**Ministry of Regional Development and Infrastructure of Georgia.**
**Roads Department of Georgia.**

# DETAILED DESIGN FOR THE CONSTRUCTION OF POTI-GRIGOLETI-KOBULETI BYPASS. SECTION OF INTERNATIONAL E-70 SENAKI-POTI (DETOUR) - SARPI (BORDER OF TURKISH REPUBLIC) ROAD

## LOT 1: GRIGOLETI-KOBULETI BYPASS ROAD

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## ACTIVITY 2 (DETAILED DESIGN, LOT 1)
## ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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## LIST OF ACRONYMS

| | |
|---|---|
| AASHTO | American Association of Highway and Transportation Officials |
| ACC | Automatic counts (traffic) |
| AH | Affected households |
| AP | Affected people |
| EA | Environmental Assessment |
| EIB | European Investment Bank |
| CLS | Core Labour standards |
| EMP | Environmental Management Plan |
| ESIA | Environmental and Social Impact Assessment |
| EU | European Union |
| FS | Feasibility Study |
| GoG | Government of Georgia |
| HGV | Heavy Goods Vehicle |
| HSE | Health, Safety, Environment |
| HS | Health and Safety |
| ILO | International Labour Organisation |
| KP | Kilometre Post |
| LA | Land Acquisition |
| LV | Light vehicle |
| MCC | Manual Classification Counts (traffic) |
| MCMP | Ministry of Culture and Monument Protection of Georgia |
| MENRP | Ministry of Environment and Natural Resources Protection of Georgia |
| MESD | Ministry of Economy and Sustainable Development of Georgia |
| MLHSA | Ministry of Labour, Health and Social Affairs of Georgia |
| MRDI | Ministry of Regional Development and Infrastructure of Georgia |
| NGO | Non-Governmental Organization |
| O/D | Original destination (traffic survey) |
| OP/BP | World Bank's Operational Policy/Bank Policy |
| PAP | Project affected person |
| PAH | Project affected household |
| pK | Reference point (piquet) |
| PR | EBRD Performance requirement |
| QC/QA | Quality Control and Quality Assurance |
| RAP | Resettlement Action Plan |
| RLG | Red List 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 | World Bank |
| WHO | World Health Organisation |

## GLOSSARY

| | |
|---|---|
| Accidental impact | Impact that results from accidental (unplanned) events within the Project (e.g. fuel spillage during re-fuelling) or in the external environment affecting the Project (e.g. landslide). In these cases the probability of the event occurring is considered. |
| Area of influence | Area of influence is the overall area affected by the Project, including, for example, construction camps and lay-down areas. The percentage of habitat impacted is by reference to the national area of such habitat. In practice it is not possible, nor is it intended to try, to calculate these percentages. Instead, this criteria is used to provide an approximate indication, based on professional judgement and available knowledge, of the proportion of any one type of habitat that may be affected, primarily for the purposes of highlighting where a large proportion of a habitat is affected |
| Cumulative impact | Impact that act together with other impacts, from the same or other Projects, to affect the same environmental or social resource or receptor |
| Direct (or primary) | Impact that results from a direct interaction between a planned activity and the receiving environment |
| Hazard | Potential impact |
| Impact | Any change to the physical, biological or social environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services |
| Indirect impact | Impact that results from other activities that are encouraged to happen as a consequence of the Project (e.g. new business set up to cater for increased traffic on roads) |
| Land acquisition | Land acquisition refers to the permanent and temporary loss of use of the land by a farmer and any other users of the land (e.g. graziers, people who use vegetation on the land for fuel, |

| | |
|---|---|
| | etc.) and subsequent restrictions on use during operation. |
| Long-term impact | Impact that will continue over an extended period, but ceases when the Project stops operating. These will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period |
| Magnitude of impact | Magnitude is used to encompass nature of the change (what is affected and how); size, scale or intensity; geographical extent and distribution; duration, frequency and reversibility. |
| Mitigation measures | Actions or systems that are used, or have been proposed, to avoid, eliminate, reduce or compensate for identified impacts. |
| Natural habitats | Natural habitats are land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions. Habitat may be considered to be critical by virtue of (i) its high biodiversity value; (ii) its importance to the survival of endangered or critically endangered species; (iii) its importance to endemic or geographically restricted species and sub-species; (iv) its importance to migratory or congregatory species; (v) its role in supporting assemblages of species associated with key evolutionary processes; (vi) its role in supporting biodiversity of significant social, economic or cultural importance to local communities; or (vii) its importance to species that are vital to the ecosystem as a whole (keystone species). |
| Negative impact | Impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor |
| Permanent impact | Impact that occurs during the development of the Project and causes a permanent change in the affected receptor or resource (e.g. the destruction of a cultural artefact) that endures substantially beyond the project lifetime |
| Positive or beneficial | Impact that is considered to represent an improvement to the |

| | |
|---|---|
| impact | baseline or introduces a new desirable factor |
| Secondary impact | Impact that follows on from the primary interactions between the project and environment as a result of subsequent interactions within the environment (e.g. loss of part of a habitat affects the viability of a species population over a wider area) |
| Short-term impact | Impact that is predicted to last only for a limited period (e.g. during construction) but will cease on completion of the activity, or as a result of mitigation/reinstatement measures and natural recovery (e.g. temporary employment of unskilled workers during construction) |
| Social determinants of health (SDH) | SDH are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems. |
| Risk | Likelihood x consequence |

# 1. INTRODUCTION

The Government of Georgia (GoG) 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. 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 main targets of the program for upgrading are major roads in Georgia such as E-60 and E-70. The World Bank, JICA and ADB have already providing series of loans to the Government of Georgia for construction/rehabilitation of the road infrastructure.

As a part of the program under the funding from European Investment Bank (EIB), construction of Grigoleti-Kobuleti bypass and Poti-Grigoleti sections of international Senaki Poti (detour) - Sarpi (border of Turkish Republic) road is planned.

Consortium represented by Getinsa-Payma-Eurostudios has been awarded a contract for the mentioned project. As defined under the Terms of Reference for this assignment, feasibility study of Poti-Grigoleti-Kobuleti bypass have been carried out. This stage was followed by development of detailed design, preparation of bidding document, elaboration of environmental protection and resettlement documents for Grigoleti-Kobuleti bypass. Design for the Poti – Grigoleti section is pending.

To deal with environmental and social (including resettlement) components of the assignment Georgian environmental consultancy company - Gamma Consulting Ltd (hereinafter – Gamma) has been hired by the Consortium. The tasks of Gamma under the contract include 1) preliminary impact assessment of the project alternatives and development of Resettlement Framework on Feasibility Study stage and 2) preparation of the full scale ESIA and Resettlement Action Plan (RAP) on the detailed design stage of the project.

This report presents draft Environmental and Social Impact Assessment (ESIA) for Grigoleti-Kobuleti bypass component of the project developed based on PESIA prepared during FS, detailed design and additional site surveys carried out by the team of environmental and social specialists.

**NEED FOR ESIA**

The project belongs to the types of activities capable to have significant environmental and/or social impact and requires full-fledged environmental impact assessment according to both the national and IFI environmental regulations (ref. Law of Georgia on Environmental Impact Permit; EU EIA Directive (DIRECTIVE 2011/92/EU as amended by Directive 2014/52/EU - Annex I); EBRD Environmental and Social Policy (Category A project); EIB statement of Environmental and Social principles and Standards; etc.).

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.

In the course of assessment the issues related to labour, health and safety – need for compliance with labour standards, occupational and community health and safety, population movement (including involuntary resettlement issues, with particular focus on vulnerable groups) was paid attention to. The process was carried out with active involvement of the stakeholders.

# 2. LEGAL AND POLICY FRAMEWORK

The ESIA has been carried out in compliance with the Georgian legislation and environmental standards, environmental and social safeguard policies of International Financial Institutions, as well as Core Labour standards (CLS) outlined in the ILO Declaration on Fundamental Principles and Rights at Work, and the relevant national labour laws.

During planning, implementation of the ESIA and development of this report a range of documents has been considered. The list, inter alia, includes:

- International Conventions and Directives (environment, social);
- European Investment Bank (EIB) Statement of Environmental and Social Principles and Standards (2009);
- EIB Environmental and Social Handbook (version 9 2013);
- Environmental and social safeguards of International Financial Institutions, such as:
    - World Bank Environmental and Social ( 2013);
    - EBRD Environmental and Social Policy (2014);
    - IFC Environmental and Social Performance Standards (2012);
    - 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).
- Recommendations given in the WB technical paper No. 376 "Roads and the Environment. A Handbook" (1997).

## 2.1. OVERVIEW OF GEORGIAN ENVIRONMENTAL LEGISLATION AND WB POLICY

## 2.2. ENVIRONMENTAL LEGISLATION OF GEORGIA.

Environmental legislation of Georgia comprises the Constitution, environmental laws, international agreements, by-laws, presidential decrees, ministerial orders, instructions, and regulations. Georgia is a party to international conventions, including the environmental ones. The **Table 1** presents a list of Georgia's environmental legislation as it pertains to the proposed project.

