12288	7227	11983	6736
Samegrelo-Zemo Svaneti	57493	14473	57290	13573

Samtskhe-Javakheti	24230	3829	23834	3447
Kvemo Kartli	45859	9841	46030	8825
Shida Kartli	49169	21227	48104	19764

Note: Upper Abkhazeti not included

IDP and community oriented projects in the area. The region was affected by military actions in August 2008. Total number of IDPs following this event is 9,800. Since then various projects have been implemented in the region in order to elevate economic and social situation in the area. Most of the projects focus on IDP. Most of the projects have and are implemented with international financial assistance. Projects in the region have been implemented by CARE with the aid of ECHO, British Embassy Tbilisi through the UK Conflict Prevention Pool (GCPP), The Food and Agriculture Organization of the United Nation (FAO), USAID, the United Nations High Commissioner for Refugees (UNHCR), Embassy of the Federal Republic of Germany in Georgia, and others.

6.3.11. RESORTS.

Shida Kartli is famous for its resorts such as Biisi; Gorijvari; Bazaleti Lake and Tkemlovani. None of the resorts are in the project impact area.

6.3.12. HISTORICAL AND ARCHAEOLOGICAL SITES

Shida Kartli is known for its rich architectural heritage. In total around 180 monuments of different historic periods is registered. Some of them are listed below: Khashuri castle (XVIII); Surami tower (XVI-XVII) ; Surami castle (XII-XIII); St Marine church (XVI-XVII); Dedaghvtisa ; Kviratskhoveli church in Surami (1998); St.George Church in Surami (XVIII-XIX); Kviratskhoveli church in Ali (XIX); St Mary church in Ulumbo (now monastery).

Shida Kartli is notable for archaeological sites. Research implemented in the region revealed the presence of a considerable number of Late Chalcolithic and Early Bronze Age settlements in the alluvial plain of the Mtkvari River and on the surrounding hills. Archaeological sites are generally located on high fluvial terraces or low natural hills in the flat alluvial plain formed by the braided river Mtkvari and its tributaries, with the exception of the Khashuri district, where some of them are situated in the neighbouring hilly zone.

There is an opinion that during the last few thousand years the river basin has been under degradation rather than aggradation conditions, and therefore, except for very specific local conditions, ancient sites are rather unlikely to have been buried under thick deposit layers, and were more likely subjected to a certain amount of surface erosion.

7. EXPECTED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1. INTRODUCTION

Environmental impacts of the proposed Zemo Osiauri –Chumateleti section's upgrading show in three stages: pre-construction, construction and operation.

On **pre-construction** phase all clearance and permits related to the project will be obtained, a range of plans (such as waste management, traffic management, erosion management) will be developed and agreed, sources /suppliers of materials identified, sites for temporary camps, material, topsoil, spoil and waste selected with consideration of environmental and safety requirements. On pre-construction phase impact on environment is not expected.

Impacts during construction and operation of the highway are described in the sections given below.

7.2. IMPACT ON WATER RESOURCES

7.2.1. WATER IMPACT ASSESSMENT: ROAD CONSTRUCTION

The causes of potential pollution of surface water can be accidental fuel/oil spills from machinery/vehicles (including emergency situations), poorly managed liquid/ solid waste and construction materials, contaminated runoff, siltation of surface water during excavation/earthworks, and waste pollution during arrangement of river/stream crossings.

Percolation of contaminated runoff, infiltration of polluted surface water, impact on ground water aquifer during excavation, and/or leakage of fuel during construction are generally assumed to be potential causes of ground water pollution. According to the engineering geological survey, the ground water level in the project area varies from 1 to 6.5m. Thus, the risk of impact on shallow aquifers which are more vulnerable exists. The impact probability in the bridge construction areas, where extensive excavation compared to that during the road construction works is needed, is higher.

Pollution of water may be observed during construction works near the Suramula river and Shukghele stream. During construction works, qualitative parameters of these surface water bodies may be affected by accidentally spilled fuel/oil orcontaminated surface runoff. Increase of turbidity caused by the lack of erosion control, and pollution with poorly managed solid construction waste may also occur.

Discharge of waste water/sewage into the river is not planned.

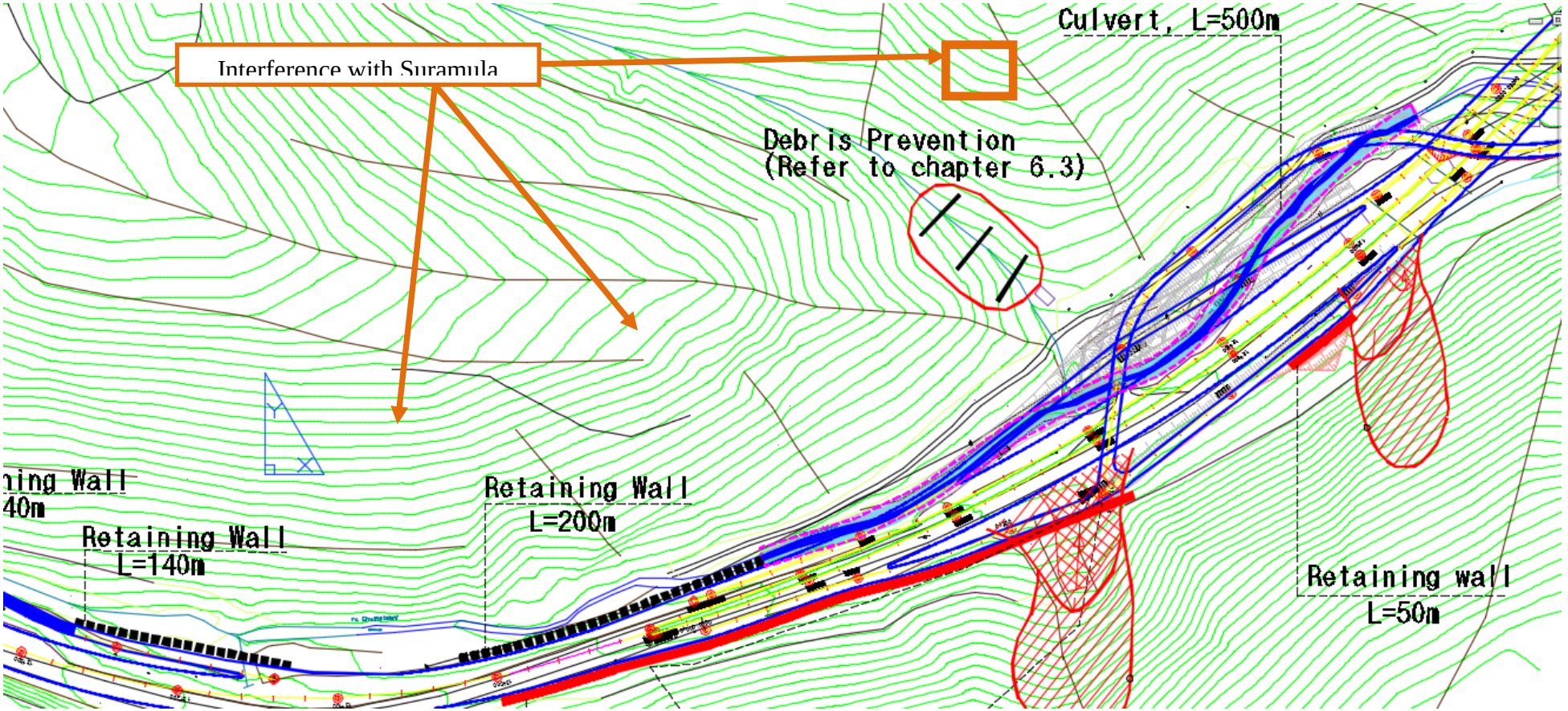


Figure 7.1. The section of potential impact on surface water (km 12+275-km 13+020)

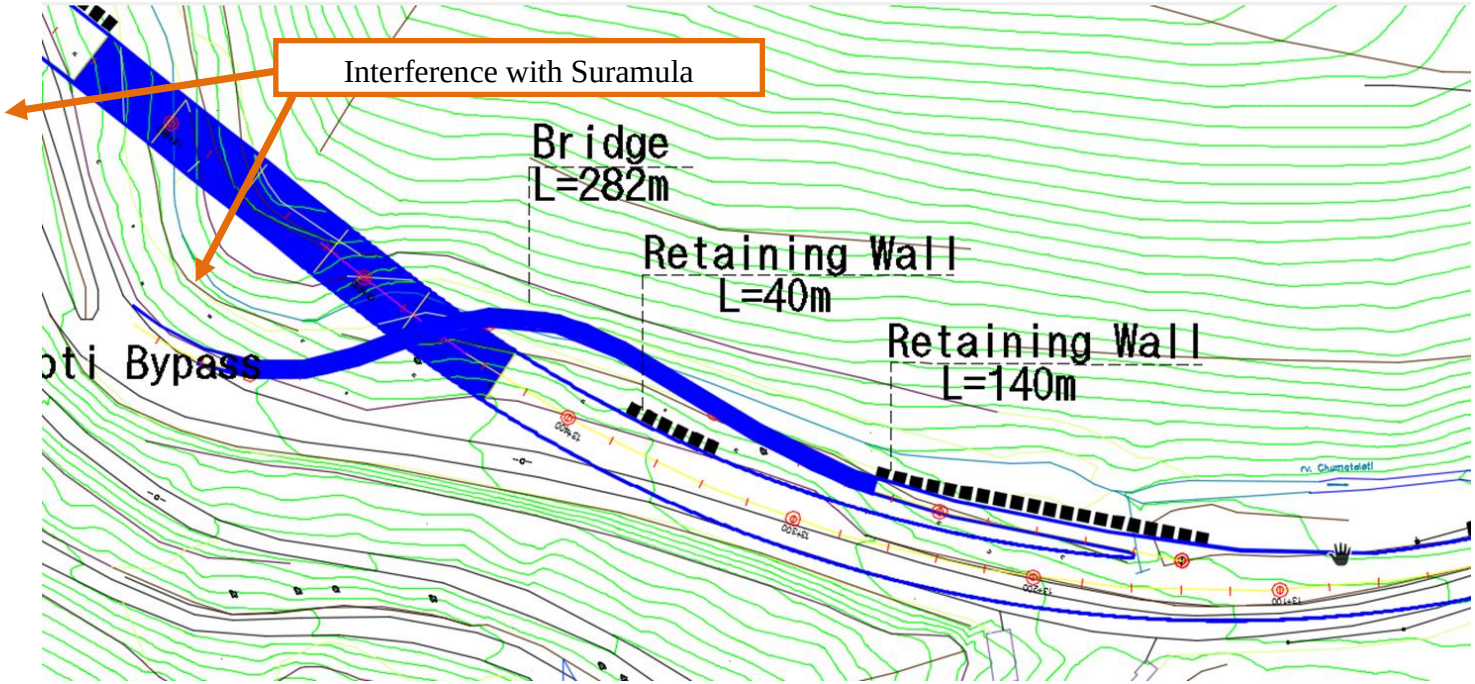


Figure 7.2. The section of potential impact on surface water (km 13+130-km 13+660)

In order to avoid or mitigate impact, construction works should be performed with due consideration of environmental safety measures:

- Should any temporary fuel tank be available, it must be located within at least 100m from the riverbed. The tank must be placed in covered areas with berms or dikes installed to intercept spills, if any. Any spill should be immediately intercepted and cleaned up with absorbent materials
- Onsite repairs /maintenance and fuelling activities should be limited. Priority should be given to offsite commercial facilities. If impossible, a designated area and/or a secondary containment for possible spills for on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels surface water bodies. (distance between the maintenance site and the river should be at least 100m).
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site.
- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing oils from vehicles or equipment. For small spills, absorbent materials must be used.
- Tyre washing unit, if any, must be equipped with drainage a settling facilities. The washout pit must be cleaned immediately upon 75 % filling.
- Usage of off-site vehicle wash racks or commercial washing facilities is preferable. If on-site cleaning is required, bermed wash areas for cleaning activities must be established. The wash area may be sloped to facilitate collection of wash water and evaporative drying.
- Discharge of any untreated water into the surface water body must be strictly prohibited.
- Discharge of cement contaminated water must be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life.
- Materials and waste must be stockpiled so as to avoid erosion and washing off into the river. Drainage trenches must be established to divert surface runoff from the site.
- Waste collection area must be sited so to avoid substantial amount of runoff from upland areas.
- Runoff control measures can be installed at the time of road, highway and bridge construction to reduce runoff pollution.
- To prevent runoff contamination, paving should be performed only in dry weather.
- Occurrence of soil and other pollutants in storm drains or watercourses (streams, rivers etc.) from storm water runoff should be prevented.
- In disturbed soil areas silt fence, fibber rolls, gravel bags, or other approved sediment control must be ensured. At a minimum, all bare soil (whether it's an abutment slope or a stockpile) must be protected before it rains. Soil stabilization BMPs such as mulch, soil binders, plastic sheeting or erosion control blankets must be used to protect bare soil.

Responsibility for mitigation measures rests with the contractor.
Likelihood of impacts on water during construction will be hight to medium. The impact will be temporary and reversible. Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low to negligible.

7.2.2. WATER IMPACT ASSESSMENT: ROAD OPERATION

Surface and ground water pollution from the operation of highway may occur from regular operational and maintenance as well as from traffic accidents involving cargo vehicles transporting hazardous substances. The risk of accidents will be broundt to the possible minimum by application of road safety measures. The World Bank-financed program of assistance to RD delivered though several ongoing porjects includes technical assistance with the implementation of Road Safeaty Action Plan 2016-2021, which will enhance safety of operation of the newly reconstructed sections of EWH as well. Furthermore, the selected design alternative puts sections of the EHW crossing the most difficult areas of terrain through tunnels, which also descreases likelihood of accidents as well as likelihood of environmental pollution in case of accedents, because tunnels will be equipped with adequate systems of spillage containment and drainage treatment.

Pollution from road maintenance works is possible in case of careless handling of construction materials and wastes and failure to adhere to good construction practice. To deal with this impact, most mitigation measures suggested for the construction phase shall be apply to maintenance works. Proper planning of rehabilitation works in the sections close/in the riverbed can be an effective measure for protection of the water environment during maintenance works. In addition to that, to reduce impact on the water environment while maintenance

- paving should be performed only in dry weather to prevent runoff contamination;
- proper staging techniques should be used to reduce the spread of paving materials during the repair of potholes and worn pavement. These may 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.

Finally, pollution of surface and ground water may occur from regular operation of the highway through direct release of dranage carrying heavy metals, oil products and garbage from the road surface. Road design was developed, and may be further adjusted, to minimize rapid direct discharge of draned water into rivers and streams. In a longer term perspective, as the country progresses in the implementation of recommendation for EU approximation, regulations of the age and technical condition of vehicles will considerably steefen and control over the quality of fuel will enhace, leading to the decrease of EWH from the movement of vehicles.

Likelihood of impacts on water during operation will be medium. Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

7.3. WASTE MANAGEMENT

7.3.1. WASTE: ROAD CONSTRUCTION

Waste streams generated during the construction include inert and hazardous waste.

Inert waste (earth, soil, spoil from tunnelling) do not decompose or produce leachate or other products harmful to the environment. Recyclable materials include but are not limited to cardboard, concrete aggregate, excavated rock, soil (uncontaminated), green waste, wood/lumber, scrap metal.

To prevent the impact of the waste generated during the construction on the environment it must be collected and temporarily stored in the selected area with consideration of the requirements listed below. The inert waste must be placed so as not to interfere with free movement of machinery and staff, away from surface water (within at least 100m). The waste must be source-separated in order to ensure proper management and enable reuse. Until removal from the site, domestic waste (food waste, plastic bottles, packaging) must be collected in containers with fitted lid to avoid attraction of scavengers, emanation of odour and scattering by wind. The lids also protect waste from rain and snow.

Assuming that the quantity of domestic waste generated per capita per year totals 0.7m^3 , the approximate total amount of the above-mentioned waste produced during the construction will equate 200x0.7=140 m^3/year.

In Georgia municipalities are responsible for the collection and transportation of household waste. However, regular waste collection service is only available in some of the central settlements. The household waste generated during the construction will be collected and delivered to the nearest landfill (Khashuri) under the contract with the Solid Waste Management Company of Georgia.

Hazardous waste generated during the construction will include:

- Used tires: 60-70 unit / year;
- Oil filters of construction equipment, vehicles and other machinery: 20-25 unit /year;
- Out-dated and damaged accumulators: 12-15 unit/year;
- Waste fuel, lubricants: 120-150 kg /year;
- Welding electrodes: 50-60 kg /year;
- Amount of soil contaminated with accidentally spilled oil will depend on the scale of the spill.

Since Georgia has no infrastructure for the final disposal of hazardous waste, such waste generated during works on the EHW will be handed over to licensed companies for treatment (deactivation, incineration) or re-use in other technological processes. The area allocated for temporary storage of hazardous waste shall have special preventive measures implemented, in particular, containers shall have secondary containment and no mixing of hazardous waste with any other waste shall be allowed. Hazardous waste containers shall be

checked for tightness. The staff involved in hazardous waste management shall be trained in waste management and safety issues. The waste shall be removed every 3 days. Treatment, utilisation, disposal of waste shall be carried out by an authorised contractor.

Soil polluted with petroleum hydrocarbons because of accidental small scale fuel/oil spills (leakages) can be remediated onsite (e.g. in situ bioremediation). Larger spills (less likely to be the case from experience with other similar projects) must be localized, contaminated soil removed by authorized contractor for remediation. New, clean soil must be introduced, followed by recultivation. It is recommended to involve an authorised company for this service.

Any waste materials that may be used for the project must be reused on the site, residues should be disposed at the nearest landfill, given away for recycling or reused elsewhere for the needs of the region, as the case may be, under agreement the municipal authorities .