***Table 1. List of environmental laws and regulations relevant to the project***

| Year | Law / Regulation | Last revision | Code |
|---|---|---|---|
| 1994 | Law on soil protection | 16/07/2015 | 370.010.000.05.001.000.080 |
| 1996 | Law on entrails | 26/12/2014 | 380.000.000.05.001.000.140 |
| 1996 | Law on environmental protection | 01/06.2017 | 360.000.000.05.001.000.184 |
| 1996 | On the system of protected areas | 17/02/2016 | 360.050.000.05.001.000.127 |
| 1997 | Law on wildlife | 01/06.2017 | 410.000.000.05.001.000.186 |
| 1997 | Law on water | 26/12/2014 | 400.000.000.05.001.000.253 |
| 1997 | Law on tourism and resorts | 24/09/2013 | 460.070.000.05.001.000.192 |
| 1998 | Law on protection zone of resorts and recreation areas | 26/12/2014 | 470.210.000.05.001.000.339 |
| 1998 | Law on establishment and management of Kolkheti protected areas. | 01/06.2017 | 360.050.000.05.001.000.456 |
| 1999 | Law on protection of atmospheric air | 01/06.2017 | 420.000.000.05.001.000.595 |
| 1999 | Forestry code of Georgia | 01/06.2017 | 390.000.000.05.001.000.599 |
| 1999 | Law on compensation of damage from hazardous substances | 06/06/2003 | 040.160.050.05.001.000.671 |
| 2000 | Law on regulation and engineering protection of the sea and river banks | 05/05/2011 | 400.010.010.05.001.000.830 |
| 2003 | Law on Red List and Red Book of Georgia | 01/06.2017 | 360.060.000.05.001.001.297 |
| 2005 | Law on licences and permits | 29/06/2017 | 300.310.000.05.001.001.914 |
| 2003 | Law of Georgia on conservation of soil and restoration-amelioration of soil fertility | 19/04/2013 | 370.010.000.05.001.001.274 |
| 2007 | Law on ecological expertise | 01/06.2017 | 360.130.000.05.001.003.079 |
| 2014 | Waste code | 01/06.2017 | 360160000.05.001.017608 |
| 2017 | Environmental Assessment Code | 01/06.2017 | 360160000.05.001.018492 |

Laws and regulations related to social aspects and land ownership applicable to the project are presented in the **Table 2**.

***Table 2. List of social and land ownership related laws relevant to the project***

| Year | Law / Regulation | Last revision | Code |
|---|---|---|---|
| 1996 | Law on agricultural land ownership | 16/06/2017 | 370.030.000.05.001.000.132 |
| 1997 | Civil code of Georgia | 30/06/2017 | 040.000.000.05.001.000.223 |
| 1997 | Law on compensation of land substitute costs and damages due to allocating agricultural ;and for non-agricultural purposes | 25/12/2014 | 370.020.000.05.001.000.244 |
| 1997 | Law on Tourisn and Resorts | 24/09/2013 | 460.070.000.05.001.000.192 |
| 1999 | Law on rules for expropriation of | 06/09/2013 | 020.060.040.05.001.000.670 |

| | | | |
|---|---|---|---|
| | property for public needs | | |
| 2007 | Law on cultural heritage | 01/06/2017 | 450.030.000.05.001.002.815 |
| 2007 | Law on public health | 01/06/2017 | 470.000.000.05.001.002.920 |
| 2007 | Law on entitlement of ownership rights to lands possessed (employed) by physical and legal persons of private law | 03/06/2016 | 370.060.000.05.001.003.003 |
| 2010 | Law on state property | 04/05/2017 | 040.110.030.05.01.004.174 |
| 2014 | Law ib public safety | 26/07/2017 | 140070000.05.001.017468 |

## 2.3. ENVIRONMENTAL REGULATIONS AND STANDARDS

***Table 3. Regulations and standards***

| Last revision | Document | Document Code |
|---|---|---|
| 24/02/2017 | Technical regulations – special requirements for collection and treatment of hazardous waste approved by the governmental decree #145 | 360160000.10.003.019210 |
| 04/08/2015 | Technical regulations – review and approval of waste management plan approved by the governmental decrss #211 | 360160000.22.023.016334 |
| 02/03/2017 | Technical Regulation – Fishing and fish stock protection | 300160070.10.003.017645 |
| 05/05/2017 | Governmental decree #136, on approval of Rules and conditions of issuance of mineral resources abstraction licence. | 380050000.10.003.018178 |
| 29/03/2016 | Technical Regulation – Special requirements referring to collection and processing of hazardous waste – approved by governmental decree #145 | 360160000.10.003.019210 |
| 04/08/2015 | Technical Regulation – Review and approval of company's waste management plan – approved by order #211 of the Minister of environment and natural resources protection. | 360160000.22.023.016334 |
| 11/08/2015 | Technical Regulation – Arrangement, operation, closure and subsequent maintenance of landfills – approved by governmental decree #421 | 300160070.10.003.018807 |
| 17/08/2015 | Technical Regulation – Specification and classification of waste inventory according to type and characteristics - approved by governmental decree #426 | 300230000.10.003.018812 |
| 05/06/2015 | Decree on revision of the Technical Regulation | 300160070.10.003.018645 |

| Last revision | Document | Document Code |
|---|---|---|
| | – Method for determination (calculation) of damage to environment- approved by governmental decree #54 (14/01/2014) | |
| 17/02/2015 | Rules for implementation of the state control by Environmental supervision department under the Ministry of Environment and Natural Resources of Georgia - approved by governmental decree 61. | 040030000.10.003.018446 |
| 29/12/2014 | The list of the green zones and resort areas of the state forest fund under the management of the National Forestry Agency – public legal entity of the Ministry of Environment and Natural Resources Protection of Georgia - approved by the decree #161 of the Minister of Environment and Natural Resources Protection of Georgia | 360050000.22.023.016284 |
| 03/07/2014 | Approval of the list and status of resorts – approved by governmental decree №428 | 460070000.10.003.018048 |
| 16/01/2014 | Technical Regulation - Temporary regulation ruled for operation of Kolkheti National Park, Temporary regulation ruled for operation of Kobuleti protected areas - approved by governmental decree #84 | 300160070.10.003.017703 |
| 03/01/2014 | Technical Regulation - Protection of the air environment in unfavourable weather conditions - approved by governmental decree #8 | 300160070.10.003.017603 |
| 06/01/2014 | Technical Regulation - Method for inventory of Stationary Sources of Air Pollution - approved by governmental decree #42 | 300160070.10.003.017588 |
| 03/01/2014 | Environmental Technical Regulation – approved by governmental decree #17. | 300160070.10.003.017608 |
| 14/01/2014 | Technical Regulation - Environmental damage determination (calculation) method - approved by governmental decree #54 | 300160070.10.003.017673 |
| 15/01/2014 | Technical Regulation - Drinking water - approved by governmental decree #58. | 300160070.10.003.017676 |
| 03/01/2014 | Technical Regulation - Radiation safety standards within the territory of Georgia - approved by governmental decree #28 | |
| 03/01/2014 | Technical Regulation - Sanitary rules of water sampling - approved by governmental decree | 300160070.10.003.017615 |

| Last revision | Document | Document Code |
|---|---|---|
| | #26 | |
| 31/12/2013 | Technical Regulation – Methods of calculating maximum permissible discharges (MPD) of pollutants together with wastewater into surface water bodies - approved by decree #414 | 300160070.10.003.017621 |
| 31/12/2013 | Technical Regulation –Protection of surface water contamination - approved by decree #425 | 300160070.10.003.017650 |
| 31/12/2013 | Technical Regulation – On approval of technical regulations for calculating threshold limit values of emission of harmful substances into the ambient air", approved by governmental decree #408 | 300160070.10.003.017622 |
| 03/01/2014 | Technical Regulation – Exploitation of gas-dust trapping devices – approved by governmental decree #21 | 300160070.10.003.017590 |
| 15/01/2014 | Technical Regulation – on Maximum allowable concentrations of harmful substances in the air at the workplace – approved by governmental decree #70 | 300160070.10.003.017688 |
| 03/01/2014 | Technical Regulation – on Radiation safety limits in Georgia – approved by governmental decree #28 | 300160070.10.003.017585 |
| 03/01/2014 | Technical Regulation – Sanitary rules for water sampling – approved by governmental decree #26 | 300160070.10.003.017615 |
| 31/12/2013 | Technical Regulation – on Calculation of air pollutant index and index values for air pollution with harmful substances of extremely polluted, highly polluted, polluted and non-polluted category regions according to the pollution levels with harmful substances - approved by governmental decree №448 | 300160070.10.003.017617 |
| 31/12/2013 | Technical Regulation – Methods of calculating the actual amount of emissions according to instrumental methods for determining the actual amount of emissions in ambient air from stationary sources of pollution, list of special measuring and controlling equipment for determining the actual amount of emissions in ambient air from stationary sources of pollution and | 300160070.10.003.017660 |

| Last revision | Document | Document Code |
|---|---|---|
| | technological processes from stationary pollution sources - approved by governmental order #435 | |
| 31/12/2013 | Technical Regulation - provisions on Determining Levels of Soil Fertility and Soil Conservation and Fertility Monitoring - approved by governmental decree #415 | 300160070.10.003.017618 |
| 31/12/2013 | Technical Regulation - Topsoil Removal, Storage, Use and Cultivation - approved by governmental decree #424 | 300160070.10.003.017647 |
| 31/12/2013 | Technical Regulation - water protection zones of small rivers in Georgia - approved by governmental decree #445 | 300160070.10.003.017646 |
| 31/12/2013 | Technical Regulation - on Water Protection Strip - approved by governmental decree №440 | 300160070.10.003.017640 |
| 31/12/2013 | Technical Regulation – on Quarries safety - approved by governmental decree #450 | 300160070.10.003.017633 |
| 31/12/2013 | Technical Regulation – Fishing and protection of fish stock - approved by the governmental decree #423 | 300160070.10.003.017645 |
| 13/08/2010 | Forest protection and restoration rules – approved by governmental decree #241 | |
| 20/08/2010 | Rules of forest use – approved by governmental decree #242. | |
| 11/08/2008 | Governmental regulations (#132) on approval of rules and conditions for issuance of forest use licence, revised 17/07/2015 | 390.050.020.10.003.000.266 |
| 10/05/2007 | Governmental regulations (#96, dated 10 May 2007) on approval of provisions for exclusion and inclusion of land from/into the state forest fund | 390.040.050.10.003.000.737 |
| 4/04/2014 | Resolution of the Government of Georgia (№271) 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) | 300160070.10.003.017891 |

## 2.4. INTERNATIONAL CONVENTIONS RELEVANT TO THE PROJECT RATIFIED BY GEORGIA

List of key conventions on air quality and climate change, biodiversity and protection of ecology and habitats, cultural heritage, public consultation, labour issues and the dates of ratification by Georgia are listed below (see **Table 4**):

***Table 4. Conventions (relevant to the project) ratified by Georgia***

| | |
|---|---|
| **Natural environment** | |
| 1994 | Rio Convention on Biological Diversity, 1992 |
| 1994 | Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973 |
| 1997 | Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat, 1971 |
| 2000 | Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (CMS), 1983 |
| 2008 | Convention on the Conservation of European Wildlife and Natural Habitats (Bern) |
| 2011 | European Landscape Convention |
| **Climate** | |
| 1994 | UN Framework Convention on Climate Change (UNFCCC), 1994 |
| 1996 | Montreal Protocol on Substances that Deplete the Ozone Layer, 1987 (and its London, Copenhagen, Montreal and Beijing Amendments) 2000. 2011 |
| 1996 | Vienna Convention for the Protection of the Ozone Layer, 1985 |
| 1999 | Kyoto Protocol to UNFCCC, 1997 |
| 1999 | International Convention to Combat Desertification, 1994 |
| 1999 | Geneva Convention on Long-Range Transboundary Air Pollution |
| **Cultural heritage** | |
| Notification for succession | Paris Convention Concerning the Protection of the World Cultural and Natural Heritage, 1992 |
| 2011 | Council of Europe Framework Convention on the Value of Cultural Heritage for Society, 2005 |
| 1997 | European Cultural Convention, 1954 |
| 2000 | Convention for the Protection of the Architectural Heritage of Europe, 1985 |
| 2000 | European Convention on the Protection of the Archaeological Heritage, 1982 |
| **Public participation and information accessibility** | |
| 2000 | Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, 1998 |
| **Labour issues** | |
| 1993 | Discrimination (Employment and Occupation) Convention |
| 1993 | Employment Policy Convention |
| 1996 | Geneva Convention concerning Minimum Age for Admission to |

| | Employment |
|---|---|
| 1996 | Equal Remuneration Convention |
| 1996 | Abolition of Forced Labour Convention |
| 1997 | ILO Social Policy (Basic Aims and Standards) Convention |
| 1997 | Forced Labour Convention |
| 1997 | Freedom of Association and Protection of the Right to Organise Convention |
| 1997 | Social Policy (Basic Aims and Standards) Convention |
| 1999 | Employment Service Convention |
| 1999 | European Convention for the Protection of Human Rights and Fundamental Freedoms |
| 2003 | Labour Relations (Public Service) Convention |

In addition to conventions listed above, the following EU directives will be taken into account:

- EU Environmental Impact Assessment (EIA) Directive [Directive 2014/52/EU of the European Parliament and Council, amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment];
- Habitats Directive [Directive 92/43/EEC (ref. Art. 6 of the Directive)];
- Bird Directive [Directive 2009/147/EC on the conservation of wild birds];
- EU Water Framework Directive [Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy];
- EU Waste Framework Directive [Directive 2008/98/EC on waste].

## 2.5. NATIONAL TECHNICAL REGULATIONS APPLICABLE TO THE PROJECT

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

- Law on Roads (310.090.000.05.001.000.089, last amended in 2013);
- Construction norms and regulations 2.05.03-84 - Design of bridges, viaducts, overpasses and pipes;
- Construction norms and regulations 2.05.02-85 - Motor roads (regulate traffic safety, environmental issues, set forth main technical and traffic operation norms, crossings and intersections, paving aspects, etc.)

According to these documents for category I roads the following environmental aspects are set:

- 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.

For OTL crossing and relocation/reinforcement of pipelines the following regulations will be observed:

- Rules for Electric Installations -2002, 7-th Edition;
- Rules of Safety for Operation of Electric Devices;
- Construction Norms and Rules III-4-80" (SNIP III-4-80) -Construction Safety Rules.
- Government of Georgia, Decree 365 – on Establishment of the rules for protection of main pipelines (oil, oil products, oil by-products and natural gas and their transformation products) and their protection zones (24.12.2014)

## 2.6. ENVIRONMENTAL PERMITTING PROCEDURE – NATIONAL REGULATIONS

The permit application/issuance procedure for the planned development, including ESIA coordination, timeframes for information disclosure and public review are set in the law of Georgia on Environmental Impact Permit and include the following steps:

***Table 5. Environmental impact permit issuance procedure***

| Step | Action | Comment | Timeframe |
|---|---|---|---|
| 1 | Publication of information on the project in central and regional newspapers. | | Day 0 |
| 2 | Submission of the draft ESIA report to the Ministry of Environment and Natural Resources Protection (MENRP) | Hard copy and electronic version of the report delivered to MENRP | within 3 days after announcement in the newspapers |
| | Feedback | Receiving public comments on the disclosed ESIA | 45 days from announcement in the newspapers |
| | Organisation of public meeting(s) in regional centres withing the project impact zone – publication os announcement | Advertisement is to include the project title, location, place and the date, time and venue of public disclosure | |

| Step | Action | Comment | Timeframe |
|---|---|---|---|
| | | meeting(s); locations where the ESIA can be reviewed and where comments may be submitted. | |
| | Meetings with stakeholders including local community, NGOs, local authorities, etc. | All comments and questions must be documented and answers, minutes of the meeting(s) written up. | Between 50 and 60 days after publication of the advert |
| 3 | Development of final version of the ESIA and submission to the MENRP (together with Non-technical Summary, Technical Summary, reports on emissions and allowable limits) for the state ecological examination. | Comments received from the stakeholders considered in the report. Minutes of meeting(s) enclosed to the document as attachment. . | After arranging a public review of the EIA report and development of final version of the ESIA, the developers is authorised to submit, within one year, an application to the permit issuing administrative body for a permit |
| 4 | Consideration of the documents by MENRP and issuance of conclusion | | 20 days after registration of an application for a permit and submission of the ESIA package to the MENRP. |

*Note: According to the national regulations (Law on Licenses and Permits and in compliance with Resolution of the GoG on rules and conditions for issuance of construction permit (#57, 24 March 2009, with amendments) construction/ modernisation of highways requires 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 Ministry of Environmental and Natural Resources Protection in the permitting process. For the project subjected to the construction permit, the authorisation (construction permit) incorporates elements of environmental impact permit.*

## 2.7. PERMIT AND LICENCES FOR OFF-SITE WORKS DURING CONSTRUCTION

Off-site works will include extraction of construction materials or purchase of material from already existing licensed quarries. (The latter option is preferable.)

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 sedimentation 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, construction 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 reinstating a site and giving up the license even if its term has not expired. Department of Environment 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.

## 2.8. BRIEF COMPARISON OF THE NATIONAL ENVIRONMENTAL LEGISLATION AND IFI REQUIREMENTS

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

- Screening. Environment Impact Permit, according to the Georgian Law is required only for notified activities. Whereas, the IFI funded projects are screened at initial stages of preparation and categorized according to significance of a project's potential environmental impacts.
- Preliminary ESIA. National environmental regulations do not request development of preliminary ESIA.
- Considering ecological risk, cultural heritage, resettlement and other factors, the IFI 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 law on environmental

impact permit. This list is compatible with the Category A projects of the Bank's classification.

- 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 Banks who take a comprehensive approach to this issue.
- Stakeholder Engagement Plan (SEP): Under the national regulations development of SEP is not obligatory.
- Responsibility for the ESIA: While the Bank's document 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 ESIA.
- Consultation: The IFIs provide for consultations for A and B Category projects (at least two consultations for Category A projects) and requires a timetable of consultations from the Borrower. Georgian regulations request one public consultation meetings on the stage when draft ESIA is disclosed.

## 2.9. INSTITUTIONAL FRAMEWORK

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

Roads Department (RD) responsibilities include, at a minimum, accepting the feasibility study and final designs and accepting road sections after completion of construction. Maintenance also falls under the responsibility of the RD, but is sourced out to private enterprises. (Note: Maintenance means winter maintenance, regular checks and repair of the road, including drainage facilities, bridges, guardrails, road signs etc.). Garbage collection alongside the road is also among the duties of the RD through a contracted company.

Ministry of Environment and Natural Resources Protection (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 MENRP 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 etc. and explanations from authorities concerning the Project.

The following ministries/departments of the government play a certain role in the approval/agreement process for the Project, including but not limited to:

- Ministry of Economy and Sustainable Development;
- Agency of Protected Areas under the MENRP;
- National Environmental Agency of the MENRP;
- National Agency for Cultural Heritage Preservation of Georgia (under the Ministry of Culture and Monument Protection);
- Department of Spatial Planning and Construction Policy of the Ministry of Economy and Sustainable Development;
- Ministry of Labour, Health and Social Affairs; and
- Ministry of Agriculture.