Management of wood is to follow procedure described herewith. When forest resources are affected, management of timber is regulated by Law on the State property. According to the latter and the Forestry Code of the Georgia, wood/timber must be stored in the area indicated by the forestry authority and disposed according to the rules set in governmental regulations on approval of the rules for forest use (#242, 20 August, 2010). Upon decision of the forestry authorities[3], finally, the wood/timber may be handed over to the municipality based on acceptance-submission certificate and subsequently and, by decision of the municipal authority, distributed to the residents.

Surplus soil disposal site must be selected with consideration of the national environmental regulations. Topsoil management must comply with requirements set in the Government regulations (#424, dated 31 December, 2013) on topsoil removal, storage, use and recultivation. Good management practice experience must be also taken into account (see Annex3).

Excavated subsoil pile must have a natural angle of slope of up to 40° depending on texture and moisture content but, if stable stockpiles are to be formed, slope angles will normally need to be smaller. For stockpiles that are to be grass seeded and maintained, a maximum side slope of 1 in 2 (25°) is appropriate.

If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion and to help reduce infestation by nuisance weeds that might spread seed onto adjacent land. Sites of temporary storage of excess material will be agreed with the local municipalities.

[3] National Forestry Agency

Site for permanent disposal of tunnelling spoil and other excess material will be selected by local municipalities and agreed with MENRP. Reuse of spoil material for the needs of construction is planned. Potential users of soil/spoil material will be identified to reduce the amount of permanent storage. Permanent disposal site management and recultivation plan must be developed whether appropriate.

Excavated soil can be used on site and/or for grading of disturbed areas after completion of construction works. Exact balance will be calculated as a part of the detailed design. According to preliminary estimate material can be fully utilized.

Contractor will be obliges to provide waste management plan.

Impact of waste generation on environment during construction can be mitigated by proper storage, maximum reuse and timely removal of unusable waste to agreed location. The closest to the site municipal landfill is in Khashuri. To dispose general waste there, agreement with the Solid Waste Management Company of Georgia must be made.

7.3.2. WASTE: ROAD OPERATION

During operation of the highway, roadside litter may accumulate (unfortunate practice). It is predominantly food waste, plastic and paper that people fly tip. The roadside litter is extremely unsightly. Uncollected litter may attract vermin. It can impact animals that may get trapped or poisoned with litter in their habitats. Cigarette butts and filters threaten wildlife, as fish and birds often mistake this waste for food. Litter may end up in rivers and canals, and the last but not the least, the litter is also a road hazard that may occasionally contribute to accidents.

A fine for littering has been introduced in Georgia. However the littering along the highway is rather difficult to manage. One way of its reduction is education. It is necessary to:

- ensure that the community is aware of the range of ways to dispose of their waste correctly;
- educate the community that littering is illegal, fines apply and behaviours are monitored , inform the community of the level of fines that littering incurs .
- The signs may be suitable for placement in a series of two to four signs at 10 km intervals to repeat the message in different ways.

Management of waste during operation will be responsibility of the contractor identified by the Roads Department.

7.4. IMPACT ON AIR QUALITY

7.4.1. AIR POLLUTION IMPACT ASSESSMENT: ROAD CONSTRUCTION

The major air quality issue during road construction is the production of dust during earthworks, storage and transportation of soil or other fine-grained materials (cement, sand,), and vehicles moving across unpaved or dusty surfaces. Dust is also emitted during the production of concrete, especially if good production practice for dust emissions mitigation is not followed. It is very difficult

to accurately quantify dust emissions arising from construction activities. It is thus not possible to easily predict changes to dust soiling rates or PM_{10} concentrations. Therefore it is necessary to determine the likelihood of a significant impact which should be combined with an assessment of the proposed mitigation measures, such as the following:

- *Spray all unpaved roads and significant areas of uncovered soil with water every four hours on working days, during dry and windy weather;*
- *Provide a wheel-washing facility and ensure that it is used by all vehicles before leaving all sites;*
- *Cover all loose material with tarpaulins when transported off-site on trucks;*
- *Keep at least 300 m distance from residences windward to reinforced concrete production plants.*

Air quality during road construction is reduced by emissions from construction machinery and heavy goods vehicles used for materials transportation, though it is strongly recommended to ensure appropriate technical service for the traffic fleet used in road construction.

Likelihood of impacts on air quality during construction will be high. Under condition that mitigation measures are implemented the magnitude of residual impact will be low to negligible.

7.4.2. AIR POLLUTION IMPACT ASSESSMENT: ROAD OPERATION

Amounts of vehicle-emitted pollutants mainly depend on the technical condition of the vehicles, fuel quality and speed. Older vehicles usually have lower fuel consumption efficiency and cause higher emissions of combustion by-products. Increasing speed of the vehicle demands higher fuel supply and therefore results in larger amounts of emitted pollutants

After upgrading the Zemo Osiauri – Chumateleti section of EWH the speed limit will be set to 100 km/h in hilly terrain and 80 km/h in mountainous terrain (*speed limits correspond to the Georgian Design Standard for roads of international importance with daily traffic of more than 8 000 vehicles*).. The improved road capacity will result in an increased number of vehicles passing the route and in higher emission levels.

Dispersion of main pollutants emitted by traffic (CO, NO_2, and PM) was modelled aiming on evaluation and comparison of traffic induced air pollution along the Zemo Osiauri – Chumateleti road section. (Traffic emissions mostly depend on speed, vehicles technical condition and percentage of Heavy Goods Vehicles (HGV) in the traffic flow.)

The new alignment runs north from Khashuri mainly through the rural landscapes therefore background concentrations of pollutants are assumed to be zero and are not included in dispersion modelling (Source: “Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held“).

Modelling results revealed that concentrations of CO, NO_2 and PM would not exceed the MAC and would be negligibly low as compared with MAC. Modelling results are given in Table 7.1. Pollutant concentrations were evaluated at a distance of 5 and 50 m from road boundaries.

Table 7.1. Modelled pollutant concentrations*

		Modelled concentrations (30 min onetime maximum)					
		CO, mg/m³		**NO_2, µg/m³**		**PM_{10}, µg/m³**	
		Distance from road		Distance from road		Distance from r	
		5 m	50 m	5 m	50 m	5 m	50
(km 142)	5.5 – 6.6	1.6 – 2.1	10 – 15	4 – 6	3.0 – 5.0	0	
	100 km/h	3.5 – 4.5	0.8 – 1	8 – 10	2 – 3	1.0	0

Results of modelling enable to conclude that no specific air pollution mitigation measures are recommended for Zemo Osiauri – Chumateleti road section; however it is advised to keep proper planning of greenery near settled areas.

Likelihood of impacts on air quality during operation will be high. Magnitude of residual impact, according to the modelling, will be low.

7.5. IMPACT ON THE NOISE LEVELS

7.5.1. NOISE AND VIBRATION IMPACT ASSESSMENT: ROAD CONSTRUCTION

Road construction will introduce additional noise sources to the local area. Road construction noise is caused by construction equipment and operations, i. e., there are two main sources of noise during the construction: noise resulting from road upgrading works, and noise from additional activities, such as transport of materials by HGV along the route. The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling. Only in a few cases noise generated by the process dominates (for example, impact pile driving, pavement breaking,). Noise levels during the construction will vary depending on the construction activity and schedule. Noise levels induced by the main road construction equipment and operations are presented in in Table 7.3.

Table 7.3. Construction equipment noise emission levels

Equipment	Typical noise level (dBA) approximately 15 m from source
Air compressor	81
Backhoe	80
Compactor	82
Concrete mixer	85
Derrick crane	88
Bulldozer	85
Grader	85
Jack hammer	88
Paver	89
Pile-driver (impact)	101
Pile-driver (sonic)	96

Pneumatic tool	85
Truck	88

Reconstruction works will involve usage of some specific machinery (backhoe, bulldozer, trucks, heavy roller). Noise and vibrations will be inevitable from such activities as digging trenches, soil compaction, breaking of the old road pavement by hydraulic hammer and other. According to the data presented in Table 7.3, frequent exceedances of acceptable noise levels resulting from construction activities are anticipated. Increased HGV movement along the route during the construction will be low as compared to the existing traffic flows and will cause no noise-related disturbance.

The Decree # 234n (Ministry of Health and Social Welfare of Georgia, Oct. 6, 2003) defines minimum distances for various construction related activities from sanitation zones, to protect human health from the impacts of noise and vibration:

- Borrow pits (Art. 32) > 100 m;
- Asphalt plants (Art. 34) > 500 m;
- Reinforced concrete production (art. 35) > 300 m;

Noise limits for various working environments are estimated in General EHS Guidelines "Occupational health and safety" (issued by International Finance Corporation, 2007) which is the main document to rely on for noise and vibration issues. For heavy industry (with no demand for oral communication) limit equivalent noise level is set to 85 dBA; maximum – 110 dBA.

Noise impact assessment was performed identifying sensitive receptors (settlements, dwellings) within minimum distances from realignment boundaries as indicated in the Georgian standards for various construction related activities as it is described above. It is expected to have adverse noise impacts during road construction, but they are not considered to be of high importance. Settlement patterns along the road section from Zemo Osiauri to Chumateleti in case of any chosen alternative imply that only few people would be exposed to elevated noise levels during the road construction (most likely the ones working in the fields near the construction sites). However, construction noise impact will be temporary and of medium significance, if environmental and safety requirements will be followed.
Vibration impacts are expected to be felt only locally near construction sites and should not have any negative impacts on residents.

In case if residential dwellings fall into the restricted zone established for asphalt plants or reinforced concrete production (300 m and 500 m respectively), to protect human health from the impacts of noise and vibration the following is recommended:

- to keep the requested distances from appropriate activities to the closest dwellings and residential areas;
- to keep restrictions on working hours on week days, weekends or public holidays, no night-time working.

People working at the construction sites will be exposed to elevated noise and vibration levels. According to the data presented in Table 7.4, most of the road construction activities will result in noise levels exceeding 85 dBA. Therefore, it is recommended:

- To enforce the use of hearing protection by using hearing protective devices capable of reducing sound levels at the ear to at least 85 dBA;
- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through the choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure (EHS Guidelines, 2007).

Likelihood of impacts on noise environment during construction will be medium to high. Under condition that mitigation measures are implemented the magnitude of residual impact will be low to medium.

7.5.2. MODELING OF LONG-TERM NOISE LEVELS: ROAD OPERATION

There are two types of noise caused by the road operation: the noise generated by vehicle engines and the noise generated by tyre-road friction. Noise levels increase with the speed. After upgrading the Zemo Osiauri – Chumateleti section of EWH-60 (in case of implementation of any of the four alternatives, the speed limit will be set to 100 km/h in hilly terrain and 80 km/h in mountainous terrain (*speed limits correspond to the Georgian Design Standard for roads of international importance with daily traffic of more than 8 000 vehicles*). .

Modelling of long-term noise dispersion targeted quantitative evaluation of increased noise levels and possible negative impacts on residents near the EWH. Noise modelling using forecasted traffic data was implemented.

In addition to the increased traffic flow and speed, noise levels are expected to be higher because of the concrete pavement which increases noise levels approximately by 3 dBA as compared with the asphalt - concrete pavement.

In the context of the road upgrading, relevant environmental quality regulations and standards mainly relate to the control of air and noise pollution, which may be of concern during both construction and operation of the upgraded road.

An increased speed after the implementation of the project would result in the exceedance of the acceptable noise levels. Anyway, the road would bypass town of Khashuri, and there would be only few residential houses falling into the zone of potential impact.. According to modelling the new alignment would not have any impact on residents along the road section. Modelling results are given in Table 7.4..

Table 7.4. Results of noise dispersion modelling

Location (km of EWH)	Approximate number of residential houses under impact*	Modelled noise levels near residential houses, dB(A)**	Acceptable noise levels are exceeded in a distance of, m (in a territory with no obstacles, excluding impact of the railway)

		Daytime 7 am - 10 pm	Night time 10 pm - 7am	Day time	Night time
9.1 km to 10.3 km of the designed road: Surami Bijnisi	 0 0-			40 – 52	32 – 78

*Number of houses under impact is calculated excluding impact of railway noise
** Noise levels exceeding acceptable ones are in bold text

It is worth pointing out that long-term prognosis for noise dispersion might be inaccurate in the way that all impact factors are difficult to foresee. For example, calculations are made using noise emission factors reflecting current traffic fleet. It is obvious that such a long-time period will bring positive changes to the economy of Georgia, resulting in higher percentage of new cars in the traffic fleet and respectively lower noise levels.

Likelihood of impacts on noise environment during operation, depending on the section of the road, will be high. Magnitude of residual impact, according to modelling, will be low.

7.6. IMPACT ON FLORA AND FAUNA

7.6.1. FLORA AND FAUNA IMPACT ASSESSMENT: ROAD CONSTRUCTION

Vegetation/Flora

General impacts of roads and other linear structures on flora include the following:

- Removal of roadside vegetation and vegetation within the RoW;
- Soil compaction, sealing of soil surface;
- Indirect impact from dust, particles; oil, fuel;
- Impact of covering riverbed on riparian vegetation.

Spoil material from road cutting can kill vegetation on disposal site and add to slope instability/erosion processes leading to additional damage of productive soil and vegetation next to disposal sites if not managed properly.

Loss of the slope stability may entail further loss of vegetation through continuous loss of soil substrate, which again may negatively affect water environment.

The project will affect farmlands and vegetation in the RoW. Within the first 10km, the highway will bypass natural forest stand where, according to available information, CITES protected species *Dactylorhiza urvilleana*, *Dactylorhiza romana subsp georgica* and *Cephalanthere damasonium* are registered. Description of impact by sections is given below.

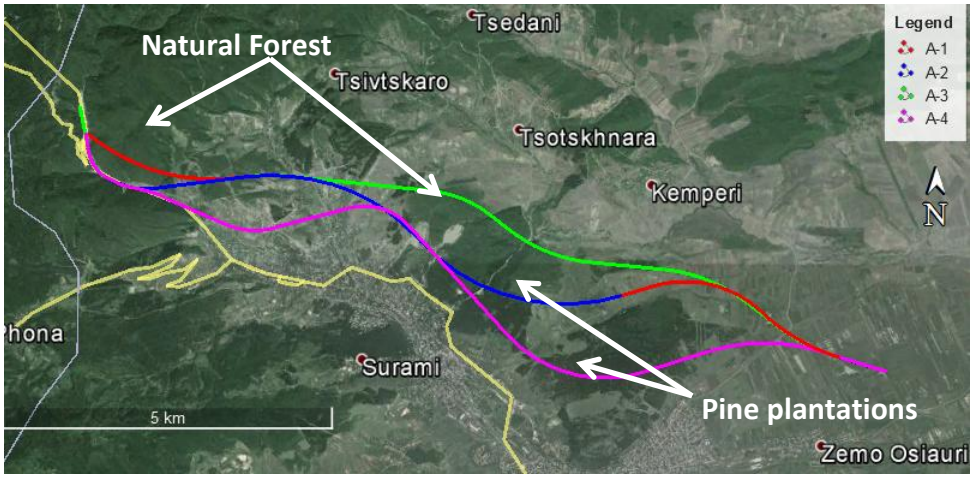


Figure 7.3. Forestry fund areas in the project area

Section 1 – from Zemo Osiauri (X-0386443 Y-4652960 H-706m) up to pine plantation area (X-0382549 Y-4653237 H-888m). The RoW area within this section of alignment will affect arable land and around 0.1 ha of thorn bushes. Because of small diameter and low species index these plants have neither commercial value nor special protection status. In the section under consideration various types of plant communities are met. From floristic perspective the area belongs to low conservation value botanical unit. On the whole, the section is ranked as medium sensitivity area. Within this section of the road 0.1ha of bushes will be removed.

Section 2. Pine plantations (start point: X-0382549 Y-4653237 H-888m; end point: X-0381831 Y-4653733 H-807m) The section crosses Caucasian pine *Pinus sosnowskyi* plantations[4]. Dimensions of affected strip will be length – 1000m, width – 32m. The undergrowth in the section of interest is represented by various cenosis, in particular shrubs like *Cotoneaster racemiflora*, *Rubus chamaemorus*, *Rosa canina.* In total in this section of the road **2596 mature pine trees (artificially planted) will be extracted.** The pine plantation under consideration may have important role in formation of the microclimate in the Saurami resort area. Nevertheless, coniferous forest plantations like that are generally ranked as medium conservation value areas.

Section 3. Oak and oriental hornbeam with secondary scrub and pine plantation. (start point X-0381831 Y-4653733 H-807 m; end point X- 0380578 Y-4654788 H-842 m; X-0379430 Y-4655370 H-811 m). In this section 180 m long and 32 m wide corridor (approximately 5760 square meters) will be affected - 410 ripening pine

[4] The coniferous forest in the RoW is ascribed to: mature stand – by age group; average stand (0.5-0.6) – by density group; 61-70% - by leaf canopy closing present; $0\text{-}5^0$ – $21\text{-}30^0$– slope inclination group. The stand is 'built of' similar age trees (planted) ascribed to A category (timber).

tree[5] will be cut. 15 young pine trees (planted) on the north-east slope will be extracted. The area along alignment, south west to the coniferous forest is used by locals as a pasture. From this section via vil Urtkva towards the hill, 5 mature oak trees (Georgian oak - *Quercus iberica*) will be cut (d=0.3-0.4m)[6]. Impact on grasses during construction will be minimum. Destruction of any species is not expected as the same plants are found in all plant communities. Population reduction risk and the level of impact will be low. The third section of the road is not valuable from floristic view. Extracted trees and shrubs are small (exception – pine plantations and oak trees). Average diameter or the trees at chest level is 3-5cm. The trees have no commercial value.

In total in the RoW of the third section of the new alignment (from X-0381831 Y-4653733 H-807m; X- 0380578 Y-4654788 H-842m; till X-0379430 Y-4655370 H-811m) the following species will be affected: 40 pine trees (G category); 410 pine trees (B category); 5 oak trees (B category); 15 pine saplings (planted) and shrubs within the 0.6ha strip.
Within the last 4.5km of the new alignment, construction of tunnels will allow to avoid interference with natural forest where protected species - Chestnut trees (*Castanea sativa*), Field Elm (*Ulmus minor*) and Wych elm (*Ulmus glabra*) are registered. Some impact on vegetation at the outlets of the tunnel will be observed.

Section 4. (start point X-03784230, Y--4656320, H--790m; end point X-0376526 Y-4655348 H-831 m) natural vegetation is represented by individual shrubs and trees. The sensitive area - forest is at higher elevation and is not affected by the project. During construction of east and west portals of the tunnel 140 Alder trees (C category); 16 Georgian oak trees (C category), 28 Caucasian hornbeam trees, 26 Oriental Hornbeam trees (C category) will be felt, 0.8 ha area – cleared of shrubs. In the 'ending' section construction works will affect around 45 planted pine trees (d ≥ 0,08 – 0.3 m, C category), 15 young Alder trees and shrubs (d ≤ 0,08 m) within the 0.1ha area.

Table 7.5. Summary table of impact on trees/vegetation in the new alignment

Section 1 (length 5.8km)	Shrubs at 0.1 ha area
Section 2 (length 1 km)	2596 Pine trees (Category A)
Section 3	40 Pine trees (C category); 410 Pine trees (B category); 5 Oak trees (B category); 15 Pine saplings and shrubs within the 0.6ha strip.
Section 4	140 Alder (C category); 16 Georgian oak trees (C category); 28 Caucasian hornbeam; 26 Oriental hornbeam; Shrubs within 0,8ha area; 45 Pine trees (C category); 15 young Alder

[5] The coniferous forest in the area belongs to ripening stand, medium density (0.5-0.6); leaf canopy closing present (51-60%); slope inclination (0-5^0). The stand is ascribed to B category (semi-timber).
[6] Material is ascribed to B category (semi- timber).

	trees; Shrubs within 0.1ha area
Total	3046 Pine trees, 155 A;der trees, 54 Hornbeam, 21 Oak, 1.6ha shrubs and 15 Pine saplings

Note: During construction slight increase or decrease of the abovementioned quantity may be observed.

None of affected plants is endangered or belongs to protected category.

According to the current forestry regulations, the strip of forest plantations (ascribed to the State Forest Fund) subject to removal for the needs of the project must be excluded from the State Forest Fund. Prior to commencement of works tree felling in the forest area, clearance (decision of the GoG on exclusion of the area from the state forestry fund) from National Forestr Agency must be received. Procedure includes – justification of the need and filing of application with indication of the boundaries of the area by developer, description of the site and implementation of cadastral and taxation survey by the forestry specialists, issuance of authorization based on the survey by the agency.

Tree felling in the project area is not expected to cause functional damage of ecosystem. Therefore, impact on vegetation will be mitigated by replanting of the saplings of native species at the ratio of 1:3 (planting 3 trees to compensate the loss of one) with subsequent minimum of 2 year maintenance of plantations. However first and formost, unnecessary damage and remoal of trees will be avoided to the extent possible. Access roads, the equipment/machinery stationing yard, and the camp must be established with maximum caution so as to preserve the vegetation/trees.

Compensatory tree planating will be performed within the highway corridor. When trees are planted along the highway, safety requirements must be taken into account while planting, so that the trees do not block the view, have acceptable diameter when mature while they are planted in certain locations and their canopies do not reach over the road.

Fauna

Constructin and operation of EWH in those sections which pass through transformed landscaptes and cultivated lands will not cause significant impacts on animal life, because such areas do not support important animal species due to human presence and consequest significant permanent disturbance. Steep hillsides and deep gorges provide more suitable hibitats for fauna however because of complexity of terrain, large sections of EWH are designed to pass through tunnels. Hence impacts on fauna are expected rather in the construction stage and will be considerably lesser in the operation stage. Expected impacts from the constructed works are as follows:

- Loss of shelter due to removal of vegetation;
- Soil compaction, sealing of soil surface – potential impact on worms;
- Death of animals caused by road mortality;
- Higher levels of disturbance and stress, including that related to noise;
- Barrier effect - reduced connectivity;

- Indirect impact from exhaust emissions and dust and/or accidentally spilled oil/ fuel.
- Impact of on aquatic life because increased water turbidity (riber crossings)
- Impact due to soil and/or water pollution with spilled fuel/oil, poorly managed waste.

The roads and excavated sites are considered as a barrier for some mammals (hamsters, mice, hedgehogs), reptiles and amphibians registered in the project area, both during construction and operation.

Dust deposited on the plants in the road impact zone may affects food base of the vertebrate and invertebrate species.

Noise from construction machinery and heavy traffic on construction and operation stages will have immediate impact on animal world in the area. Animals respond to noise pollution by altering activity patterns, and with an increase in heartbeat and production of stress hormones. Birds and other wildlife that communicate by auditory signals may be confused near the road construction sites. On construction stage the magnitude of noise and vibration will be in the range from detection to avoidance level. Besides, because of the presence of people on the ground animals will try to avoid the project areas anyway.

Erosion during and after construction of roads, highways and bridges can contribute sediment and silt to runoff waters, which can deteriorate water quality and lead to impact on macroinvertebrates, fish kills, siltation. Heavy metals, oils, other toxic substances and debris from construction traffic and spillage can be absorbed by soil at construction sites and carried with runoff water to the river. Keeping in mind minimum contact of selected alternative with the streams this kind of impact is ranked as low.

The following measures for impact mitigation on the flora and fauna are suggested:

- Boundaries of RoW and operation area, including traffic routes during construction must be strictly kept to avoid impact on the adjacent vegetation;
- Vegetation must be preserved as much as feasible;
- Reforestation must be implemented as indicated by forestry authorities;
- Lost vegetation must be ‘replaced’ by triple amount of the same species replanted in the area (for additional information refer to section 7.9);
- Location of the stockpiles must be selected with consideration of environmental safeguards;
- Topsoil must be removed to the temporary stockpile prior to use during recultivation;
- Special attention should be given to the avian fauna in the spring-summer (April to July). Tree cutting in the season most sensitive for birds (nesting/hatching) must be avoided;

- Construction in/near the riverbed should be avoided in the fish spawning season (June-September);
- Noise and vibration level should be reduced by means of securing proper technical maintenance of machinery/vehicles, adherence to no horn policy, strictly keeping to the stationing/operation ground during the construction and operation;
- Dust reduction measures should apply, such as covering materials, removed topsoil and waste to avoid wind erosion and spreading around; restriction of the speed of trucks delivering materials to the construction ground, covering friable material with tarpaulin during transportation, avoiding high dumping of materials during unloading. If required, the ground (machinery stationing, camp site) should be watered to avoid generation of dust;
- Boundaries of RoW and operation area, including traffic routes during the construction must be strictly kept to avoid impact on vegetation;
- Special attention should be given to environmental safety during the construction near the riverbed. Operations entailing environmental risks (fuelling, servicing of cars/machinery) should be carried out in at least 100m from the surface water body;
- Proper management of waste, including household, should be followed, waste dumping into the river or scattering around should be excluded. The site for temporary storage of waste should be selected in at least 100m from the surface water body;
- Maintenance and fuelling at commercial service facilities must be enforced.
- The fuel/oil storage, in case available, should be equipped with adequate secondary containment (impermeable cover of the area, and the containment of sufficient capacity to avoid pollution of soil/water outside the berm and/or washing it off by the runoff);
- Spills should be immediately cleaned up to avoid spreading of pollution;
- Trenches or pits, if made, should be fenced or protected to avoid entrapping and injuries of the fauna species. Bright coloured ribbons may be used for big animals (e.g. cattle), while metal plastic and other shields/fences may be used for small animals. If, despite of the mentioned precautions, small animals turn to be entrapped, upon completion of the shift, planks or medium size twigs must be made available for the animals to escape from the pits/trenches after the night. Pits and trenches must be checked prior to filling up.

The construction impact will be temporary. Likelihood of impacts on biodiversity during construction will be medium to high. The scale of impact may be reduced by means of organizing the works with due consideration of environmental safety requirements and mitigation measures recommended above. The the magnitude of residual impact will be low to medium.

7.6.2. FLORA AND FAUNA IMPACT ASSESSMENT: ROAD OPERATION

No direct impact on flora is expected during operation of the highway. Indirect impact can be related to dust and exhaust emissions from traffic and pollution

with contaminated runoff from the road. Pollutants washed off from the road can impair growth of vegetation and affect soil organisms.

Main impacts on fauna during operation in general may include:

- Death of animals caused by road mortality;
- Higher levels of disturbance and stress, including that related to noise;
- Barrier effect (reduced connectivity) ;
- Modification of food availability and diet composition (e.g. reduced food availability for bats due to the air temperature change along the road embankments at night);
- Modification of humidity conditions (e.g. lower moisture content in the air due to higher solar radiation, stagnant moisture on road shoulders due to soil compaction);
- Modification of light conditions;
- Indirect impact from dust, particles (abrasion from tyres and brake linings); oil, fuel (e.g. in case of traffic accidents), including chronic contamination due to bioaccumulation.

As mentioned above, immediate impact related to the road operation is noise from heavy traffic. The birds and other wildlife that communicate by auditory signals may be particularly confused near roads.

Pollutants, such as heavy metals, carbon dioxide, and carbon monoxide, emitted by vehicles, may all have serious cumulative effects. Combustion of petrol containing tetraethyl lead, and wear of tyres containing lead oxide, result in lead contamination of roadsides. Many studies documented increasing levels of lead in plants with proximity to roads, and with increases in traffic volume. Plant roots take up lead from the soil, and leaves take it up from contaminated air or from particulate matter on the leaf surface. The lead then moves up the food chain, with sometimes toxic effects on animals, including reproductive impairment, renal abnormalities, and increased mortality rates.

The impacts of other heavy metals, such as zinc, cadmium, and nickel are less known. Motor oil and tyres contain zinc and cadmium; motor oil and gasoline contain nickel. These metals, like lead, were found to increase with proximity to roads, with increasing traffic volume and decreasing soil depth. Earthworms were found to accumulate all these metals, in concentrations high enough to kill earthworm-eating animals.

Impact of roadside litter is also to be mentioned. Poorly managed waste may attract and entrap small animals, while cigarette butts and filters are often mistaken for food by fish and birds.

Change of land use form will reduce acreage of pastures/arable lands.

The roadside vegetation will be re-established after completion of the construction, so within a few years, mammals, birds and bats may return to familiar surroundings. Removed plantation will be restored under indication of the Forestry authorities (National Forestry Agency).

The barrier effect of the road will be low keeping in mind the design which includes tunnels andbridges.

None of the species (terrestrial, aquatic) within the impact zone are rare, endangered or protected.

Impacts on flora and fauna during operation are reduced by

- Arrangement of barriers preventing cattle and animals from death caused by road mortality;
- Arrangement of passages to improve connectivity;
- Prohibition of direct discharge of untreated runoff into the river;
- Roadside waste collection;
- Preservation of roadside vegetation.

During maintenance of the road cover, mitigation measures set for construction stage must apply.

Likelihood of impacts on biodiversity during operation will be medium to high. Under condition that mitigation measures are implemented the magnitude of residual impact will be low to medium.

7.7. IMPACT ON GEOLOGY

7.7.1. GEOLOGY IMPACT ASSESSMENT: ROAD CONSTRUCTION

The construction will include a certain amount of earth moving, thus the probability of landslides and other mass movements in road cuts, erosion from fresh road cuts and fills, and sedimentation of natural drainage channels should be taken into account. It should be also considered that siltation of canals and gorges in the RoW may case their blockage and flooding of the area.

The principle impact that highway development projects have on the natural geologic erosion process includes temporary exposure of disturbed soils to precipitation and to surface runoff. The soil exposure and the resulting reshaping of the topography may create situations when detrimental erosion and sedimentation temporarily occur.

The two factors that have the greatest impact on the slope stability are the slope gradient and the groundwater. Generally, the greater is the slope gradient and the presence of the groundwater, the lower is the stability of a certain slope regardless of the geologic material or the soil type.

The erosion of embankments near surface water body may have environmental impacts, including: pollution of surface water, damage to adjacent land. In general the process may be controlled by:

- selection of a reasonable embankment height and stabilization of the slopes;
- establishment of temporary berms, slope drains, temporary pipes, contour ditches, ditch checks, diversions, sediment traps.

Culverts used in the road, bridge and berm construction are to prevent flooding and washing out of roads. They also minimize erosion, build-up of standing water, and provide pathways for run-off.

Some of the problems and solutions are listed below.

Problem	Solution
When the runoff is allowed to flow down an excavated slope, the risk of erosion is high.	A combination of diversion ditches and slope blankets may be considered.
The outer surface of a fill is usually less compact than the rest of it. In wet weather, the moisture content of the outer layer will increase and the slope of adequate stability may fail in dry conditions.	Compaction, use of temporary shields
Bridge end fill slopes often suffer from the effects of concentrated flow, either running off the deck or from the deck drains.	Blocking the surface drains on the bridge temporarily, until vegetation becomes established, in the meantime collecting the water in a controlled manner at the end of the deck or placing water impact protection such as sufficiently large pads of rockfill under the drains.

Cut slopes may be stabilized by hydroseeding,

The feasibility study report and engineering geological survey carried out by Geoengineeting Ltd under the request of the design company have have identified sensitive locations in the project area. Alternative selected as preferable bypasses all known landslide bodies in the study area. Development of hazardous processes within the RoW is not expected.

7.7.2. GEOLOGY IMPACT ASSESSMENT: ROAD OPERATION

The operation impact is less likely to occur, as the design is developed based on the results of extensive geotechnical and engineering geological surveys implemented in the design stage of the project. However, taking into account sensitivity of the area, visual observation of the slopes, in particular after significant adverse weather must be carried out. Monitoring of the technical status of tunnels and maintenance is required.

Likelihood of triggering hazardous geological processes during operation will be low.

7.8. IMPACT ON SOILS

7.8.1. SOIL IMPACT ASSESSMENT: ROAD CONSTRUCTION

Loss of the vegetative soil layer along the road section will inevitably occur, and soil properties will be changed to form sub-grades along the route, resulting in the loss of soil productivity. The road construction impact on the soil will mainly relate to organizing and operating the camps/machinery stationing and operation

grounds, spoil disposal site, fuel/oil spills from vehicles and/or fuel storage (if available on the camp site/building ground) and erosion due to modification of the natural conditions.

The primary effect of roads is that on the topsoil. (According to the engineering survey in the area the topsoil depth varies from 0.3 to 0.5m).Total volume of topsoil removed from the project area will be around 184 $m^{3.}$ The amount of topsoil removed for construction always has significant value. In addition to the loss of the topsoil, if is not stripped prior to the construction, impact on soil productivity outside the RoW may be affected by excessive ramming.

In order to avoid or mitigate impact impact on topsoil and other impacts caused by accidental fuel/oil spills, poor management of waste and/or polluted runoff, the operation ground must be established with consideration of environmental safety measures, as presented below:

- Ground clearance must be minimized;
- Topsoil must be removed from all areas required for permanent and temporary needs of the project;
- To preserve the quality of the topsoil it must be removed so as not to mix with the subsoil;
- To avoid loss of the productive soil layer, all suitable topsoil and other material shall be saved and stockpiled separately for the future recultivation of the area ;
- Stockpiles of removed topsoil l must be properly designed and managed (see recommendations in Annex 3);
- Stockpiles of excavated soil must be properly designed and managed – stability of the stockpile through preservation of 'safe' slope inclination and diversion of runoff from the area must be ensured ;
- Topsoil and subsoil must be stored separately until reuse. (The topsoil removed from the new road alignment may be handed over to the local municipality for soil quality improvement);
- To ensure stability, the soil piles shall not be higher than 2 metres. The piles must be placed and managed so as to avoid erosion and washing off. Drainage trenches around the piles must be provided.
- Soil compaction may be reduced by strictly keeping to temporary roads, camp/operation ground boundaries;
- Disturbed vegetation must be replanted immediately after the construction/disturbance stops;
- Any temporary fuel tank shall be placed in a covered area with berms or dikes to contain any spills. Any spill shall be immediately contained and cleaned up with absorbent materials;
- Onsite repairs /maintenance/fuelling activities shall be limited. Priority shall be given to offsite commercial facilities. If impossible, a designated area and/or secondary containment for the on-site repair or maintenance activities must be provided.;
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall

be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site;

- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment. Drip pans or absorbent materials shall be provided. On small spills absorbent materials shall be used;
- Use of off-site vehicle wash racks (commercial washing facilities) is preferable. If on-site cleaning is necessary, bermed wash areas for cleaning activities shall be established. The wash area may be sloped to facilitate collection of wash water and evaporative drying;
- Waste collection area must be sited so as to avoid receiving a substantial amount of runoff from upland areas and draining directly to a water body;
- In case of the fuel/oil spills risk, an oil trap shall be additionally provided;
- Adequate training on environmental protection and safety shall be provided to the staff;
- No fly tipping policy shall be followed. Discharge of effluents into the environment is not planned. Only wastewater cleaned up to the established norms (TPH 0.3 mg/l and suspended particles 30 mg/l) may be discharged to the relief. Receiving area must not be prone to erosion.
- It is advisable not to drain water to the area where crops are cultivated.