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

## 3. DESCRIPTION OF THE PROJECT

The project is located in the Black Sea coastal area, Samegrelo-Zemo Svaneti and Guria Regions of west Georgia and comprises the area from Poti up to the Kobuleti bypass.

The studied section (Grigoleti-Kobuleti bypass) starts from the area north to Supsa terminal, left bank of the Supsa river, and connects to the newly constructed Kobuleti bypass, south to the Black Sea Arena. Based on functional conditions and agreed with the Roads Department, the start point of the design alignment connects directly the new highway Samtredia-Grigoleti.

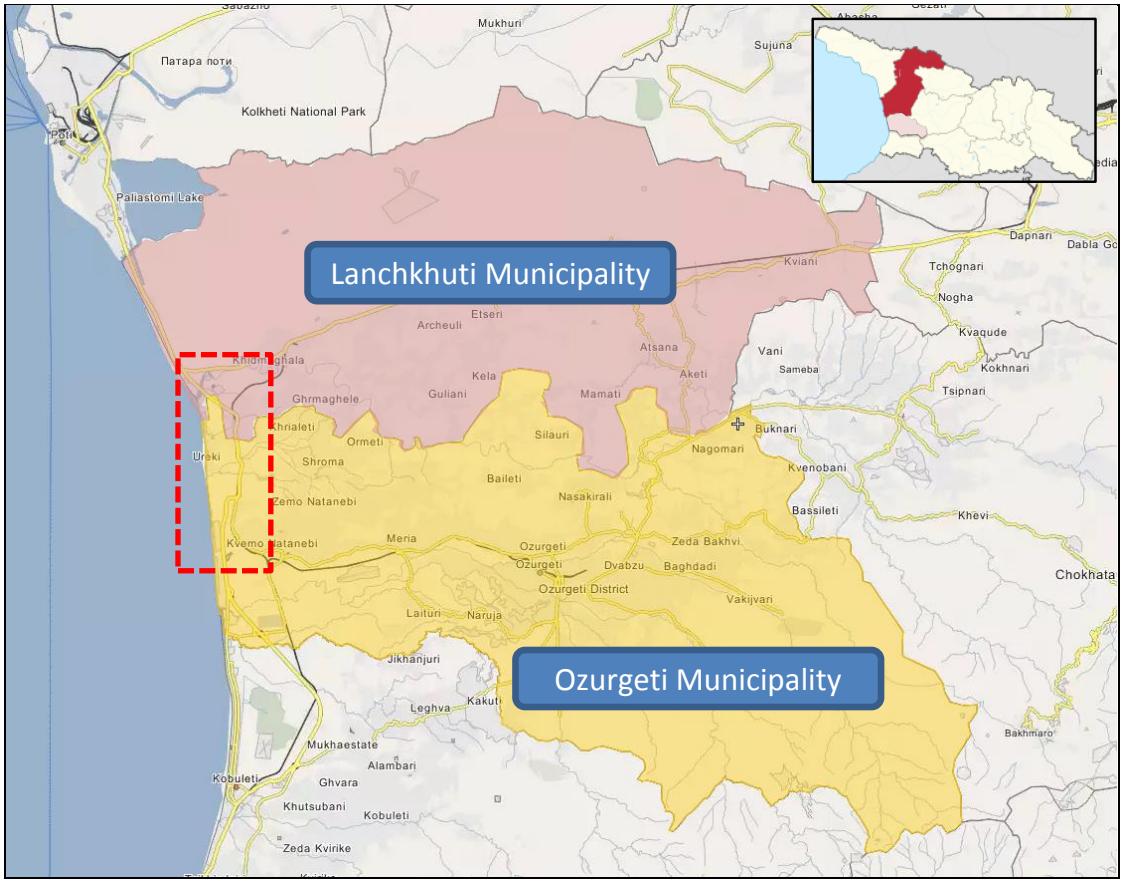


***Figure 1. Location of the project***

As stated in the Terms of Reference, detailed design of the 4 lane highway has been developed with consideration of the design speed 120 km/h. For interchanges (ramps and loops), depending on the type of the interchange and traffic flow 40 km/h, 60 km/h, 80 km/h or 100 km/h were set as the design values.

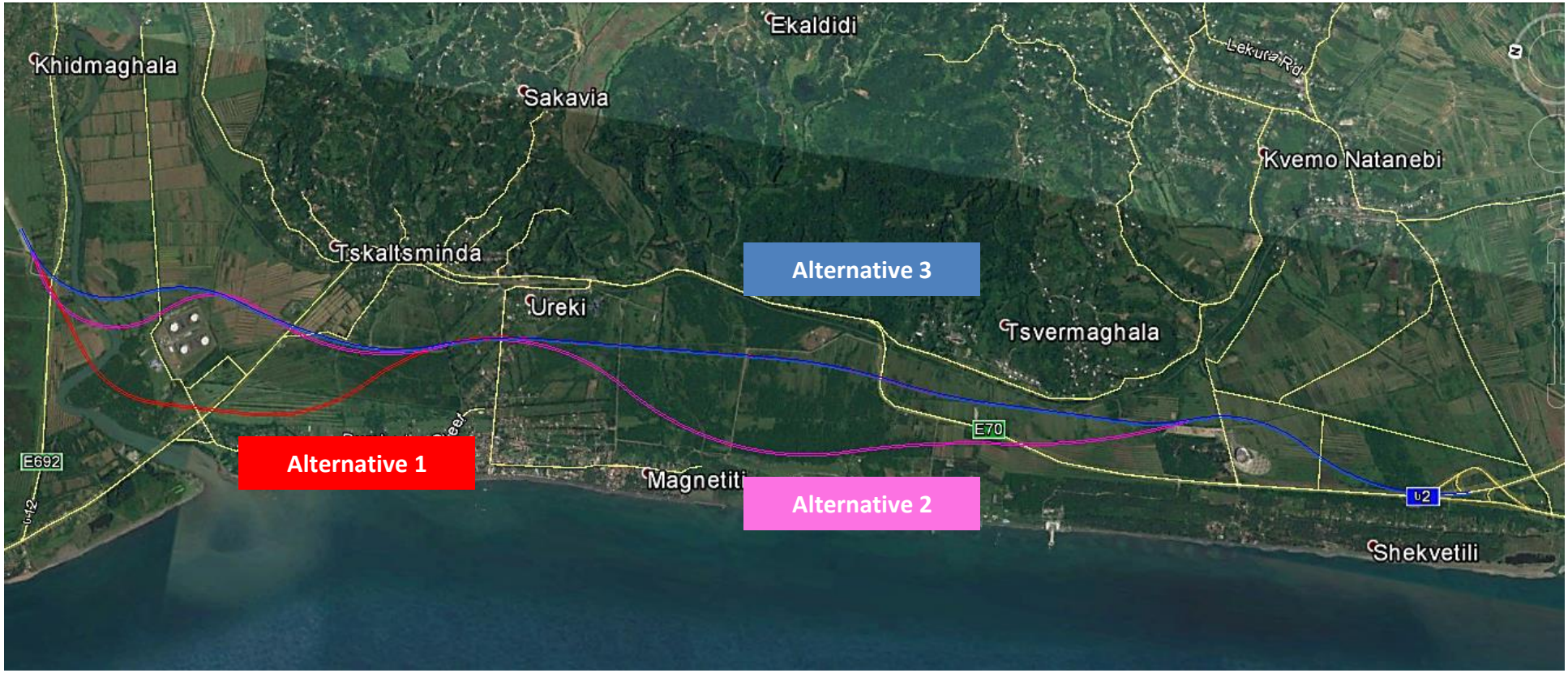


***Figure 2. Alternative alignments***

## 3.1. DESCRIPTION OF ALTERNATIVES

Along with 'no action' alternative, three alternative alignments have been considered on Feasibility stage of the project. Layout of considered option is shown in **Figure 2**, length of alignments is given in **Table 6**.

***Table 6. Length of alternative alignments***

| Alternative | Total Length (m) |
|---|---|
| **1** | 14.110,43 |
| **2** | 13.914,04 |
| **3** | 13.444,52 |

Alignments were selected so to minimize impact of existing infrastructure and reducing the need for its relocation.

### 3.1.1. ZERO ALTERNATIVE

The section of starts from the crossing of E-692 and E-70 highways. Crosses Supsa river in 178m wide section of the river, crosses residential area on the left bank of the river, bypasses Supsa terminal from the south-west, runs next to substation, crosses Tskhaltsminda village, runs through Ureki, almost parallel east to the railway line, turns west near Tsvermaghala and runs in about 530m distance from the coastline in the last section of alignment east to pine grove stretched along the coastal strip. (see **Figure 3**)


***Figure 3. Existing road (zero alternative)***

### 3.1.2. ALTERNATIVE 1

Alignment starts from Samtredia – Grigoleti road and follows existing road in the section from pk0+00 to pk 0+500. At 0+800 a trumpet type interchange (see **Figure 4**) is planned. After the interchange alignment curves and crosses the Supsa River.