To reduce amount of surplus subsoil and impact of the permanent stockpiles on the environment, the ways for beneficial use of this material must be defined. Tunnelling spoil and surplus excavated soil will be used for the needs of the project. Other potential users of material will be identified to reduce the need of permanent disposal of spoil/soil in the area.

In the construction stage, the responsibility for soil protection from pollution rests with the contractor.

Likelihood of impacts on soil during construction will be medium. Under condition that mitigation measures are implemented the magnitude of residual impact will be low .

7.8.2. SOIL IMPACT ASSESSMENT: ROAD OPERATION

The road operation is usually related to soil pollution by heavy metals in a narrow band on either side of the road. Pollutants settling in soil within the RoW may impair vegetation growth and increase the risk of erosion. Impact on soil may result from blockage of the drainage system which may cause flooding and/or erosion of soil. Another impact is the pollution with litter. The impact on soil during operation is more difficult to manage as the sources of impact in this stage are the “users” of the highway.

Impacts may be partly mitigated by awareness raising and education of the community. The establishment of the rest/service facilities with consideration of environmental requirements may also contribute to the reduction of soil pollution with waste. To prevent impact on erosive sliding of the soil or flooding, blockage of the drainage system must be avoided. Phytoremediation may be considered as a measure for reduction of soil contamination.

Likelihood of impacts on soil during operation will be medium to high. Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

7.9. LANDSCAPE AND VISUAL IMPACT

7.9.1. LANDSCAPE -VISUAL IMPACT ASSESSMENT: ROAD CONSTRUCTION

Visual impact during construction will be related to machinery and people operating on the ground, onsite and offsite traffic as well as the temporary facilities (car stationing, material and waste storage areas, camp (if available), borrow pits and quarry sites), built sections of the road and bridges. Most of activities will be implemented away from the residential areas.

As the road is a linear structure, construction works will not be always 'concentrated' in one location. So, the source of visual disturbance will be 'moving'. Within the last section of alignment works will be implemented mostly underground, however duration of works in the portal areas will be longer.

Landscape visual impact will also be due to temporary spoil disposal areas. The site for stockpiling material and dimensions of the pile must be selected so avoid significant visual impact. Most of material will be used in construction. By the end of works it is assumed that spoil will be fully removed from the area. Special attention must be paid to the need for recultivation of all disturbed areas (including borrow pits/quarries) after completion of works. Adherence to the terms of licenses for resource extraction will be tracked by RD through technical supervisor or works and overseen by the Department of Enviornment Protection Oversight of MENRP.

Visual impact of construction works will be mitigated by keeping to the boundaries of the worksites and traffic routes and preservation of vegetation.

The impact during construction will be unavoidable, though short term (restricted to duration of construction), local and reversible. Under condition that mitigation measures are implemented the magnitude of residual impact will be low to negligible.

7.9.2. LANDSCAPE VISUAL IMPACT ASSESSMENT: ROAD OPERATION

When in place, the new alignment will change the landscape substantially. Within the first 10 kilometers the road will be completely new structure in agricultural and forest landscape. So, visual impact related to it will be significant.

In the last section effect will be less disturbing. The main recipients of impact here are commuters. 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.

In the sections where this is possible, the impact can be mitigated by tree plantations. Planting and landscaping of the roadsides where feasible, is generally considered as an efficient way of restoring, sometimes improving aesthetic views

of the area and mitigating the impression of the landscape disturbance. At the same time plants along the roadside may act as windbreaks providing protection of farmland in the impact area. Planting with vegetation, preferably local, will also support wildlife by creating habitats.

While planning the below-described aspects must be taken into account:
The minimum clear zone (an area for drivers of errant vehicles to regain control after running off the road) distance for high speed highways is estimated as 9m. Clear zone distances larger than 9 m must be provided the outside of horizontal curves.

Large trees may be planted within 9 m distance where they will not constitute a fixed object[7]; for example, on cut slopes above a retaining wall, behind the existing barrier curbs (0.6m behind) or in areas behind the existing guardrails (0.4m behind). Trees may be planted behind barrier curbs if the road speed is sufficiently low so as to prevent cars from mounting the curb. Design exceptions may include:

- locations where the cumulative loss of trees would result in a significant adverse change in character of the roadside landscape;
- residential or similar areas where trees and other forms of vegetation provide significant functional and/or aesthetic value.

For planting trees closer along roadways, other considerations should include potential maintenance problems of roadway shading, leaf or other tree debris litter, etc. In areas of the right of way that are not impacted by limitations of the clear zone, naturalistic plant growth shall be encouraged.

Lines of sight should be observed. Plants should not interfere with the effective sight distance limits for stopping, passing or making manoeuvres at intersections. Low-growing plants of 5.5 m or lower may be planted in the sight line area as long as other requirements for sight distance are met. Taller growing plants are to be planted beyond these calculated sight line setbacks.

In the cases where an existing facility does not already provide adequate sight distance because of geometric restrictions, no further reduction will be allowed. Locations, such as the inside of curves, inside interchange loops and median shoulders shall be kept clear and the designed sight distance shall be kept.

As impact on forest fund is expected, revegetation plan must be coordinated with the State Forestry Agency authorities and approved by them.

The impact will be unavoidable. Mitigation measures will reduce impact to some extend, however the impact will be significant. With time, as community gets

[7] A single tree with a trunk diameter larger than 0.1m is considered a fixed obstacle.

accustomed to the new infrastructure, visual discomfort related to the change will diminish.

7.10. SOCIO-ECONOMIC IMPACTS

The project will have positive impact on Georgia's economy on the global scale. Modernizationof the E-60 highway section between Zemo Osiauri and Chumateleti, as a part of the program to upgrade the major roads of the country launched by the Government of Georgia will contribute to improvement of transportation and transit of goods to surrounding countries, which is a significant and growing contributor to GDP.

However, as any other development along with positive impact the project (construction and operation stage) will have a range of negative effects on socil-economical environment in the project area.

7.10.1. SOCIO-ECONOMIC IMPACT ASSESSMENT: ROAD CONSTRUCTION

Road construction will have both, negative (such as dust, noise, loss of roadside businesses and land/harvest) and positive impact (temporary employment, supporting small businesses) from social-economic standpoint. Impacts during construction will be limited to duration of construction works, mainly reversible and local. In this context resettlement and land acquisition issues should be considered separately.

Issues related to the involuntary resettlement, including land take, will be covered under the RAP developed by resettlement specialist hired by PEC. The survey is in process. Results will be available within 2 months. Resettlement action plan will be submitted as a separate document. Brief summary of results will be included in the final version of the ESIA document. Three categories of affected private land plots are distinguished according to the land use type and distances from the road, that define their compensation value. Expected loss of crops and agricultural land, business, and property include cereals, vegetables, orchards, residential houses, ancillary buildings next to residential houses. Compensation to private land owners and other affected people for both permanent and temporary impact will be completed prior to the commencement of works.

Certain negative impact during construction works will be due dust, noise and temporary restriction of free movement due to the project related activities. Contractor will be obliged to prepare and agree works implementation and traffic management plans to reduce and manage the nuisance. Warning signs and fencing will be installed to ensure public safety. Working hours, in particular during operation near the residential areas will be kept. Noise, dust impacts can be mitigated by implementation of mitigation measures set for air emissions and noise reduction. Local roads, if damaged by movement of construction machinery and vehicles, will be restored by contractor prior to quitting the site. Restoration should bring the local roads to at least the original condition or upgraded as feasible.

Community will be informed about the schedule of works, any inconvenience related to the work process and potential duration of the 'impact' in advance.

Exact location of cattle passages and culverts will be agreed with the stakeholders.

Negative impact during construction can be due to failed expectations of employment for local resident. Therefore the issues must be carefully addressed and be transparent. Contractor must be encouraged to employ local residents as far as feasible. The more so as unskilled labour force is available on site.

The civil works contracts will include provisions to encourage employment of women. Additionally, women headed households will be considered vulnerable and special assistance is provided in the land acquisition and resettlement plan.

Local small businesses will benefit by provision of accompanying services (food, small maintenance works, etc.). In case contractor decides to rent accommodation in the village instead of running construction camp, this will provide additional temporary income for community.

Likelihood of impacts on community during construction will be high to medium. Under condition of efficient communication, transparency of information and cooperation with residents and local authorities the impact will be manageable.

7.10.2. SOCIO-ECONOMIC IMPACT ASSESSMENT: ROAD OPERATION

After shifting the traffic from the existing road dust, noise and emission impact on the residents of the settlement will reduce. For the same reason, pedestrian safety in Surami, Khashuri will improve. Modernisation of the road will result in higher traffic safety as the highway will bypass the residential areas reducing the risk of traffic accidents and fatal injuries.

In some sections where the road will cross arable land plots, faster traffic on the highway and presence of the median barriers will 'disconnect' the right and the left side properties. Although, keeping in mind that in the first 10km of the new alignment where the risk of impact on connectivity may occur construction of 10 bridges is planned connectivity will not be a problem. The concerns community may have with regard to this issue is being discussed with the stakeholders (local community) and reflected , if appropriate, in the design. As mentioned above, exact location of cattle passages, culverts and/or the need for installation of new ones is being specified on design stage. So, complains related to this issues during operation stage are not expected.

Two key health risks in relation to roads and traffic are accidents and air quality changes. Along with the exposure to emissions from the traffic, health risk is also related to potential contamination of crops cultivated adjacent to the road.

Diversion of the traffic will affect businesses along the existing alignment. The list of business establishments in the section of interest includes: 79 booths selling bottled water and food, 43 small shops, 9 car maintenance stations, 5 pharmacies, 9 large shops, 34 furniture outlets and 112 small bakeries (bread and sweet bread (nazuki) outlets) in the section from Surami towards Rikoti tunnel. Effect of diverted traffic on the shops and car service spots in the limits of the residential area (Khashuri, Surami) will depend on their location. Worth to mention is impact

of traffic diversion on vendors along Surami-Chumateleti section of the road, since the main client of the latter are travellers using the road towards Riokoti tunnel.

Women account for majority (75%) of the employees in the mentioned business. In each outlet one person is employed. Income from the business is seasonal. According to the interviews, off season sales may amount to 35 nazuki per day, whereas in winter, on Easter holiday and in summer daily sales often reach 80 units. The price varies around 2 to 3 GEL. Daily income from the business varies from 20 to 60 GEL. For some families this is the only source of income, but the income is not stable.

According to the interviews with local residents carried out by the team attitude toward the project varies. Most of the respodents are concerned that diversion of the traffic will affect their business, and are sceptical that establishment of alternative businesses will be feasible is short term prospective. In their opinion this will be possible only in case of support from the state.

Assessing impact of diversion of the flow to the new alignment on the businesses effect of the project for rehabilitation of 50 km long Dzirula-Kharagauli-Chumateleti road[8] is to be taken into consideration. The road is connection between Kharagauli Municipality and E-60 highway. It goes along the river Chkherimela and Khashuri-Kharagauli-Zestaponi railway and is known to be used more than 37000 local residents (Source of information: RD).

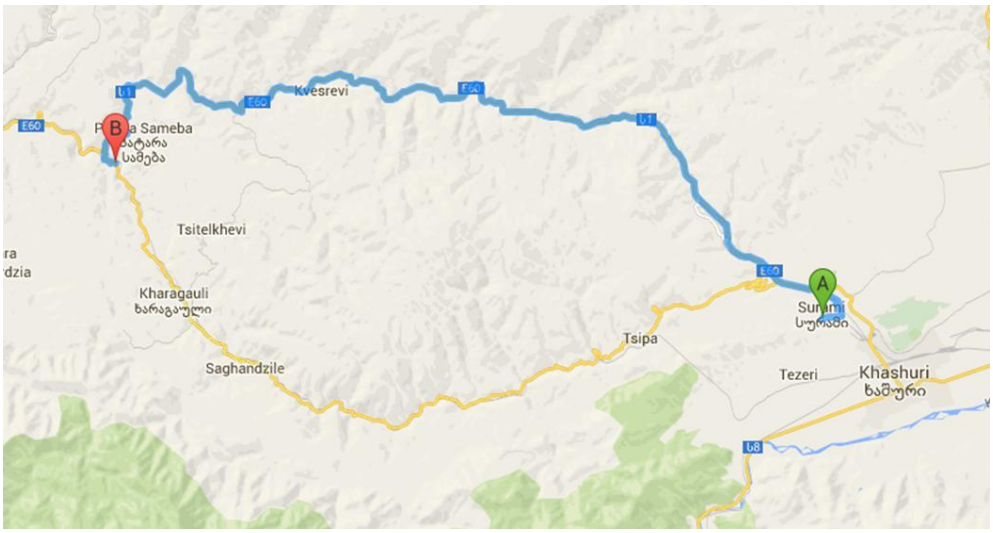


Figure 7.4. Dzirula-Kharagauli-Chumateleti road and E-60 highway

[8] . Feasibility study and preliminary design is being prepared under Dzirula -Chumateleti road development project with financing of the Asian Development Bank by consulting company Kocks Consult.

The road (Dzirula-Chimateleti) is used by the residents of 20 villages along the Chumateleti-Dzirula alignment, and tourists. Keeping in mind that the distance from Chumateleti to Kharagauli via this alignment is shorter, it is assumed that the road will be actively used. Rehabilitation of the road may help to preserve reasonable traffic through the section bypassed by the new alignment of EWH and reduce impact on the businesses in the project affected area.

On the whole, the scale of the impact of the businesses will correspond the the change in the traffic flow through the bypassed area. Existing alignments through Khashuri is assumed to be used by travellers towards Borjomi and Samtskhe-Javakheti region. Therefore the impact on nazuki vendors and other businesses bypassed by Oziauri-Chumateleti section of the EHW will not be detrimental. Nevertheless mitigation measures to reduce the impact are suggested (see below).

Measures to reduce/mitigate impact on socio-economic environment during operation of the road include:

- signs, barriers to reduce access of pedestrians to the carriageway;
- allowing adequate passages and routes for non-motorized transport and pedestrians;
- establishment of leisure zones along the route to support the development of local businesses and businesses affected by diversion of the traffic from the existing road;
- development of alternative possibilities for employment. These can be support for family hotels or, keeping in mind that Shida Kartli is one of the leading fruit growing regions - arrangement of small enterprises for fruit processing or drying. The issue should be discussed with community and resolved with participation of the stakeholders involved in the process.

Ranking of the impact is given in Section 9.3. Part of the the above listed mitigation measures are included into the EWH design (passes, junctions, leisure zones), some are subject to the restoration of livehihood as part of resettlement action plans (alternative employment), and others are subject to the Road Safety Action Plan of RD (signage, barriers).

7.11. HISTORICAL-CULTURAL IMPACTS

Selected alternative bypasses cultural heritage sites, cemeteries and places of worship. With consideration of the fact that the region is rich in archaeological heritage, chance find procedure must be put in place (see Annex 5). As a part of construction permit clearance from cultural heritage authorities must be obtained. Supervision of works by an archaeologist may be advisable.

There is no risk of operation impacts.

7.12. PROTECTED TERRITORIES AND CRITICAL HABITATS

There are no protected areas in the project impact zone. Biodiversity survey has not revealed any critical habitat in the direct impact zone of the project.

7.13. CUMULATIVE IMPACT

The project area is rural. No other existing or planned projects or sources capable to add to the impact of this project are known. Rehabilitation of Chumateleti-Dzirula road will not overlap with the project's impact area . No cumulative impact is there fore expected.

8. ANALYSIS OF ALTERNATIVES AND IDENTIFICATION OF THE PREFERRED OPTION

Along with 'no action' alternative, one (1) alternative (Alternative A4) suggested in the P/FS and three (3) alternatives (Alternative A1, Alternative A2 and Alternative A3) analysed by the Consultant are shown in the Figure 8.1.

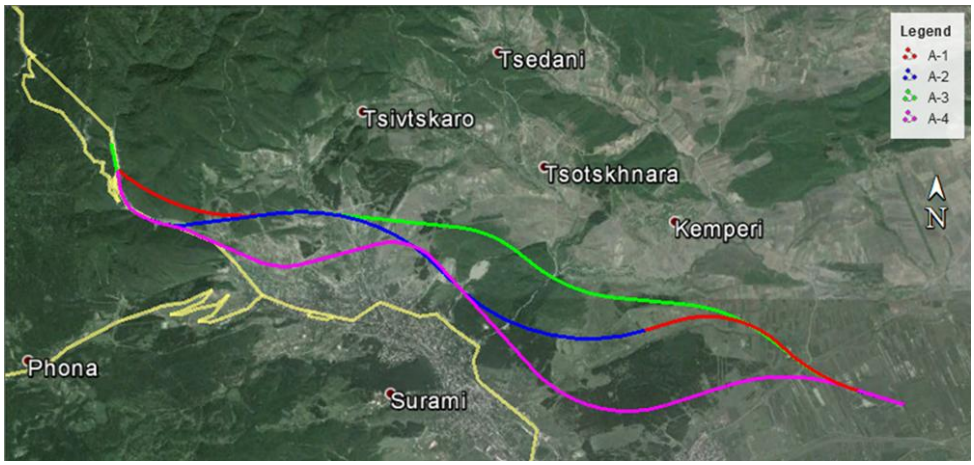


Figure 8.1 Alternative alignments

Zero (no action) alternative. Zemo Osiauri-Chumateleti section is a part of the E-60 highway which is being upgraded to handle increased traffic flow. With consideration of the future prospective, existing road through the residential areas will not be sufficient to ensure unconstraint traffic. Even if it is well maintained the problems will be noise and traffic related emissions, traffic congestion and traffic/pedestrian safety. The last and not the least, widening of the road within the boundaries of the built-up areas is not feasible. Therefore, this alternative has been excluded from further consideration.