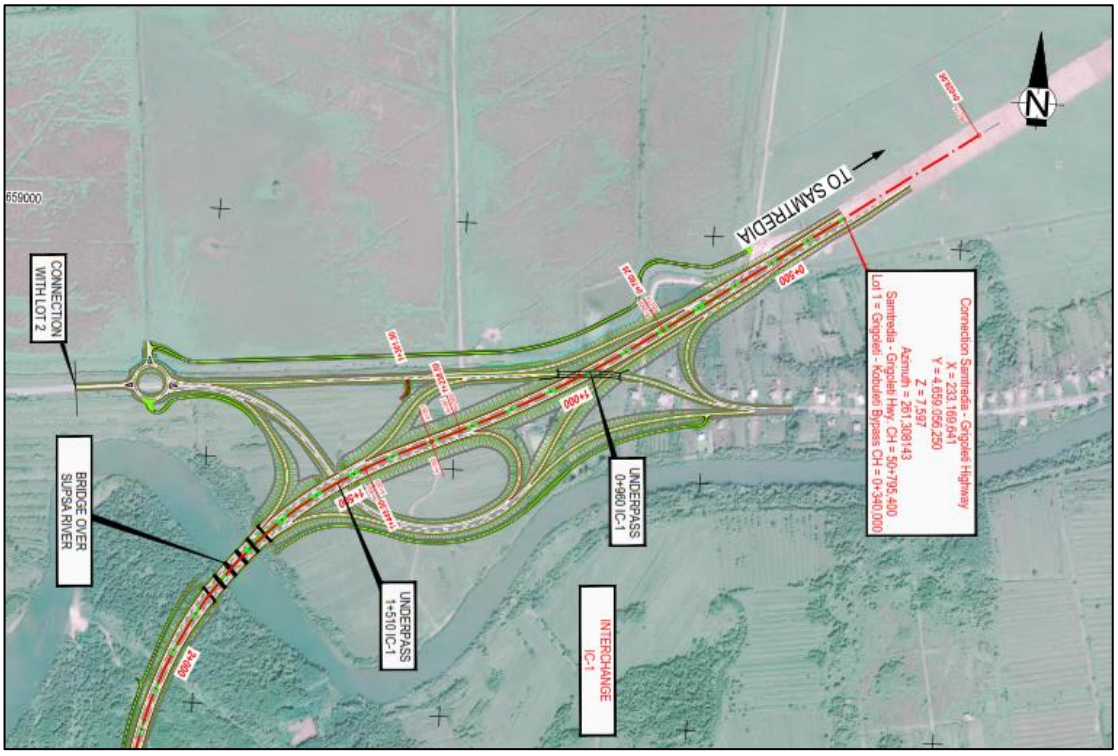


***Figure 4. Starting section of the Grigoleti-Kobuleti alignment fragment, showing Alternative 1 and E-70 highway crossing area***

From pk2+400 to pk 2+900 the road runs between the Supsa terminal and the residential buildings located west to the alignment. (Distance from the nearest building and the terminal area to the axle of the new road is 20m and 21m respectively).

In pk2+500 to pk2+700 alignment crosses small stream and overpasses old cemetery. After the bridge at pk 2+580, alternative crosses the road to terminal and the E-70 highway. In these section two underpasses (pk2+782 and pk2+960) are planned

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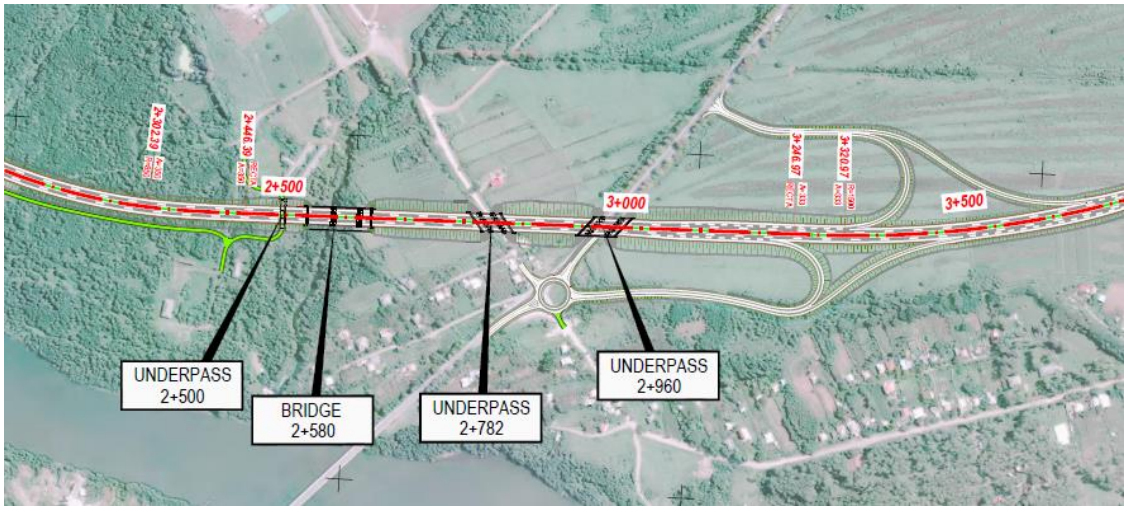


**Figure 5**).

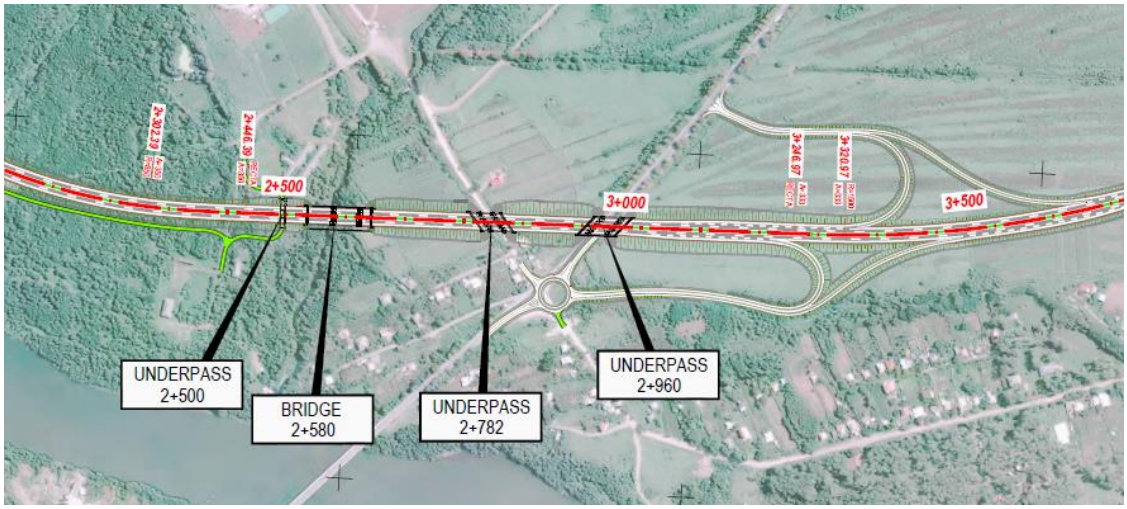


***Figure 5. Underpasses near Supsa and interchange IC-1B***

The straight section from pk2+500 to almost pk3+500 is followed by interchange and a left curve (R=1,500m). The curve leads to the local Ureki-Magnetiti road which is crossed by the design alignment at pk5+600 (**Figure 6**). This is the only point where impact on residential houses in the area can be avoided. Starting from the crossing site the road goes straight, has two curves (R=5,000m and R=-5,000m).

At pk5+800 up to the end of alignment, Alternative 1 coincides with Alternative 3. At pk6+750 construction of overpass in planned. Farther the road crosses the Sepa River (at pk7+100) and its tributary (the section between pk7+600-pk7+700).

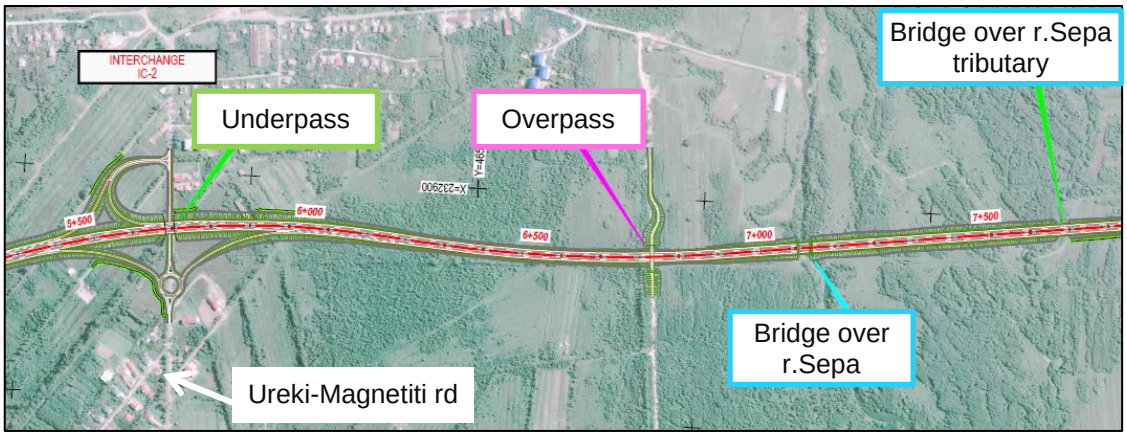


***Figure 6. Layout of alternatives with indication of Ureki Magnetiti interchange (pk5+600) and road crossings***

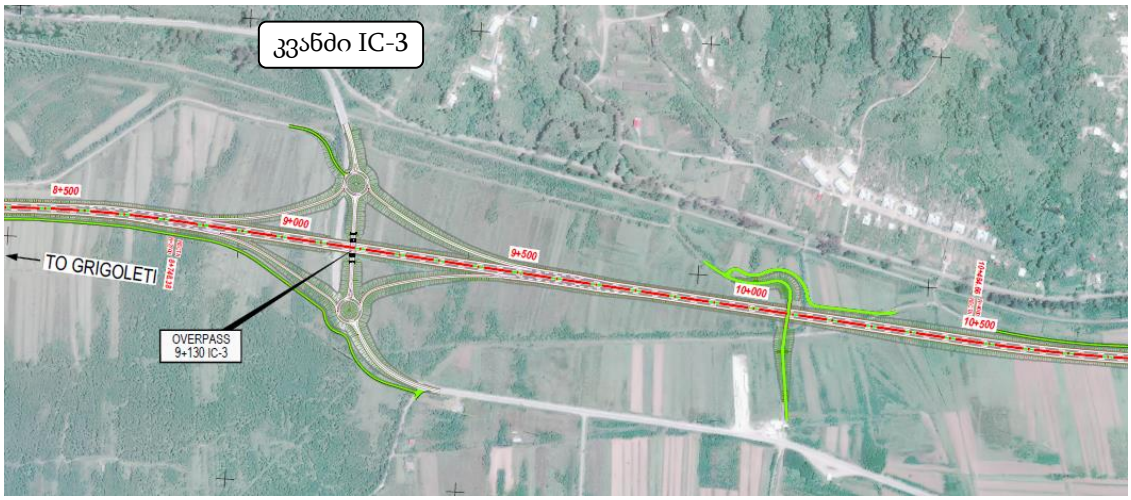


***Figure 7. Layout of alignment in Ureki, interchange in E-70 crossing area***

Alignment crosses E-70 highway at pk9+000

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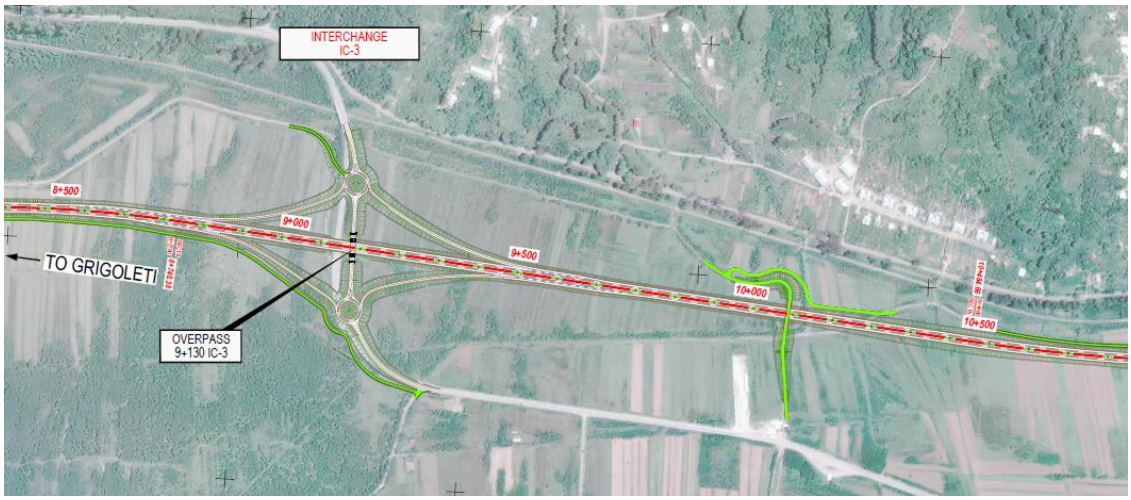


**Figure 7**), overpasses the road art pk12+070, has another straight section, curves leftwards (R=1,500m), than has a right curve (R=12,000m), crosses road near the Black Sea Arena and connect to the Kobuleti bypass road at pk14+000. (**Figure 8**).

In connection with the Kobuleti bypass, existing interchange will be adapted - a new ramp and few changes in some ramps will be required.

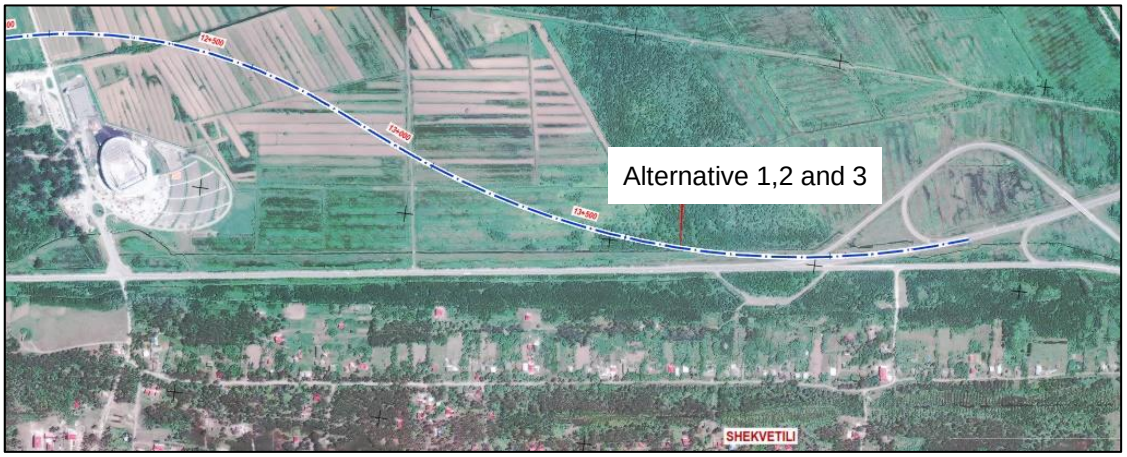



***Figure 8. Last section of alignment***

### 3.1.3. ALTERNATIVE 2

Alignment starts from Samtredia–Grigoleti road and follows existing road in the section from pk0+00 to pk 0+500 (**Figure 9**). At 0+800 an interchange is planned (***Figure 10***).

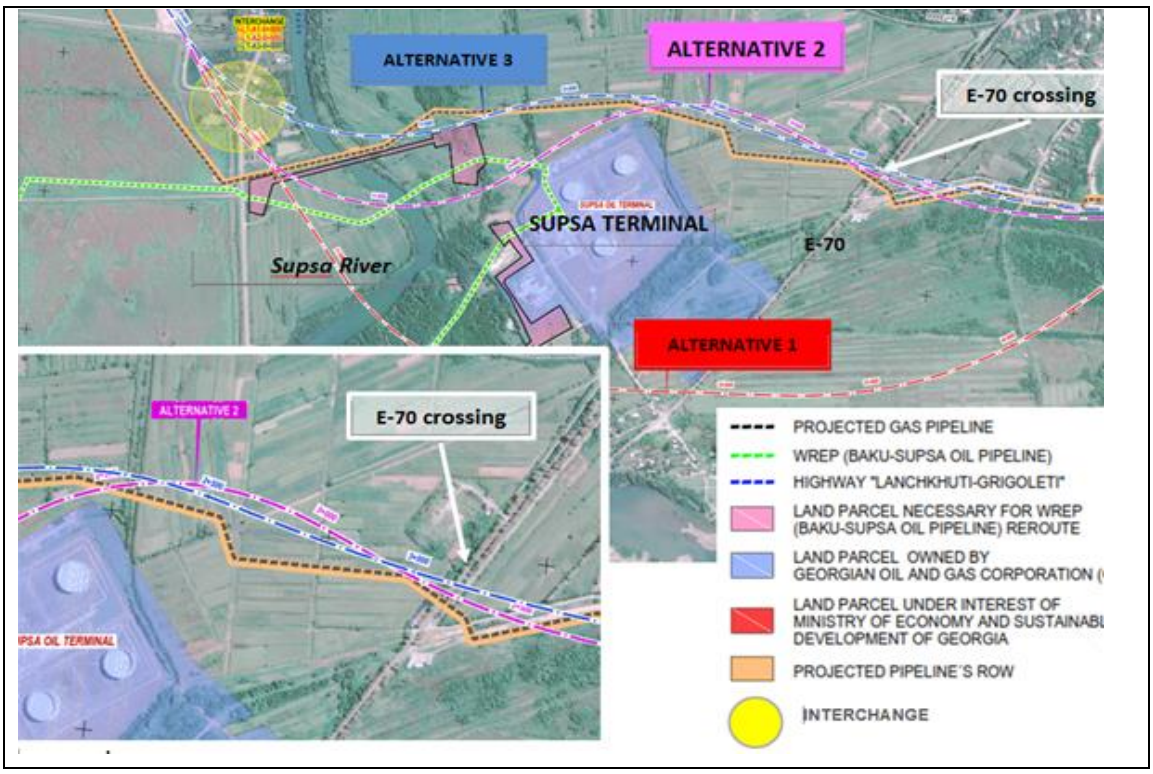



***Figure 9. Starting section of the Grigoleti-Kobuleti alignment; fragment, showing Alternative 2, 3 and E-70 highway crossing area***

Three options have been considered for the interchange, option b selected as preferable one:

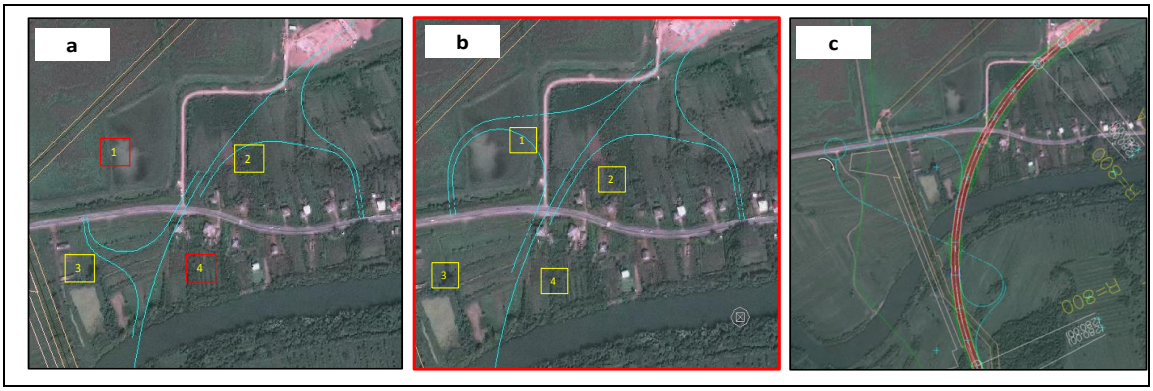



***Figure 10. Interchanges at pk0+800 (Modified clover a - with opposite quadrants; b- with adjacent quadrants (1 and 2) and c - Interchange with a semi-direct movement, two direct movements, and a lacet*** [1]

After the interchange alignment curves right (R=2,500m) and crosses the Supsa River. The radius of the curve in the river crossing area equated R=700m. Then the

[1] Radius for the lacet: 40 m, for 30 km/h design speed

road curves again (R=-700m). This allows bypassing the Supsa Terminal area. (Distance of the design road axle to the boundary of the terminal area is about 23m). At about pk3+350 alignment crosses the E-70 highway. In this section, in about 80m from the substation, the design road curves left (R=-1,800m), and then curves again (R=1,800m) crossing Ureki-Magnetiti road at pk5+200. For the crossing modified clover type layout[2] is selected so to avoid impact on buildings. Alignment goes South West curves twice (R=-2,500m and R=8,000m), crosses E-70 highway at pk10+200[3] (***Figure 11***), curves again (R=-5,000m). From pk11+700 Alternative 2 alignment coincides with Alternative 3, crosses the road near the Black Sea Arena and connect to the Kobuleti bypass road at pk14+000. (***Figure 8***).

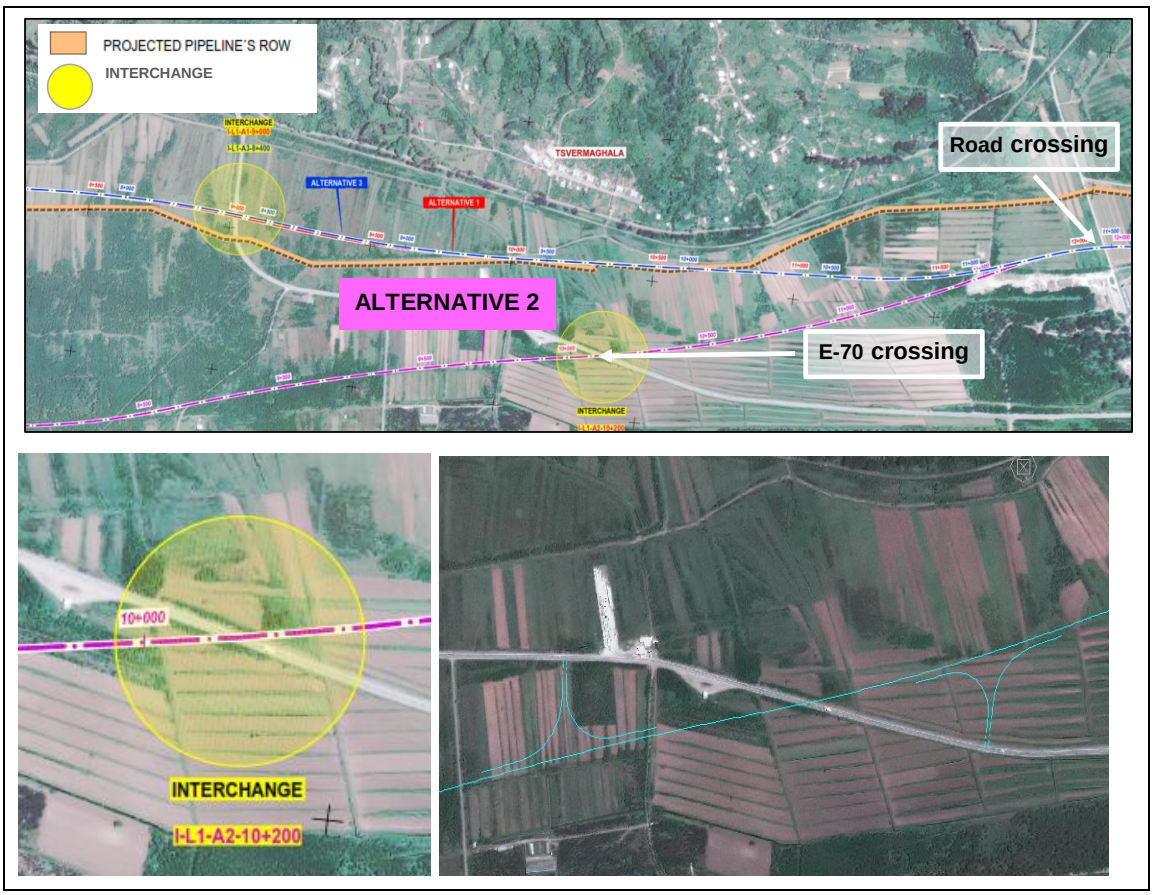



***Figure 11. Layout of Alternative 2 in Ureki; interchange at pk10+200***

[2] The radii of the lacets of the is 65 m; design speed 40 km/h). To minimize impact, in both sides two T junctions are recommended.

[3] Clover modified using opposite quadrants. The minimum radii for the exit ramps are 65 m, for 40 km/h design speed

### 3.1.4. ALTERNATIVE 3

Alignment starts from Samtredia–Grigoleti road and follows existing road in the section from pk0+00 to pk 0+500 At 0+800 an interchange is planned Alignment crosses the Supsa River with a left curve (R=-800 m). Then, with a right curve (R=1,100 m) bypasses the Supsa Oil Terminal from the East. (Distance from the axle of alignment to the Terminal area is 70 m), runs East to the substation. (***Figure 9***).

After that two curves (R=5,000m and R=1,800m) are designed. Alternative crosses the local Ureki-Magnetiti road with a right curve (R=3,500 m). Then coincides with Alternative 1 (straight section of alignment), and later with two curves of radii 5,000m and-5.000m crosses existing Grigoleti-Kobuleti road. Then the alternative has another straight alignment, followed by left (R=1,700 m) and right (R=-1,200m) curves. From pk11+700 Alternative 2 alignment coincides with Alternative 3, crosses the road near the Black Sea Arena and connect to the Kobuleti bypass road at pk14+000. (**Figure 8**).

## 3.2. DESIGN PARAMETERS AND GEOMETRIC STANDARD

The design was developed with consideration of TEM and Georgian standards. The list of parameters is given in **Table 7**.

***Table 7.Paremeters of the new alignment***

| **Parameter** | **Description** |
|---|---|
| **Highway** | |
| Design Speed: | 120 km/h |
| Spiral Transition Curves: | **TEM** standards compliant |
| Bend (Superelevation): | **Georgian standard** – minimum crossfall and minimum bend of 2.5%. The value is in line with TEM standards where the value ranges from 2% to 7%. |
| Expansion width in curves: | No need in expansion, given each lane is 3.75 m wide. |
| Main parameters | **TEM** compliant<br>• Width of roadway: 26.5 m<br>• Number of lanes: 4 (2 lanes per direction)<br>• Width of carriageway: 2x7.5 m<br>• Width of lane: 3.75 m<br>• Width of central reserve: 4.0 m (median strip 2m as per Georgian standard)<br>• Width of shoulder: 3.0 m |

| Parameter | Description |
|---|---|
| | • Width of paved shoulder: 3.0 m<br>• Width of service walkway: 0.75 m |
| Transitions: | • With the starting section (median strip of 6 m of the Samtredia-Grigoleti Highway cross section), a transition of the median strip is needed.<br>• In the ending section, it is needed to close the median strip and join both carriageways into one, linking the new Highway with the existing Kobuleti by-pass. |
| Vertical Gradients: | **TEM** standards<br>Minimum vertical gradient: 4%<br>Maximum vertical gradient (for drainage purposes): 0.30% |
| Vertical Curves: | **Georgian Standards** sets 250m of stopping distance for 120 km/h design speed.<br>Convex vertical curves: 22,600<br>Conclave vertical curves: 7,700 |
| **Interchanges (ramps and loops)** | |
| Design Speed: | 40 km/h, 60 km/h, 80 km/h or 100 km/h depending on the solution adopted for the interchange and the traffic volume of the ramp. Loops have the lower design speed due to geometrical reasons. |
| Spiral Transition Curves: | **TEM** standards compliant |
| Bend (Superelevation): | **Georgian standard** – minimum crossfall and minimum bend of 2.5%, suggested maximum is 7%. The value is in line with **TEM** standards where the value ranges from 2% to 7%) |
| Expansion width in curves: | **Georgian Standards**, no indication is available in TEM |
| Section Type: | • Width of roadway: 7.5 m<br>• Number of lanes: 1 (single lane)<br>• Width of lane: 4.00 m<br>• Width of paved shoulder: 1.0 m<br>• Width of service walkway: 0.75 m (slope: 6%) |
| Vertical Gradients: | **TEM** standards<br>• 5% for a design speed of 100 km/h and<br>• 6% for lower design speeds <100 km/h.<br>• Minimum gradient, for drainage purposes: 0.30%.<br><br>Max longitudinal suggested values for longitudinal gradient suggested by design team is 7-8%. This is assumed to allow design of more efficient ramps from a cost-benefit point of view as the lower values need higher length of ramps. |
| Vertical Curves: | Georgian Standards |