Comparison of other alternatives considered during ESIA is presented below.

Table 8.1. Advantages and disadvantages of alternatives

Advantage	Disadvantage
Alternative A1	
• Lowest land sealing rate • Bypasses problematic areas such as the cemetery, landslide and densely populated residential areas • Shorter route – lower air emissions • Minimized impact on the landscape within the last section of the road where tunnels are being arranged • Low impact on biodiversity in the last section – because of tunnels • Minimum contact with	• Possible impact on Shukghele stream • Significant construction and operation/maintenance costs

Suramula River • Minimum resettlement needs • Improved road safety	
Alternative A2 (A2-1, 1A2-1, A2-2)	
• Distance from densely populated areas • Bypasses problematic areas such as the cemetery, landslide • Improved road safety	• Landslide areas near the alignment and landslide risk • Possible problems due to large-scale cutting and embanking on the unstable weak ground • Impact on Suramula River hydrology due to construction of piers in the riverbed (Alternative 1A2-1, A2-2) • Impact on the Suramula water quality during operation • Impact on aquatic biodiversity (both options, in particular in case of Alternative A2-1, and 1A2-1, which envisaged covering the river with carriageway) • Traffic congestion due to road widening • Medium construction cost • High road maintenance cost
Alternative A3 (A3-1, A3-2)	
• Low cost • Improved road safety	• Impact on forest area • Landslide areas near the alignment and landslide risk • Possible problems due to large-scale cutting and embanking on the unstable weak ground • Impact on Suramula River hydrology due to construction of piers in the riverbed (Alternative A3-2) • Impact on the Suramula water quality during operation (A 3-1) • Impact on aquatic biodiversity (both options, in particular in case of Alternative A3-1, which envisaged covering the river with carriageway) • Impact on terrestrial biodiversity due to large scale cutting and embanking • Proximity to residential area, i.e. nuisance related to emission and noise impact during construction and operation of the road for local community. • Traffic congestion due to road widening • High maintenance cost because of the need for permanent monitoring abd maintenance of the landslide areas
Alternative-A4 (A4-1, A4-2)	
Low cost	• Impact on forest area • Landslide areas near the alignment • Possible problems due to large-scale cutting and embanking on the unstable weak ground • Impact on Suramula River hydrology due to construction of piers in the riverbed (Alternative A4-2)

	• Impact on the Suramula water quality during operation (A4-1) • Impact on aquatic biodiversity (both options, in particular in case of Alternative A4-1, which envisaged covering the river with carriageway) • Proximity to residential area, i.e. nuisance related to emission and noise impact during construction and operation of the road for local community. • Cutting off cemetery from the residential area. • Traffic congestion due to road widening

Evaluation of alternatives by their impact on biophysical and social environment is presented in Table 8.2.

Table 8.2. Comparison of alternatives

	A -1			A 2-1			1A2-1			A2-2			A3-1			A3-2			A4-1			A4-2		
	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value	Ranking	Score	Score value
CONSTRUCTION																								
Landscape visual impact	15	0.3	4.5	15	0.5	7.5	15	0.5	7.5	15	0.3	4.5	15	1	15	15	0.3	4.5	15	1	15	15	1	15
Local air-quality	5	0.3	1.5	5	1	5	5	1	5	5	1	5	5	1	5	5	1	5	5	1	5	5	1	5
Noise	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	1	5	5	1	5
Impact on biodiversity & ecological integrity	20	0.3	6	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20
Impact on surface water	5	0.3	1.5	5	1	5	5	1	5	5	0.5	2.5	5	1	5	5	1	5	5	1	5	5	1	5
Land Acquisition & displacement , social	20	0.5	10	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20
Geotechnical Risks, Impact on the Existing Landslide Areas	20	0.3	6	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20	20	1	20
Impact on infrastructure	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5
	100		32.5	100		80.5	100		80.5	100		75	100		88	100		77.5	100		91.5	100		91.5
OPERATION STAGE																								
Landscape visual impact	15	0.5	7.5	15	1	15	15	1	15	15	1	15	15	1	15	15	1	15	15	1	15	15	1	15
Local Air-Quality	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5
Noise	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5
Impact on biodiversity &ecological Integrity	20	0.3	6	20	1	20	20	1	20	20	0.5	10	20	1	20	20	1	20	20	1	20	20	1	20
Impact on surface water	5	0.3	1.5	5	1	5	5	1	5	5	0.5	2.5	5	1	5	5	0.5	2.5	5	1	5	5	0.5	2.5
Land Acquisition & displacement , social	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
Geotechnical Risks, Impact on the Existing Landslide Areas	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0

Impact on infrastructure	5	0	0	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5	5	0.3	1.5
	100		18	100		44.5	100		44.5	100		32	100		44.5	100		42	100		44.5	100		42

Ranking components	**Ranking value**
impact on landscape	15
impact on soil	5
impact on air quality	5
noise	10
impact on biodiversity	15
impact on water	10
geotechnical risks	15
physical and economical resettlement	20
impact on infrastructure	5
	100

Note: The scores given to the components reflect magnitude of impact. For the needs of the project the following scoring system applies:

No or negligible impact	0
Low impact	0.3
Medium impact	0.5
High impact	1

According to methodology described in section 5.6., each score was multiplied by ranking value of the component. The score of alternative was calculated as total of individual components ranked

T**he ranking of suggested alternatives shows that** Alternative A1 is considered as preferred from environmental and social view point of view.

9. SUMMARY OF IMPACT ASSESSMENT FOR THE PREFERRED ALTERNATIVE

9.1. RANKING OF IMPACTS

Table 9.1. Environmental and social impacts - construction

#	Potential Impacts	Severity	Sites
1	Impact on natural landscape in the right-of-way	Minor to medium	Whole alignment
2	Impact on natural landscape	Medium	Borrow pit sites; Waste dumps, Construction camps ; Equipment yards – to be defined at the pre-construction stage by the contractor.
3	Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.	Minor to medium	Part of alignment, which passes hilly and mountainous landscape. During works near the riverbed
4	Increased suspended sediment in stream/river (canal, ravines) affected by erosion at construction sites and fresh road cuts, fills and waste dumps. Declined water quality and increased sedimentation	Medium	Bridge construction area, road section next to the surface water streams
5	Risk of flooding triggered by blockage of canals, ravines	Minor/medium	Sections running close/crossing the river
6	Soil and water contamination during construction – spilled oil, grease, fuel, paint.	Minor	Water –ravines, canal ; Soil – along the whole alignment; camps, equipment yards /concrete mixing sites
7	Poor sanitation/solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management)	Minor to medium	Note: Location to be defined by constructing contractor.
8	Construction wastes alongside the RoW, spoil; roadside litter.	Medium	Along alignment; at worksites; spoil disposal areas
9	Air pollution from vehicle operations, dust.	Minor	Near the settlement, along alignment, in quarry/borrow pit areas, along the traffic route
10	Air pollution from concrete plants.	Medium	Supplier site
11	Noise from machinery/vehicle traffic, local	Minor	Near the settlements
12	Poaching by construction workers	No to negligible	Suramula, forest area
13	Impact on biodiversity (noise, emissions, barriers for movement water pollution)	Minor to medium	Suramula, along the route; forest area
14	Creation of stagnant water bodies in borrow pits, quarries etc. suited to mosquito breeding and other disease vectors.	Minor	
15	Health hazards by noise, air emissions/dust (workers)	Minor	Near the Operation ground
16	Impacts on archaeological sites	Minor to medium	Along the RoW
17	Hazardous driving conditions where construction interferes with existing roads.	Minor	Whole alignment ; Near the settlements
18	Impact on existing infrastructure	Medium	Communications, optical cable and transmission line crossing areas

19	Traffic related accident risks	Minor	Whole alignment; Most sensitive sites are near the settlements
20	Physical and economical displacement of people living on the right of way	Medium to High	Affected households
21	OHS risks related to operating machinery, works on height and tunnelling	Medium to High	Worksites

Environmental and social impacts of the operation stage are presented in the table below.

Table 9.2 Environmental and social impacts - Operation

#	Potential impacts	Severity	Sites
1	Impact on landscape	Medium/High	Whole alignment
2	Impact on the access roads, borrow pit sites, waste dumps	Minor	During repair
3	Roadside litter	Minor	Along alignment, landfills
4	Erosion from road cuts and fills risk of landslides.	Medium	Within the RoW.; Most of the alignment, in particular the section running close to the riverbed
5	Alteration of land/subsoil drainage patterns	Negligible	The existing culverts and drainage systems d
6	Soil and water contamination by oil, grease, fuel and paint alongside the highway	Minor	Most of the alignment
7	Air pollution from machinery during maintenance works.	Minor	Most of the alignment
8	Air pollution from traffic	Minor	Most of the alignment
9	Noise pollution from traffic	Medium	Most of the alignment
10	Roadside litter	Medium	Most of the alignment
11	Disturbance of fauna (noise, collision risks)	Minor/medium	Most of the alignment
12	Creation of a transmission corridor for pests and weeds	Medium	Most of the alignment
13	Health hazards - dust and exhaust emissions	Minor	Near the settlements:
14	Obstruction of routes from homes to farms, increasing travel time.	Minor	Near the settlement
15	Impairment of non-motored transportation and pedestrians in the highway corridor due to reduced or impeded rights-of-way.	Minor	Near the settlement
16	Impact on businesses	Medium to high	Vendors, businesses along the bypassed section of existing E-60 section Oziauri-Chumateleti section
#	**Emergency Related Impacts**	**Severity**	
16	Accident risks associated with traffic that may result in spills, injuries or loss of life	Medium	Near the settlements; Most part of alignment

The impact matrix from the construction stage is presented in the table below.

Table 9.3. Impact matrix - Construction Stage

Activity	Impact	Direct/ Indirect (D/I)	Positive/ Negative (P/N)	Reversible/ Irreversible (R/I)	Temporary (Short term-S, Medium term-M, Long term-L)
Land clearance and grading in the RoW	Impact on landscape, flora/fauna, habitats	D	N	R/I	S
	Erosion	D	N	I	S
	Emissions	D	N	R	S
	Noise, vibration	D	N	R	S
	Soil pollution	I	N	R	S
	Waste generation	I	N	R	S
	Ground and surface water pollution	I	N	R	S
Construction, pavement	Emissions	D	N	R	S
	Noise, vibration	D	N	R	S
	Soil pollution	I	N	R	S
	Waste generation	I	N	R	S
	Ground and surface water pollution	D/I	N	R	S
Exploration of borrow pits	Impact on landscape, flora/fauna, habitats	D	N	R/I	M
	Erosion	D	N	R/I	M
	Emissions	D	N	R	S
	Noise, vibration	D	N	R	S
	Soil pollution	I	N	R	S
	Waste generation	I	N	R	S
	Ground and surface water pollution	D	N	R	S
Transportation of material from borrow pits	Emissions	D	N	R	S
	Noise, vibration	D	N	R	S
	Soil pollution	I	N	R	S
	Waste generation	I	N	R	S
	Impact on landscape, flora/fauna, habitats	D/I	N	R/I	S
	Ground and surface water pollution	I	N	R	S
Disposal of spoil and wastes	Impact on landscape, habitats	D	N	R	S
	Emissions	D	N	R	S

	Noise, vibration	D	N	R	S
	Soil pollution	I	N	R	S
	Waste generation	I	N	R	S
	Ground and surface water pollution	I	N	R	S

The character of the main anticipated impacts of the operation stage is presented in the table below.

Table 9.4 Character of the Main Anticipated Impacts - Operation Stage

Activity/ Factor	**Impact**	**Direct/ Indirect (D/I)**	**Positive/ Negative (P/N)**	**Reversible/ Irreversible (R/I)**	**Temporary (Short term-S, Long term-L)**
Physical existence	Impact on landscape	D	N	I	L
Traffic	Impact on landscape, flora/fauna, habitats	D/I	N	R	S
	Emissions	D	N	R	L
	Noise, vibration	D	N	R	L
	Soil pollution	I	N	+R/I	+M
	Waste generation	I	N	+R	+S
	Ground and surface water pollution	I	N	R/I	+S/M
Maintenance works	Impact on landscape, flora/fauna, habitats	D/I	+N	R	S
	Erosion	D	+N	R/I	+S
	Emissions	D	N	R	S
	Noise, vibration	D	N	R	S
	Soil pollution	I	N	+R/IR	+S
	Waste generation	I	N	+R	S
	Ground and surface water pollution	I	N	+	+
Accidents	Impact on landscape, flora/fauna, habitats	D/I	N	+R	+S
	Erosion	I	N	R	S
	Emissions	I	N	+R	+S
	Noise, vibration		N	R	R
	Soil pollution	I/D	N	+R/IR	+S
	Waste generation	I	N	+R	+S
	Water pollution	I	N	+R/IR	+

9.2. RESIDUAL IMPACT

Residual impact will be low if mitigation measures are in place, environmental management and best construction and operation practices are kept to. In Table 9.5 „Negligible" means that residual impact is not anticipated or it is insignificant.

Table 9.5. Residual Impact- construction stage and opereation stages

Impact	Ranking
Construction	
Deterioration of air quality	Low to negligible, short term, reversible, local (According to the modelling data, impact is not high, no mitigation is required).
Noise and vibration	Low to medium , short term, reversible, local (According to the modelling data, impact is not high, no mitigation is required).
Water quality	Low to negligible, short term, reversible, local.
Deterioration of soil quality	Low to negligible, short term, reversible, local.
Development of geohazards	Negligible, as alternative bypass all hazardous areas identified suring the site survey.
Impact on flora/vegetation	Low to medium, l ocal, in the areas not to be alienated permanently - medium to short term (temporary), reversible. Impacted will Alder trees, shrubs, pine trees, grasses removed during site clearance. In temporarily used areas impact will be reverted by reinstatement of the disturbed areas. None of affected species are rare, endemic, endangered, Red List or otherwise protected.
Impact on fauna	Medium to low depending on the section of alignment, temporary, reversible, local. These will be - residual noise propagation, exhaust emissions, certain risk of impact on aquatic life due to temporary impact on water quality (mainly increase of turbidity), collision. None of affected species are rare, endemic, endangered, Red List or otherwise protected.
Landscape and visual alteration	Low to negligible (depending on location), temporary, local, reversible
Land acquisition and resettlement	Small scale physical resettlement will be required.
Operation	
Deterioration of air quality	Low , According to the modelling data, impact is not high, no mitigation is required.
Noise and vibration	Low, According to the modelling data, impact is not high, no mitigation is required.
Water quality	Negligible - pollution with surface runoff.
Deterioration of soil quality	Low to negligible - pollution with surface runoff.

Development of geohazards	Negligible.
Impact on flora/vegetation cover	Negligible - None of potentially affected species are rare, endemic, endangered, Red List or otherwise protected.
Impact on fauna	Negligible to low. Noise propagation, exhaust emissions, certain risk of impact on aquatic life due to water quality deterioration and risk of collision.
Landscape and visual alteration	Significant change due to road and bridges
Land acquisition and resettlement	Effect of exonomical resettlement - medium

10. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Information included in the EMP is based on the main findings outlined in every chapter of the ESIA report, i.e., all proposed mitigation and monitoring actions set to a timeline, specific responsibility assigned and follow up actions defined.
The EMP is presented in a table format and divided into three main parts, dealing with the physical environment, with the biological environment, and with the socio-economic and cultural environment. Each part is organized by development stages, i.e. pre-construction, construction and road operation.

The overall objective of the EMP is to bring the project into compliance with national environmental and social requirements and environmental and social policies of the World Bank.

EMP will be included into the bidding documents so that bidders can consider and incorporate their environmental responsibilities into their bid proposals. Later EMP becomes an integral part of a contract for the provision of works and is binding for implementation.

Once works provider is contracted, the provider should develop and submit to RD for approval the following thematic management plans:
Waste Management Plan;
Traffic Management Plan;
Health and Safegty plan; and
Emergency Response plan.
These plans should be prepared and cleared prior to commencement of works.

Compensatory tree planting (and other greening/reinstatement as required) plan may be produced at a later stage, once progress of works allows initiation of reinstatement within the project area.

10.1. INSTITUTIONAL FRAMEWORK

The RD of the MRDI is responsible for general oversight of environmental compliance of works through ensuring quality performance of the technical supervisor and of the contractor. RD will perform these functions through its Resettlement and Environment Division comprising twelve staff members with relevant education and professional skills, as well as the safeguards consultants with international experience hired for the technical supervision of operations. This in-house capacity will be supported by external individual consultants upon demand.

The supervisor of works commissioned by the RD will be charged with the responsibility to establish strong field presence in the project area and supervise the works. Along with ensuring consistency with the design and quality of works, the supervisor is mandated to track the implementation of the EMP by the contractor, reveal any deviations from the prescribed actions, and identify any environmental / social issues should they emerge at any stage of the works.

Monitoring shall include visual observation and measurements as appropriate. Field testers and hand-held equipment shall be used to monitor short- term

impact. Calibrated equipment and approved methods of monitoring must be used. Calibration must be done regularly, all calibration records and monitoring results, along with the copies of the site records, certificates, permits and documents shall be submitted and kept by the Roads Department.

The list of records must include:

- Work program and schedule;
- Environmental permits and licences;
- List of equipment;
- List of mitigation measures;
- Route/program of construction material transportation;
- Inspection records – noise, water quality monitoring data;
- Copies of correspondence related to environmental issues;
- Site drainage plan;
- Records of maintenance and cleaning schedules for sediment and oil/grease traps;
- Records of sewage disposal;
- Records of quantity of discharged wastewater and concentration of pollutants;
- Waste disposal records
- Written designation of waste disposal sites and instructions for waste transportation from local authorities;
- Air quality monitoring results;
- Log of material inventories and consumption;
- Chance find records (if any);
- Complaints register;
- Incidence register (environmental limits excedence forms, injuries records, etc.);
- Records on remedial actions taken;
- Equipment control and maintenance log;
- Corrective and preventive action request records;
- Training records.

Works supervisor will be responsible for reporting to the RD on the environmental and social performance under the EWHCIP on monthly basis through including safeguard compalince section into the general reporting. Supporting photo material shall also be attached. RD will make monthrly reports from the works supervisor available to the World Bank upon demand. Also, RD will include analytical sections on the EMP impelemntation and overall safeguard performance into the regular project progress reporting to the World Bank. This reporting will be based on the information received from the works supervisor, but should also reflect results of RD's own due diligence (quality control over the supervisor's work) and RD's assessment of supervisor's performance.

Environmental Management and Monitoring

The environmental management and monitoring required at each individual stage of the Project are presented in the tables below.

Table 10.1 Mitigation Plan for the Design Phase

Issue	Measures taken or to be taken	Implementing Organization	Responsible Organization - supervisor
Dust/air pollution	• Location of soil borrowing sites, waste disposal sites and concrete mixing sites shall be identified with consideration of environmental issues (to avoid negative impacts on humans and wildlife).	PEC/Contractor	RD
Noise	• Planning of auxiliary and haulage routes shall be planned with maximum use of existing roads and/or away from densely populated areas to reduce nuisance related to noise .	PEC/Contractor	RD
Surface water pollution	• Identification of the need for installation of drainage system. Identification of surface water protection measures for facilities/works near or in the riverbed (Shukghele and Suramula rivers)	PEC	RD
Loss of land/harvest Loss of a source of income/business	• Development and implementation of Land acquisition and resettlement plan • Compensation of damage/loss according to the RAP	PEC	RD
Landscape visual change	• Selection of design, colour and shape with consideration of peculiarities of the landscape	PEC	RD
Impact on surface water	• Design of the river crossing allowing minimum interference with active riverbed	PEC	RD

Table 10.2 Mitigation Plan for Construction Phase

AIR QUALITY				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Exhaust emissions from the engines of construction vehicles and machinery	• All vehicles, equipment and machinery used for construction will be regularly maintained and inspected/certificated to ensure that the pollution emission levels conform to the standards prescribed. • Avoid idling of engines. • Ban the use of poorly maintained machinery or equipment that cause excessive pollution (e.g., visible smoke, fuel/oil leaks).	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Dust generated during hauling of the construction materials	• The construction materials (gravel, sand, etc.) will be transported in covered (for example, by tarpaulins) vehicles.	*Details are given in Table 10.4*		
Dust generated during the movement of vehicles	• Water truck bowser with spray bar will be used to spray water on unsealed road surfaces, asphalt mixing sites and temporary service areas, for dust	*Details are given in Table 10.4*		

	supression			
NOISE AND VIBRATION				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Construction-related noise from vehicles, asphalt plants, crushing and batch plants, equipment	• All vehicles, equipment and machinery used for construction will be regularly maintained and inspected/certificated to ensure that the noise levels conform to the standards prescribed.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Noise Impact – Disturbance to residents	• Restrict work between 06:00 to 21:00 hours within 500 m of the settlements. In addition, limit noise on construction site. Prohibit idling, use shields, if required; • Maintain dialogue or use grievance mechanism to allow residents to contact Project staff and ask for additional measures.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Noise impact on workers	• Noise standards will be strictly enforced to protect construction workers from noise impacts, in accordance with international Health, Safety and Environment (HSE) standards and procedures. • Personal Protection Equipment (PPE) (e. g., ear defenders) will be provided and used. • Noise exposure will be limited to 85 dB(A).	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
SOIL AND WATER				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Pollution of soil and water (Shukghele, Suramula)	• Contractor shall provide information about location and floor space of the area required and layout of the work camp. • Description and layout of equipment maintenance areas and lubricant /fuel storage facilities including distance from water sources and irrigation facilities. Storage facilities for fuels and chemicals will be located away from watercourses. The storage must be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination Prior to the commencement of works the site installations shall be inspected for approval Sources of water to be used for the project	*Details are given in Table 10.4*	Contractor	RD Construction supervisor, MENRP

	needs. • Each parking, service, or cleaning and washing plateau will be equipped with waste water treatment facilities which will be temporary objects. • Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses (if discharge in surface water is planned) . • Use of offsite fuelling and maintenance facilities will be encouraged. However, in planned to have onsite – storage and handling of fuels, oils and other hydrocarbons will be a controlled process, involving measures to prevent soil and water contamination. Designs will include storage on sealed surfaces and within secondary containment and refuelling of all plant, vehicles and machinery will not be allowed within 50 m of any watercourse, drain or channel leading to a water course. • Waste management plan will be prepared. • Storing and disposal of waste/used oil should comply with environmental regulations and standards. • Contaminated or hazardous waste such as bitumen waste will be disposed only in areas approved by the MENRP. All waste disposal will comply with a Waste Management Plan, to be developed at the start of construction. • After completion of construction works the contractor shall execute all works necessary to restore the sites to their original state (removal and proper disposal of all materials, wastes, installations, surface modelling if necessary, spreading and levelling of stored top soil). • Location of temporary disposal of soil material will be selected in the area with consideration of general environmental safeguards and potential risks.			
Siltation of surface waters during construction near Shukghele, Kakalatkhevi and Suramula and/or impact on soils due to improper disposal of excess materials	• Biggest part of excavated soil will be reused, thus potential impacts due to the need for disposal of excess material will be kept to a minimum. • Temporary diversion of the streams will be applied to avoid pollution of the water. For this purpose cofferdams can be used. Another alternative, diversion of the flow via pipe.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Soil compaction due to	• Operation of heavy equipment will be confined within the corridor to avoid	*Details are given*	Contractor	RD

operation of heavy equipment	soil compaction and damage to land.	*in Table 10.4*		Construction supervisor
Loss of top soil	• All of the removed top soil within the corridor will be stored for reuse. Long-term stockpiles of topsoil will immediately be protected to prevent erosion or loss of fertility. Topsoil management recommendations are given in Annex 3). • Topsoil shall be stripped and reused during recultivateion of disturbed sites. • Soil management plan shall be provided. The plan will describe measures to be undertaken to minimize effects of wind and water erosion on stockpiles, measures to minimize loss of fertility of top soil, timeframes, haul routes and disposal sites. • Prior to operation of borrow pits, the contractor shall develop and submit reinstatement plan – indicating location of the borrow pits, rehabilitation measures, implementation schedule (Rehabilitation measures may not be necessary for borrow areas still in operation after road works have finished).	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Wastewater collection and disposal/treatment	• Camps will be furnished with sanitary and wastewater collection and disposal/treatment facilities and should operate fully compliant waste systems, involving storage of waste by waste category.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Sand and gravel borrow pit-disturbance of river bed, water quality, ecosystem disturbance	• It is allowed to use existing borrow pits or buy material at licensed facilities; no borrowing from the stream.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
ECOLOGY AND NATURAL ENVIRONMENT				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Potential damage of trees during excavation/ construction activities	• Avoiding any damage to the existing trees during construction activities a temporary vegetation protection fence shall be established.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Maintaining animal mobility through culverts and bridges	• Use of designed culverts and bridges as animal crossing points.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor

Impacts on flora	• Clearing up and removal of vegetation will be minimized to the extent necessary for the execution of works. • Re-vegetation will be performed.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Domestic and wild animals straying onto the road and being killed	• Installation of a protective fence along the road, and fencing of excavated sites as a measure to prevent domestic and wild animals straying onto the road and being killed or falling into the excavations. Protective fences will be of various density. For small animals boards or corrugated metal shields can be used. For larger animals colour ribbons can be used as a generally accepted practice.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Damage to aquatic ecosystems	• Prevent the movement of machines inside rivers, streams, or on their banks, except when it is unavoidable due to the construction of a structure or construction. • Maximum preservation of vegetation on the slopes to reduce the risk of siltation. • Avoid construction in sensitive for biodiversity periods.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Damage to river morphology	• Digging and making the foundations for bridge piers, retaining walls, and structures located at, or in the vicinity of, surface water bodies, will take place in low water period to minimize negative impacts on rivers and their banks.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Damage to aquatic habitats and fish	• All in-river works will be conducted outside of the fish spawning season and Contractors will prepare management plans for such works as a part of their Construction Method Statements. • All the works to be performed in water or near watercourses will follow statement or plan for the execution of particular works. • Erosion protection measures set in Soil and erosion management plan will be implemented, including measures that will be undertaken to address adverse environmental impacts such as erosion of river embankment and siltation of watercourses that may result from such activities. • Avoid "dropping structures" into rivers/streams. This will be done by "sawing" appropriate sections of the structure and using cranes to lift these sections or alternatively construct a platform onto which the structure could be dropped. • Discharge of sediment-laden construction water (e.g., from areas containing dredged soil) directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into	*Details are given in Table 10.4*	Contractor	RD Construction supervisor

	settling lagoons or tanks prior to final discharge.			
LANDSCAPE, VISUAL AND AGRICULTURE				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Potential deterioration of aesthetic value of the landscape and vegetation losses	• All proposed borrow areas are already in operation. Thus environmental impacts concerning potential disfigurement of landscape, vegetation losses and damage to access roads are kept to a minimum. • Development and implementation of landscape planting. • Preservation of vegetation from non-deliberate damage – achievable by keeping to the boundaries of the work areas and travel routes. • Use erosion prevention measures (straw bales, fibre rolls, other) in sensitive locations. • Stability of the slope of deep excavations for bridge piers must be ensured. For this purpose boarding can be used.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Damage to agricultural lands, including impacts of drainage and irrigation infrastructure	• Grievance procedure will be developed before start of construction; • Machinery and vehicle access will be strictly limited; • All the affected areas will be restored.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Livestock resources damaged by machinery and vehicles	• Grievance procedure will be developed before start of construction; • Machinery and vehicle access will be strictly limited; • All the affected areas will be restored.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Arrangement of new borrow pits or stone quaries, possibly damaging agricultural or archaeological	• Contractor have to use the Borrow pits on a specific locations which are predefined within the Detailed design. • Advantage should be given to already licenced sourcing areas. • Use existing quarries or obtain licence to run own quarry	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
CULTURAL HERITAGE AND ARCHAEOLOGY				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Possible loss or damage to cultural resources	• In case of chance finds, The Contractor is required to immediately, without delay, halt works and inform the authorized Institution for Protection of Cultural Monuments and to undertake measures to ensure the findings are	*Details are given in Table 10.4*	Contractor	RD Construction supervisor

	not destroyed or damaged and to protect the area and position in which they are discovered.			
HEALTH AND SAFETY				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Health and safety risks to workers and adjacent communities	• The following will be provided: Adequate health care facilities (including first aid facilities) within construction sites; • Training of all construction workers in basic sanitation, general health and safety matters, and on the specific hazards of their work; • Personal protection equipment (PPE) for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with HSE legislation; • Clean drinking water to all workers; • Barriers and warning signs at all hazardous areas for protection to the general public; • Drainage throughout the camps to avoid puddling; • Periodic cleaning of latrines and waste container to prevent outbreak of diseases. • Where feasible contractor shall arrange temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities. • Training/briefing about safety – prior to commencement of works in rules for the handling and storage of hazardous substances (fuel, oil, lubricants, bitumen, paint) and cleaning of machinery/equipment. • Keeping to occupational safety rules during operation in tunnel and drill and blast works. • Briefing related to safety during operation in the confines space. • Implement international HSE standards in all contracts. • Working on height and other safety requirements relevant to the task will be enforced.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor MENRP
Residents injured by construction traffic and machinery	• Conduct safety awareness campaigns, focusing on schools and children.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor

Community tension and disruption	• Locations for camps are predefined within the Detailed Design of the Project. Contractor should prepare Camp Management Plan	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
TRAFFIC, MACHINERY				
Potential impact	***Mitigation/Enhancement Measure***	***Monitoring requirements***	***Responsibility***	
			Development/ Implementation	***Control***
Asphalt plants	• Use existing asphalt plants or obtain permit from MENRP.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor
Traffic disruption	• Develop Traffic Management Plan in conjunction with road authorities to manage all temporary accesses, delivery of material and machinery. • Submit a traffic management plan to local traffic authorities prior to mobilization. • Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions. • Allow for adequate traffic flow around construction areas. • Provide adequate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control.	*Details are given in Table 10.4*	Contractor	RD Construction supervisor

Table 10.3 Mitigation Plan for Operation phase

Activity	Location	Issue	Mitigation measure	Responsible authority (implementation)	Responsible agency (monitoring)

Accidental fuel/oil spill and/or roadside litter washed off/blown off into the river	Surface water	Water pollution	• The trained Maintained Contractor during the operation phase will have emergence respond plan for response mitigation measures. The above mentioned team will work according to this plan and will reduce and avoid the contamination of the water at the culverts by covering the spilled areas with the sand, after the sand will absorb the contamination sand will be taken to the specialized landfill areas; • But if the spilled oil/fuel accidently will be run to the culverts, the spilled oil/fuel is going to the sediment trap with filter (during cleaning of the culverts no water is used). The contaminated soil is excavated and is taken to the specialized landfill areas; • During the ordinary cleaning the Maintained Contractor will clean the culvert from the sediments mechanically without water usage; • Control over truck traffic to minimize spills;	Road Maintenance Contractor	RD, Traffic Police
Road resurfacing	Road/bridge	Water bodies pollution by heavy metals, hydrocarbons and debris	• Maintenance paving should be performed only in dry weather to prevent runoff contamination. • Proper staging techniques should be used 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.	Road Maintenance Contractor	RD
Noise	Residential area	Disturbance of local residents by traffic related noise	• Currently not required	n/a	n/a

Littering	Along the new road	Possible negative impact on wildlife, Water pollution, Aesthetic impact	• Ensure that the community is aware of the range of ways to dispose of their waste correctly; • Inform the community of the level of fines that littering incurs; • Signage may be an element of a roadside litter prevention program, educating the community that littering is illegal, fines apply and behaviours are monitored. The signs may be suitable for placement in a series of two to four signs at 10 km intervals to repeat the message in different ways. • Cleaning up	Road Maintenance Contractor	RD
Status of biodiversity	Along the new road	Impact on vegetation, Road kills of animals	• Remove faded plants, replace them with new • Keep records of accidents. • If accident hot spots with large mammals is identified, appropriate protective measures shall be elaborated (e.g. reflectors /local fencing, warning signs, speed reduction)	Road Maintenance Contractor	RD
Traffic	Along all road sections	Accidents due to winter typical hazards (snow, ice, fog)	• Installation of warning signs • Maintenance of tunnel to ensure safety • Informing	Road Maintenance Contractor	RD
Presence of the road structure, traffic redirection	Along all road section	Restricted access because of the highway acting as a barrier, Safety issues, impact on non-motorized transport	• Smooth operation of underpasses, overpasses, road junctions, and secondary roads within the highway area	Contractor, supervision by RD	RD

Table 10.4 Monitoring Plan

Issue	What parameter is to be monitored?	Where is the parameter to be monitored?	How Is the parameter to be monitored?	When is the parameter to be monitored? (Frequency)	Institutional responsibility
CONSTRUCTION PHASE					
Waste water	Quality parameters of waste water from construction camps and portable sites, according to relevant standards	At construction camps and portable facilities at work sites	Inspection of wastewater units, latrines and septic tanks	Frequency defined by Georgian Enviornmental standards	RD, Construction Supervision
Community tension and disruption	Satisfaction/disturbance level of the residents	Camp, Construction sites	Observation, surveys	Regular frequency or when changing operations	RD, Construction Supervision
Impact on topsoil	Striping of the topsoil Stockpiling, Protection from erosion and washing away	Worksite	Inspections; observation	During removal of the topsoil layer and preparation of the sites, After stockpiling, After completion of works on shoulders	RD, Construction Supervision
Oil/fuel spills	Oil/fuel spills	Worksite, car maintenance, servicing area (if available)	Inspections; observations	Unannounced inspections during construction	RD, Construction Supervision
Impacts created by material transport (stone, sand and gravel)	Are the truck loads covered or wetted; Compliance with the Contractor's Method Statement (restricted working hours; haul routes) dust suppression methods where required	Worksite / haul routes	Supervision	Unannounced inspections during work	RD, Construction Supervision
Impacts on trees near the working area	Are the trees located close to the project area protected by fence.	At sites where trees and forests are located along the construction site.	Supervision	After begin of construction works at the respective site	RD Construction Supervision
Air pollution from improper maintenance	Exhaust emissions, dust	At site	Visual inspection, measurements of exhaust emissions	Unannounced inspections during construction works	RD Construction Supervision, MENRP

of equipment/ machinery (general)					
Dustiness	Visual presence of dust	At construction sites	Visual monitoring	Regularly site visits	RD, Construction Supervision
Air Quality - tunnel	Measuring carbon monoxide (CO) and nitrogen dioxide (NO2) is recommendable in stage one. If the measurement results show exceeded allowable concentration values, the list of pollutants should be extended by measuring the concentrations of nitrogen monoxide (NO), sulphur dioxide (SO2), hydrocarbon (CXHY), and solids/particulates (PM10).	At the entrance and exit portals of the tunnel	Measurements using lboratory equipment	Two times during a day	RD, Construction Supervision
Contamination of surface water during construction - Shukghele stream, Suramula River	Suspended solids, organic compounds, lubricants, fuel, solvents, heavy metals, pH value, mineral oils	Sampling downstream the worksite	Water quality analysis	During construction works near in the water Unannounced inspections during works near watercourses	RD, Construction Supervision
Contamination of soil during construction	Heavy metals and greases and oils	Agricultural land	Soil quality analysis	One month before the commencement of works. During construction - quarterly.	RD, Construction Supervision
Noise	Noise Levels	Village	Noise measurement equipment	Quarterly	RD, Construction Supervision
Material supply Concrete production	Obtaining valid operation license or purchasing from licenced provider	Asphalt /concrete plant	Inspection	Before work begins	RD , Construction Supervision
Material supply	Obtain a licence for material	Sand and gravel	Inspection	Before work begins	RD,

Borrow areas	extraction	borrow pit			Construction Supervision
Damage to irrigation and other infrastructure	Visual damages	Agricultural lands	Visual observations	Weekly	RD, Construction Supervision
Material production/ extraction	Asphalt/concrete plant - possession of official approval or valid operating license	Asphalt /concrete plants	Supervision inspection	before work begins	RD, MENRP
Material production/ extraction	Stone quarry – availability of licence	Quarry	Supervision inspection	before work begins	RD, MENRP
Material production/ extraction	Sand and gravel borrow pit - possession of a license	Sand and gravel borrow pit	Supervision inspection	before work begins	RD, MENRP
Transportation	Traffic management - hours and alignments selected	Job site	Supervision inspection	Regular inspections during work	RD, Construction Supervision
Possible loss or damage to cultural resources in case of Chance Finds	Presence of chance finds	Construction site, during excavation works	Permanent archaeological supervision during earth works	During earth works	Construction Contractor Archaeologist-Supervisor
Vibration (whether appropriate)	Vibration levels	Job site	Supervision, observations	Regular inspections during work and on complain	RD, Construction Supervision
Noise disturbance to population and wildlife	Noise levels	Worksite, nearest residential areas, natural habitats	Mobile noise meter	Once per week and on any complaint	RD, Construction Supervision
Traffic disruption	Existence of traffic management plan	At job site	inspection; observation	Before works start; once per week at peak periods	RD, Construction Supervision
Workers safety	Protective equipment; organization of bypassing traffic	Work site	inspection	Regular inspections during work	RD, Construction Supervision
Slope stability	Status of slopes	Sensitive areas	Stability , identification of visual traces of possible erosion	Seasonally after adverse weather events(storm, gale)	RD, Construction Supervision
Impact on planted	Status of vegetation	Planted vegetation	Visual control	Seasonally	RD,

areas		areas			Construction Supervision
Noise disturbance (residents, workers)	Noise levels	Worksite, nearest residential areas	Noise meter	Upon receipt of complaints	RD, Construction Supervision
OHS	Use of personal protective equipment (PPE) relevant to the task; Training records; Organization of traffic on the construction site Keeping to the safety rules while working in the tunnel and/or on height	Worksite	Inspection; interviews; comparisons with the Contractor's method statement	Unannounced inspections during construction and upon complaint	RD, Construction Supervision
OPERATION PHASE					
Road safety	Proper signage and traffic control arrangements in place	Entire length of constructed EWH section	Inspection	Recurrent	RD
Adequate operation and maintenance of draiange systems	Drainage infrastucture in good technical condition	Entire length of constructed EHW	Inspection	Recurrent	RD
Environmental performance during maintenance works	Temporary on-site storage of construction materials and waste organized to prevent environment pollyution; Final disposal of construction waste and excess material into designated locations; Conduct of maintenance works in adequate seasonal and weather conditions; Appropriate installation of traffic regulation and warning signs.	Maintenance sites	isnpection	During conduct of maintenance works	RD

Regular maintenance and periodic replacement of greenery within the EWH corridor	Trees planed for compensation of removed plants and grass seeded for slope stabilization properly safeguarded, watered as needed, and prelaced to substitute dead plants.	Greened areas within the RoW	Inspection	Recurrent	RD
Livelihood restoration of project-affected households and communities	Project-affected individuals, households and communities re-gained streams of income and quality of life no wortse than prior to the project implementation	Settlements of the project-affected municipalities	Inspection, Internviews, Review of statistical data	Medium-term post-project	Administrations of project-affected municipalities

10.2. COST ESTIMATE OF ENVIRONMENTAL MITIGATION MEASURES

Approximate cost estimates for mitigation measures based on the unit cost for similar road project are given below. Comprehensive cost estimate will be provided as an part of the BoQ for the project.

Table 10.5. Environmental mitigation plan

Description	**Responsible institution**	**Unit**	**Qty**	**Unit cost, GEL**	**Total cost, GEL**
Vegetation clearing within the RoW – removal of shrubs (d<=0.1m)	Contractor	ha	1.4	2090.5	2926.7
Tree felling (d>.0.1m)	Contractor	unit	3306	9.25	30580.5
Topsoil stripping and removal to temporary storage area (removal of 100-250mm thick layer)	Contractor	m3	86.6	1.75	151.55
Planting of trees and maintenance of plantations	Contractor identified by RD	each	9918	14.03	139149.54
Planting bushes and their maintenance		m^2	1.4	6.12	8.568
Seeding with grass		ha	0.5	8378.84	4189.42
Compensation - land acquisition and resettlement	WIll be covered accorfing to the RAP				
Total cots					**177006.28**

Monitoring will comprise visual monitoring and control. The costs of monitoring will be covered by salary of EHS officer of contractor. Expenses related to measurements (water and air quality control) will depend on conditions of the contract signed with service provider.

11. PUBLIC CONSULTATION AND DISCLOSURE

Public consultation and disclosure will be conducted according to the World Bank policy, the Georgian laws and reasonable international practice.

At least two meetings with communities must be conducted in the project impact area:

- *at the beginning of the project during the ESIA scoping process* to inform stakeholders about some changes in the Terms of Reference of the Consultant for preparation of the ESIA and design studies. The meeting was held on November 12, 2014; (the minutes of meeting are enclosed);
- at the *Draft Final Report disclosure stage*, to inform the public about the likely impacts of the project and the way in which they will be mitigated, and to obtain their support to the measures as far as possible. Not scheduled yet.

The draft ESIA report will be posted on the website of the RDHard copies of the document were made available at the offices of local self-governments located within the project implementation area (Khashuri).

The RD will organize a public consultation meeting to discuss the draft ESIA report as well as the draft Resettlement Action Plan (RAP). Information about the venue, date and time of the meeting will be published in the national coverage newspaper. Other methods – emails, direct contact will also be used. All stakeholders (including, local community, representatives of local administration, NGOs, PEC, RD and MENPR) will be invited. Feedback from stakeholders will be considered and incorporated in the final version of the ESIA report.

12. REFERENCES

1. Ministry of Environment Protection (2008): Regulation "On Calculation Method for Acceptable Limits and/or Temporarily Agreed Standards of Emissions of Harmful Substances into Air"; Order No. 705, 20/10/2008.
2. Ministry of Labour, Health Care and Social Affairs (2003): Acceptable limit concentrations of pollutants in atmospheric air of residential areas, hygiene standards; "On Approval of Qualitative Environmental Standards"; Order No 38/n 24/02/2003.
3. Aarhus Centre Georgia (2008): Guidelines on how to obtain the permit for Environmental Impact Assessment from the Ministry of Environment Protection of Georgia, Updated 7 April, 2008. Tbilisi, Aarhus Centre, Georgia.
4. Kocks Consult GmbH and BT Designing and Consulting Company (2009a): Feasibility Study and Alternative Alignment Analysis for Upgrading the Section between Sveneti and Rikoti, km 80 – km 144 of the E 60 Highway. Inception Report, March 2009.
5. Kocks Consult GmbH and BT Designing and Consulting Company (2009b): Feasibility Study and Alternative Alignment Analysis for Upgrading the Section between Sveneti and Rikoti, km 80 – km 144 of the E 60 Highway, Interim Report, May 2009.
6. Kocks Consult GmbH and BT Designing and Consulting Company (2009c): Preliminary Results of Household Survey: Feasibility Study and Alternative Alignment Analysis for Upgrading the Section between Sveneti and Rikoti, km 80 – km 144 of the E 60 Highway. Unpublished Report.
7. World Bank (1999a): Public Consultation in the EA Process: A Strategic Approach, EA Update #26. Washington, DC: World Bank.
8. World Bank (1999): OP 4.01 - Environmental Assessment, updated in February 2011. Washington, DC: World Bank.
9. World Bank (2001, updated 2007): Involuntary Resettlement. Operational Policy 4.12. Washington DC: World Bank.
10. World Bank (2006, updated 2007): Physical Cultural Resources. Operational Policy 4.11. Washington DC: World Bank.
11. World Bank (1999): OP 4.04 - Natural Habitats, revised in August 2004. Washington, DC: World Bank.
12. World Bank (2002): BP 4.36 - Forests. Washington, DC: World Bank.
13. World Bank (1999): OP 4.11 - Physical Cultural Resources, updated in March 2007. Washington, DC: World Bank.
14. European Commission (1985). Environmental Assessment. Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment. 85/337/EEC (Reference: Official Journal NO. L 175 , 05/07/1985 P. 0040 - 0048).
15. Handbook on Roads and Environment. Permanent weblink: http://go.worldbank.org/7989W6YLJ1
16. Climate and Climatic Resources of Georgia. Transactions of Transcaucasian Research Hydrometeorological Institute. Hydrometeorological Publishing House. Leningrad, 1971.
17. საქართველოს წითელი ნუსხა, საქართველოს პრეზიდენტის ბრძანება №303, 2006 წ. 2 მაისი.

18. ბუხნიკაშვილი ა. 2004. მასალები საქართველოს წვრილ ძუძუმწოვართა (Insectivora, Chiroptera, Lagomorpha, Rodentia) კადასტრისათვის. გამ. “უნივერსალი”, თბილისი: 144 გვ.
19. გურიელიძე ზ. 1996. საშუალო და მსხვილი ძუძუმწოვრები. წიგნში: “საქართველოს ბიომრავალფეროვნების პროგრამის მასალები”. თბილისი: 74-82.
20. კუტუბიძე მ. 1985. საქართველოს ფრინველების სარკვევი. თსუ გამომცემლობა, თბილისი: 645 გვ.
21. ჯანაშვილი ა. 1963. საქართველოს ცხოველთა სამყარო. ტ. III. ხერხემლიანები. თსუU გამომცემლობა, თბილისი: 460 გვ.
22. Верещагин Н.К. 1959. Млекопитающие Кавказа. История формирования фауны // Изд. АН СССР, М.-Л. : 703 с.
23. Гаджиев Ф.А. 1986. Животный мир. В кн.: Г. Габриелян (ред.), Физическая География Закавказья. Ереван, изд-во Ереванского гос. Ун-та.
24. Девдариани Г.С. 1986. Закавказская депрессия. В кн.: Г. Габриелян (ред.), Физическая География Закавказья. Ереван, изд-во Ереванского гос. Ун-та.
25. Мусеибов М.А., Назарян Х.Е., Габриелян Г.К., Джакели Х.Г. 1986. Физико-географическое зонирование. В кн.: Г. Габриелян (ред.), Физическая География Закавказья. Ереван, изд-во Ереванского гос. Ун-та.
26. Мусхелишвили Т.А. 1970. Пресмыкающиеся Восточной Грузии. Мецниереба, Тбилиси: 241.
27. Яблоков А. В., Остроумов С. А. 1985. Уровни охраны живой природы. М.: Наука: 176 с.
28. ნ.კეცხოველი, ა.ხარაძე, რ.გაგნიძე - ,,საქართველოს ფლორა’’, I –XIV ტომი 1987-1996.
29. რ. გაგნიძე მცენარეთა ნომენკლატურული ნუსხა, 2005წ.
30. Методика проведения инвентаризации выбросов загрязняющих веществ в атмосферу для баз дорожной техники (расчетным методом). М, 1998.
31. Метод.пособие по расчету, нормированию и контролью выбросов загрязняющих веществ в атмосферный воздух. С.П_2005г.
32. Методикой расчета выделений (выбросов) загрязняющих веществ в атмосферу при сварочных работах (на основе удельных показателей). СПб, 1997» (с учетом дополнений НИИ Атмосфера 2005 г.).

13. MINUTES OF PUBLIC CONSULTSTION PROCESS

Public consultation meeting on
Terms of Reference
for Environmental and Social Impact Assessment
for construction of the E-60 highway bypass between
Osiauri and Chumateleti

12.11.2014

Tbilisi

Chairman of meeting – Nugzar Gasviani

Secretary of meeting – Luiza Bubashvili

Speakers: Maka Stamateli, Maya Vashakidze, Mariam Begiashvili

Attendees of the Meeting:

From Roads Department – Davit Getsadze, Tamar Japaridze,

Gia Abramia – Managing Director of the center for Environmental Protection

Gia Zhorzholiani – Greens Movement of Georgia, Friends of Earth, Environmental Expert

Levan Gurgenidze – Ecovision

Agenda of the Meeting:

Introduction and context

Presentation of TOR

Questions & answers

Topic presented: Introduction made by Nugzar Gasviani about construction of the E-60 highway. The speaker mentioned that Georgia, located along the transit corridor and connecting Europe and Asia, has a potential to connect some countries in the region with global economy. In view of this, the Roads Department has extended a contract with Cowi/Gamma to carry out Environmental and Social Impact Assessment (ESIA). TOR of this contract was upgraded to introduce more detailed description of the specific tasks that the consultant shall undertake and of the outputs that the consultant shall produce. ESIA report will be developed based on the World Bank's safeguard policies: OP/BP 4.01 Environmental Impact Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.11

Cultural Heritage, OP/BP 4.12 Involuntary Resettlement and OP/BP 4.20 Gender and Development. The project is classified as environmental category "A", since it covers new construction which may have significant and irreversible impacts on the natural and social environment. Pursuant to the national legislation environmental permit need to be obtained.

The original TOR, as well as revisions made to it recently, was presented by the Consultant's team member Ms. Maka Stamateli. She explained how COWI will approach the upcoming assignment, what would be the scope of various thematic studies under ESIA, and how the ESIA process will be informed by engagement of various stakeholders.

Information concerning the World Bank OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement and OP/BP 4.20 Gender and Development was provided by Maya Vashakidze and Mariam Begiashvili. They explained World Bank Guidelines for environmental and social management.

Table of questions/feedback

Gia Abramia	Does the TOR cover a study of potential noise disturbance to local population during construction and operation of the highway?	All aspects of potential nuisance to project-affected people will be explored as part of the ESIA and extent of expected disturbance will be estimated. Based on this research, the Consultant shall provide recommendation for the application of mitigation measures. Environmental Management Matrix of the ESIA report shall provide guidance on monitoring effectiveness of the recommended mitigation measures too. Roads Department, through the supervision consultant, will follow monitoring plan and check construction contractor's performance against suggested indicators. In case of complaints from the affected people, Roads Department may decide to apply additional measures for addressing the issue.
Gia Zhorzholiani	When the draft Environmental and Social Impact Assessment report will be available?	Draft Environmental and Social Impact Assessment report will be available for stakeholders once the World Bank clears it for public disclosure. The document will be disclosed on the web page of the Roads Department in Georgian and English languages. Public consultation process will start upon disclosure of the report and will provide all stakeholders an opportunity to ask questions and comment on the draft report either by written submissions or by participation in consultation meetings. The ESIA report will then be finalized through incorporation of relevant public feedback and be re-disclosed in both languages.
Gia Abramia	Will the ESIA look at the expected impacts of the project on the	As part of the social impact assessment, the ESIA will explore all potential impacts that the project may have on the local communities. The overall goal of the project is to facilitate economic activity and growth. As

	traditional lifestyle and economic activity of the affected communities (e.g. animal husbandry)?	for the local communities in particular, the Roads Department is obligated to ensure that no one is left worse of as a result of the project implementation. Therefore, if ESIA reveals potential issues that highway construction may cause to movement of cattle within the highway corridor, then adequate cattle passes will be arranged.

Chairman of meeting: Nugzar Gasviani, First Deputy Chairman of Roads Department of Georgia

Secretary of meeting: Luiza Bubashvili

მონაწილეთა სია

სახელი და გვარი	ორგანიზაცია საკონტაქტო ინფორმაცია	ხელისმოწერა.
[illegible]	RD 593.32.30.77.	
[illegible]	GMG 577466446	
[illegible]	ICFER 599246287	
[illegible]	Roads Department 558 340566	
[illegible]	Roads Department 593001991	
[illegible]	„ეკოვიზია" „ecovision"	
[illegible]	RD 577744088	
[illegible]	[illegible] 595196839	

MINUTES

of public consultation meeting on
Environmental and Social Impact Assessment and Resettlement Policy Framework
for construction of the E-60 highway bypass between
Osiauri and Chumateleti

25.05.2015

Khashuri

Gamgeoba (Municipality) Administration Building

Chairman of meeting - Gia Sopadze

Secretary of meeting - Maya Vashakidze

Speakers:

Maka Stamateli - Environmental specialist COWI/GAMMA

Maya Vashakidze - Environmental Consultant RDMRDI

Mariam Begiashvili - Social Safeguards Consultant RDMRDI

Gia Sopadze - Head or Environmental Protection Unit Resettlement and Environmental Protection Division RDMRDI

Attendees of the Meeting: See attachment 1

Agenda of the Meeting:

1. Introduction and context
2. Presentation of the ESIA for construction of the E-60 highway bypass between Osiauri and Chumateleti
3. Presentation of Resettlement Policy Framework for construction of the E-60 highway bypass between Osiauri and Chumateleti

Topic presented: Mr. Gia Sopadze made an introduction about construction of the E-60 highway. The speaker mentioned that Georgia, located along the transit corridor and connecting Europe and Asia, has a potential to connect some countries in the region with global economy. World Bank has been financing series of East-West Highway Improvement Projects for a number of years. At present

East-West Highway Corridor Improvement Project is under preparation. It will rehabilitate a section of Highway between Zemo Osiauri and Chumateleti. While the design of works was underway, Cowi/Gamma – a consultant consortium hired by the Roads Department (RD) commented an Environmental and Social Impact Assessment (ESIA). The ESIA report was carried out based on the World Bank's safeguard policies: OP/BP 4.01 Environmental Impact Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.11 Cultural Heritage, OP/BP 4.12 Involuntary Resettlement and OP/BP 4.20 Gender and Development. The Project is classified as environmental category "A", since it covers new construction which may have significant and irreversible impacts on the natural and social environment. Pursuant to the national legislation environmental permit need to be obtained.

Ms. Maka Stamateli explained how COWI/GAMMA approached the upcoming assignment, what was the scope of various thematic studies under ESIA, and how the ESIA process was informed by engagement of various stakeholders. It was mentioned that, ESIA was incorporated a range of desktop studies and field surveys. The baseline studies included the following components: Climate and meteorology; Geology, geomorphology; Hydrology, hydrogeology; Soils, landscape and land use; Air quality and noise; Seismic conditions and hazardous processes; Habitats, flora and fauna; Historical and archaeological sites; and Social environment. Sensitive receptors were identified. Direct and indirect; short term, medium and long term; negative and positive; reversible and irreversible (if any) impacts on biodiversity, physical and social environments in the project impact zone during construction and on operation stage, were evaluated. It has been stressed that the ESIA team were cooperate with design team and resettlement specialist to ensure avoidance, minimization and/or mitigation of potential impacts on recipients. Mitigation measures for medium and high impacts were recommended; residual and cumulative impacts - ranked. The ESIA was carried out with consideration of the national environmental legislation/regulations and the Works Bank requirements. Transparency of information was ensured throughout the ESIA process. Information was posted to the RD website and remain in public domain for familiarization and review. Feedback mechanisms was explained to community to make stakeholder engagement process efficient.

Ms. Maya Vashakidze provided information concerning the World Bank OP/BP 4.01 Environmental Assessment, OP/BP 4.04 Natural Habitats, OP/BP 4.11 Physical Cultural Resources and OP/BP 4.20 Gender and Development was provided by Maya Vashakidze. She explained World Bank Guidelines for environmental and social management.

Ms. Mariam Begiashvili provided information on present document-RPF and focused attention on Safeguard Policy Requirements OP/BP 4.12 and main principles, approaches of Georgian legislation, also on Property/land evaluation methodology. Land acquisition is expected (up to 400 agricultural land plots), also physical displacement of residents is expected-up to 4-6 residual/summer houses. However, the project triggers World Bank Safeguards policy OP/BP 4.12, a Resettlement Policy Framework (RPF) is prepared and the RAP will be prepared by independent consultant based on presented RPF. The purpose of the RPF is to ensure that there is no adverse effect on the living conditions and livelihoods of the affected people as a result of loss of land.

Below is a summary of Q&A session which followed presentations by RD and COWI/GAMMA:

	Question	Answer
1.	Will the construction of the Highway damage water supply	ESIA explored all types of impacts from the upcoming construction works, including impacts on the existing infrastructure. ESIA identified that the

	system?	selected corridor of the highway does not overlap with water supply systems and there will not be any damage of the water supply systems during the construction works on the highway.
2.	Is there any possibility that the construction works will damage Bijnisi, Urtkhva, Zakota, Bugauri or Surami water supply systems?	The Water Supply Systems are located away from the construction area. There is no risk of damage to the water supply infrastructure.
3.	What happens if the construction of the highway cause the landslide?	The feasibility study report and engineering geological survey carried out by "Geoengineeting" Ltd under the request of the design company have identified sensitive locations in the project area. Alternative selected as preferable bypasses all known landslide bodies in the study area. Development of hazardous processes within the RoW is not expected.
4.	Will the local population have any preference in being employed during the construction works?	The local population will be employed during the construction works. Based on the experience and practices under the similar road projects, it could be assumed that about 200 persons will be employed during the construction process, out of which 60%-70% will be local residents. Both: semi-skilled and unskilled local workers are likely to be hired for works on E-60.
5.	If the local roads are damaged during the construction works, will the Contractor repair them?	The Contractor will be responsible for prompt repairing of damaged local roads. RD will enforce adherence to this rule.
6.	Will the local population have access roads for their lands?	The final design of the highway section is still in works. Once it is completed, Resettlement Action Plans (RAPs) will be prepared looking at all land and access related aspects of the construction and operation of the highway. RAPs will be worked out with full participation of local communities to ensure that none of their needs is overlooked. Draft RAPs will be disclosed for public feedback and finalized thereinafter.
7.	Will the local population be protected from the noise?	According to the ESIA report, the local population will not experience significant noise disturbance neither at the construction phase, not during operation of the highway. Noise levels event in the settlements closest to the construction sites will be within permitted range. In addition, RD will ensure that construction equipment is maintained in a good technical condition and that no noisy activities are performed beyond work hours set between 07:00am to 07:00pm. As for the operation phase, modelling of noise impacts showed that there will be almost no noise impact to the local population and no specific mitigation measures are required.
8.	What will be the compensation amount for land acquisition?	Compensations types and amounts will be established in RAPs currently under preparation. This is a participatory process based on full involvement of the affected people. The final draft RAPs will be available for public feedback prior to completion. Independent auditors are fixing the land market price at the moment based on relevant research of land market and valuation of your land plots according to the methodology. The methodology will be also part of RAP and will be described in information leaflet.

9.	In case if the compensation price will not be acceptable for us, what is the scenario: will be land taken anyway?	The LAR (Land Acquisition and Resettlement) process is conducted under the Eminent Domain law and in case of disagreement, the land will be expropriated upon the court decision. Court will review the prices provided by independent auditors, opinion provided by valuators hired by plaintiffs and may also engage other independent auditors. The Court decision is final. No land acquisition will be carried out before the payments are executed according to the Court decision. The issue could be solved at pre-litigation stage through negotiations and Grievance Redress Mechanism, which we have described during our presentation.
10.	How will be compensated perennial plants?	Compensation value of perennial plants will be defined according to the market rates on the basis of type, age and productive value of the trees.
11	What is the sum that families with 5 members will receive?	We have mentioned families consisting of 5 members just to say that the allowances for vulnerable and severely affected households are determined in the amount of minimum subsidence assigned by the Georgian Government for the families with 5 members. However, this fixed sum will be paid in our case to all vulnerable and severely affected families.
12.	How will be compensated lost buildings and ancillary structures?	Lost structures will be compensated at replacement cost, taking into account current prices on materials, transportation, workforce etc. These prices are calculated without any depreciation. The amount paid as compensation should be sufficient to construct the same type of structure in similar place today.

Attachment 1

აღმოსავლეთ-დასავლეთ მაგისტრალის E-60 ზემო ოსიაური- ჩუმათელეთის გზის მონაკვეთის (126კმ- 143კმ) მოდერნიზების სამუშაოების ბუნებრივ და სოციალურ გარემოზე ზემოქმედების შეფასება

მოსახლეობასთან შეხვედრა, ხაშური 25/05.2014

დამსწრეთა სია

	გვარი, სახელი	ორგანიზაცია	საკონტაქტო ინფორმაცია (ტელეფონი, ელ ფოსტა)	ხელმოწერა
	[illegible]		551 77 22 98 INAKAZISHVILI	
	[illegible]		591 05 73 77	
	[illegible]		557 77 40 48	
	[illegible]		557 23 06 29	
	[illegible]		591 68 18 78	
	[illegible]		598 210-212	
	[illegible]		591-93-32 25	
	[illegible]		599-37-92-36	
	[illegible]	[illegible]	598 15 60 69	

	ყასოყევი სერგო		5-99 55 29 34	[signature]
	ბოგასაძე დავით		598212436	[signature]
	ნოზაძე ზაზა		591-81-33-98	[signature]
	ქოვალძ ლაშა		558-14-21-31	[signature]
	ბეჟაძე ილია		593-50-65-96	[signature]
	მაისურაძე ზურა		599-494-301	[signature]

MINUTES

of public consultation meeting on
Environmental and Social Impact Assessment and Resettlement Policy Framework
for construction of the E-60 highway bypass between
Osiauri and Chumateleti

27.05.2015

Tbilisi, Roads Department of Georgia

Ministry of Regional Development and Infrastructure

Chairman of meeting - Zauri Apshinashvili

Secretary of meeting - Maya Vashakidze

Speakers:

Maka Stamateli - Environmental specialist COWI/GAMMA

Maya Vashakidze - Environmental Consultant RDMRDI

Mariam Begiashvili - Social Safeguards Consultant RDMRDI

Gia Sopadze - Head or Environmental Protection Unit Resettlement and Environmental Protection Division RDMRDI

Zauri Apshinashvili - Deputy Head of Resettlement and Environmental Division

Attendees of the Meeting: See attachment 1

Agenda of the Meeting:

1. Introduction and context
2. Presentation of the ESIA for construction of the E-60 highway bypass between Osiauri and Chumateleti
3. Presentation of Resettlement Policy Framework for construction of the E-60 highway bypass between Osiauri and Chumateleti

Topic presented:
Mr. Zaur Apshinashvili made an introduction about construction of the E-60 highway. The speaker mentioned that Georgia, located along the transit corridor and connecting Europe and Asia, has a

potential to connect some countries in the region with global economy. World Bank has been financing series of East-West Highway Improvement Projects for a number of years. At present East-West Highway Corridor Improvement Project is under preparation. It will rehabilitate a section of Highway between Zemo Osiauri and Chumateleti. While the design of works was underway, Cowi/Gamma – a consultant consortium hired by the Roads Department (RD) – commenced an Environmental and Social Impact Assessment (ESIA). The ESIA was carried out based on the World Bank's safeguard policies: OP/BP 4.01 Environmental Assessment, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement; and OP/BP 4.20 Gender and Development. The Project is classified as environmental category "A", since it covers new construction which may have significant and irreversible impacts on the natural and social environment. Pursuant to the national legislation, environmental permit need to be obtained.

Ms. Maka Stamateli, explained how COWI approached the ESIA assignment, what was the scope of various thematic studies under ESIA, and how the ESIA process was informed by engagement of various stakeholders. It was mentioned that ESIA was based on a range of desktop studies and field surveys. The baseline studies included the following components: Climate and meteorology; Geology, geomorphology; Hydrology, hydrogeology; Soils, landscape and land use; Air quality and noise; Seismic conditions and hazardous processes; Habitats, flora and fauna; Historical and archaeological sites; and Social environment. Sensitive receptors were identified. Direct and indirect; short term, medium and long term; negative and positive; reversible and irreversible (if any) impacts on biodiversity, physical and social environments in the project impact zone during construction and on operation stage, were evaluated. ESIA team cooperated with design team and resettlement specialist to ensure avoidance, minimization and/or mitigation of potential impacts on recipients. Mitigation measures for medium and high impacts were recommended; residual and cumulative impacts - ranked. The ESIA was carried out with consideration of the national environmental legislation/regulations and the Works Bank requirements. Transparency of information was ensured throughout the ESIA process. Information was posted to the RD's website and remain in public domain for familiarization and review. Feedback mechanism was explained to community to make stakeholder engagement process efficient.

Ms. Maya Vashakidze provided information concerning the World Bank OP/BP 4.01 Environmental Assessment, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement; and OP/BP 4.20 Gender and Development. They explained World Bank Guidelines for environmental and social management.

Ms. Mariam Begiashvili provided information on present document-RPF and focused attention on Safeguard Policy Requirements OP/BP 4.12 and main principles, approaches of Georgian legislation, also on Property/land evaluation methodology. Land acquisition is expected (up to 400 agricultural land plots), also physical displacement of residents is expected-up to 4-6 residual/summer houses. However, the project triggers World Bank Safeguards policy OP/BP 4.12, a Resettlement Policy Framework (RPF) is prepared and the RAP will be prepared by independent consultant based on presented RPF. The purpose of the RPF is to ensure that there is no adverse effect on the living conditions and livelihoods of the affected people as a result of loss of land.

TV crews of "Public Channel" and "Imedi" attended the consultation meeting filming footage, and both of these companies broadcasted information about the draft ESIA report discussion later in the

day. The TV channels took interviews from Zaur Apshinashvili and Mariam Begiashvili about the key messages of the Resettlement Policy Framework (RFP) and ESIA report. (https://www.youtube.com/watch?v=4iDcTX1X8Qc)
Below is a summary of Q&A session which followed presentations by RD and COWI/GAMMA:

	Question	Answer
1.	Does the ESIA report cover potential noise disturbance to local population during construction and operation of the highway?	All aspects of potential nuisance to project-affected people were explored as part of the ESIA and extent of expected disturbance was estimated. Noise impact is expected at the construction phase, coming from the operation of construction machinery. Noise impact assessment was made for the settlements nearest to the project site. It was concluded that the increase of noise levels during construction to be felt in the settlements will minor and will fall within the allowable range. Nonetheless, measures for mitigating noise impacts are included in the Environmental Management Plan and will be enforced during construction. For instance, noise generating activities will not be allowed beyond standard working hours. Modeling of noise levels during operation of the constructed highway was carried out as part of ESIA in order to explore impacts of the operation phase. The conclusion is that noise disturbance during highway operation will be insignificant and will not require application of any specialized mitigation measures. In a long term perspective, if traffic through the east-West Highway increases significantly, noise disturbance may become an issue, in which case RD will design and apply relevant mitigation measures, such as placement of noise barriers, additional plantations of trees, etc.
2.	Did the ESIA look at the expected impacts of the Project on the traditional lifestyle and economic activity of the affected communities (e.g. animal husbandry)?	As part of the social impact assessment, the ESIA explored all potential impacts that the Project may have on the local communities. Restricted access to agricultural fields, possible damage of agricultural land plots and pastures were examined in detail. In the locations where construction of carriageway will place barriers to free access or cause fragmentation of land plots/pastures, convenient road crossings will be designed and built in agreement with the local stakeholders. It is already planned to construct 10 connecting bridges in the sensitive section of the road (first 10 km of the road).
3.	Will the local population be employed during the construction works?	The local population will be employed during the construction works. Based on the experience and practice applied under similar road projects on the E-60 highway, it could be assumed that about 200 persons will be employed during the construction process, out of which 60%-70% will be local residents. During the construction phase, both semi-skilled and unskilled local workers are likely to be hired. The Constraction Company's contract will envisage the prioritized employment of the locals and supervision Company and local authorities will take care that these conditions are met.
4.	Will the local population be protected from the noise?	According to the ESIA report, the local population will not suffer from noise impact neither at the construction nor at the operation phases of the Project. During the construction phase, keeping machinery and equipment in good technical condition and prohibiting engine idling will allow to decrease modest noise impacts even lower. Noise-generating activities will be prohibited between 07:00pm and 07:00am. As regards to the operation phase, as already mentioned, there will be almost no noise impact to the local population.
5.	What will be the compensation amount for land acquisition?	Compensation types and amounts will be detailed in the Resettlement Action Plans, which are under preparation. This is a participatory process based on full participation of the affected people. The final drafts of the Resettlement Action Plans will be available for public feedback prior to completion. Independent auditors are fixing the land market price at the moment based on relevant research of land market and valuation of your land plots according to

		the methodology. The methodology will be also part of RAP and will be described in information leaflets to be disseminated to the Project-affected people.
6.	When the construction of the new Highway will start?	It is planned to start construction works approximately in the first quarter of the 2016.
7.	How will the company treat damaged infrastructure?	If any existing infrastructure appears is in the way of highway alignment, it will be shifted away prior to commencement of construction works. In case of accidental damage of local roads or communications, the construction company will be obligated to restore them to the original condition or improve as feasible.
8.	How will the perennial plants be compensated?	Compensation value of perennial plants will be defined based on the market rates and will depend on the species, age and productive value of trees.
9.	How will loss of buildings and ancillary structures be compensated?	The lost structures will be compensated at their replacement cost, taking into account current prices on materials, transportation, workforce etc. These prices are being calculated without any depreciation. The amount paid as compensation should be sufficient to construct the same type of structure in a similar place today.
10.	How will the loss of crops be compensated? Do we have possibility to harvest crops this year?	In any case, crop compensation for 1 year will be given to affected people in cash at a market rate by default, at the gross crop value of expected harvest, even in case if crop is harvested prior to commencement of land acquisition process. Land acquisition is expected to start in October/November this year.
11.	In case if the compensation price will not be acceptable for us, what is the scenario: will the land be taken anyway?	The LAR (Land Acquisition and Resettlement) process shall be conducted under the Eminent Domain law and in case of disagreement, the land will be expropriated upon the court decision. Court will review the prices provided by independent auditors in a RAP, opinion of valuators hired by plaintiffs, and may also engage other independent auditors. The Court decision is final. No land acquisition is done before the payments are made according to the Court decision. The issue could be solved at pre-litigation stage through negotiations and Grievance Redress Mechanism, which we have described during our presentation. In the presented RPF you can find description of Grievance Redress Mechanism.

Attachment 1

მონაწილეთა სია

№	სახელი, გვარი	ორგანიზაცია/ საცხოვრებელი ადგილმდებარეობა	საკონტაქტო ინფორმაცია	შენიშვნა
1			598 742 042	
2		RD	599-45-70-70	
3			595 208812	
4			599 196839	
5			577288 71	
			599246287	

მონაწილეთა სია

№	სახელი, გვარი	ორგანიზაცია/ საცხოვრებელი ადგილმდებარეობა	საკონტაქტო ინფორმაცია	შენიშვნა
1	[illegible]	RD	59332307	
2	[illegible]	RD	577 744088	
3	[illegible]	RD	595 219126	
4	[illegible]	RD	599 214048	
5	[illegible]	RD	59840888	
6.	[illegible]	[illegible] "[illegible]"	574738871	


GAP