| Parameter | Description |
|---|---|
| | The minimum radii for convex curves used are stated below:<br>• For a design speed of 40 km/h, 400 m<br>• For a design speed of 60 km/h, 1,800 m<br>• For a design speed of 80 km/h, 5,000 m<br>• For a design speed of 100 km/h, 10,000 m<br>The minimum radii used for concave curves are:<br>• For a design speed of 60 km/h,1,700 m<br>• For a design speed of 80 km/h, 3,200 m<br>• For a design speed of 100 km/h, 4,900 m |
| Acceleration and Deceleration Lanes: | According to the TEM Standards, parts 3.4.2 and 3.4.3, acceleration and deceleration lanes length should be calculated based on an average acceleration of 0.6-0.8 $m/s^2$ and an average deceleration of 1.5 $m/s^2$. The lengths obtained following these criteria, are much greater than other international standards and practices, leading to unnecessary higher construction costs.<br><br>As in the case of maximum gradient values, in this way, we have adopted the following lengths, which are considered to be more realistic and widely used:<br>• Acceleration lane: 200 m deceleration lane + 100 m lane of variable width (taper)<br>• Deceleration lane: 100 m deceleration lane + 80 m lane of variable width (taper) |

### 3.3. STRUCTURES

Main structures along alternative alignments include interchanges, bridges over the rivers (Supsa, Sepa, tributary), overpasses and underpasses.

More details for Alternative 1 selected as preferable on feasibility stage of the project is given below.

***Table 8. Bridges, underpasses and overpasses along alignment Alternative 1***

| Bridge nr. | Station | Bridge name | Type code | Total length (m) | Number of spans (ea) |
|---|---|---|---|---|---|
| 1 | 1+430 | 4-span interchange underpass | 2b | 86,00 | 4 |
| 2 | 1+640 | Bridge over Supsa River | 5 | 165,00 | 5 |
| 3 | 2+795 | Underpass | 1 | 45,00 | 3 |
| 4 | 2+960 | Underpass | 1 | 45,00 | 3 |
| 5 | 5+600 | Underpass | 1 | 45,00 | 3 |
| 6 | 6+660 | Overpass Axis 66 | 3 | 61,50 | 3 |
| 7 | 7+072 | Bridge over Sepa River | 5 | 33,00 | 1 |
| 8 | 7+644 | Bridge over Sepa River Tributary | 5 | 33,00 | 1 |
| 9 | 9+000 | Overpass PK 9+000 | 3 | 61,50 | 3 |
| 10 | 12+000 | Overpass Axis 68 | 3 | 61,50 | 3 |
| 11 | 0+725 | Overpass Interchange 1 | 4 | 63,00 | 3 |

The following types of bridges are proposed, according to the main function of the structure:

***Table 9. New structures along alignment Alternative 1***

| Type code | Type | Average width (m) | Total Length (m) | Number of spans (ea) |
|---|---|---|---|---|
| 1 | Road underpass | 2 x 13,42 | 45,00 | 3 |
| 2 | Wide interchange underpass | 17,17+13,42 | 68,00 | 3 |
| 2b | 4-span interchange underpass | 2 x 13,42 | 86,00 | 4 |
| 3 | Road overpass | 11,04 | 61,50 | 3 |
| 4 | Interchange ramp Overpass | 7,50 | 63,00 | 3 |
| 5 | Bridge over river/lake | Var. | Var. | Var. |

Several construction alternatives were studied for each engineering structure. Alternatives with best technical characteristics and cost efficiency were selected.

### 3.3.1. BRIDGES

The bridges over the rivers were designed with consideration of 100 year flow.

**Superstructure -** All bridges are precast pre-stressed concrete I-beams structures. This type of bridge enables easy and rapid construction. "I" shape precast beams are easy (cheap and fast) to fabricate and to erect in place. For the project "I" beams of the American Association of State Highway and Transportation Officials (AASHTO) have been chosen. (**Table 10**)

***Table 10. AASHTO "I" beams***

| Type | H (mm) | A ($m^2$) | Recommended span lengths ($m^2$) |
|---|---|---|---|
| AASHTO TYPE I | 711 | 0,18 | 9.1 - 13.7 |
| AASHTO TYPE II | 914 | 0,24 | 12.2 - 18.3 |
| AASHTO TYPE III | 1143 | 0,36 | 16.8 – 24.4 |
| AASHTO TYPE IV | 1372 | 0,51 | 21.3 – 30.5 |
| AASHTO TYPE V | 1600 | 0,65 | 27.4 – 36.6 |
| AASHTO TYPE VI | 1829 | 0,70 | 33.5 – 42.7 |

The deck is composed by several "I" shape precast pre-stressed concrete beams and a cast "in situ" concrete slab over them. Precast beam elements can be used for spans of up to 40 m.

Construction method includes manufacturing/procurement of precast pre-stressed beams; transportation to the site, installation over the bearings using cranes; casting upper slab in situ; using thin precast concrete slabs working as formwork to bridge gaps between beams. A simply supported scheme is used for the deck and every beam is placed over a neoprene bearing at each end. The slab over the beams links groups of spans to reduce pavement joints.

**Abutments -** For all bridges slab abutments will be used - short abutments at the top of the embankment, supported on piles with two wing walls on both sides.

**Piers -** The intermediate bents consist of a pier cap with 2 columns (in some cases 3).The piers are oblong form (short axis 1.5m, long axis 1.8m).

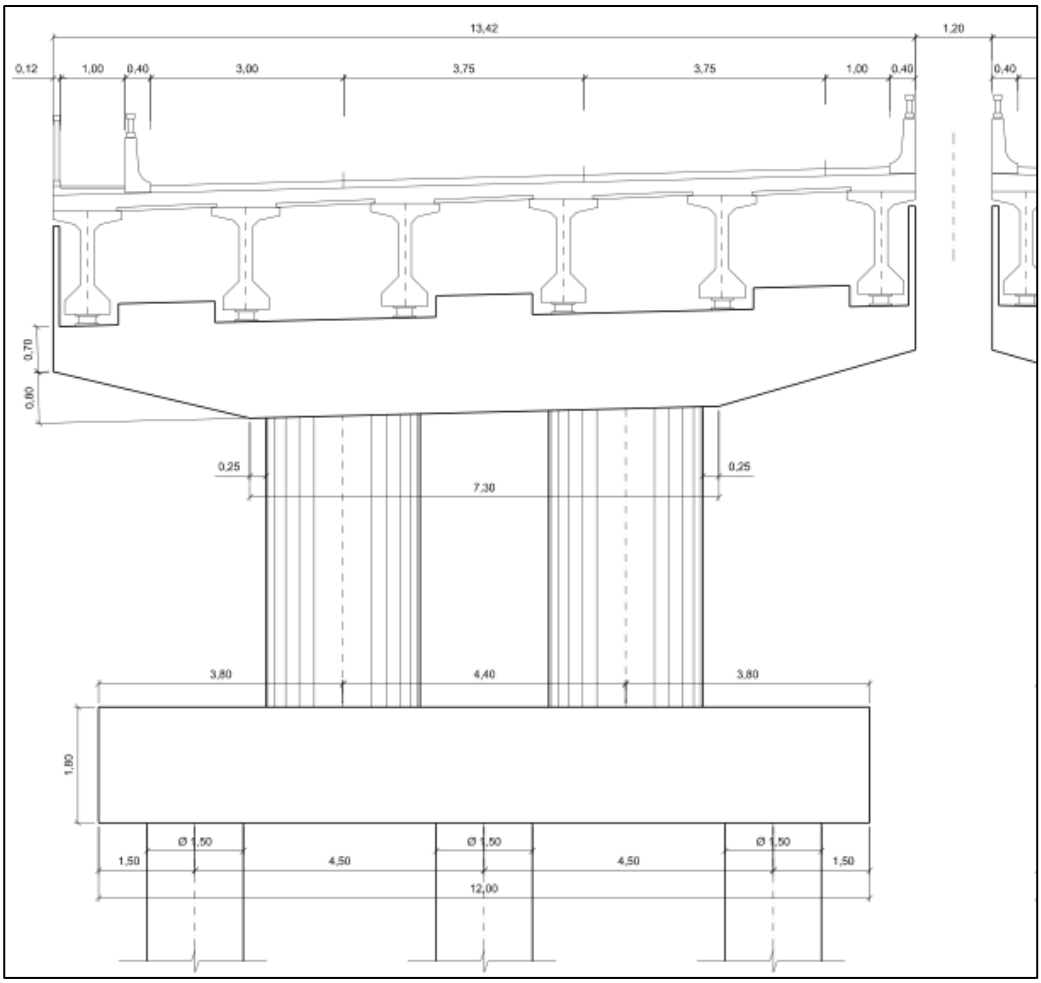



***Figure 12.*** **Typical pier**

### 3.3.2. CULVERTS

Arrangement of 37 culvers (box culvers) is planned. Location of the culverts is given in **Table 11**.

***Table 11. Culverts***

| # | STA | Crossing type | # | STA | Crossing type |
|---|---|---|---|---|---|
| 1 | 00+064 | - | 23 | 08+915 | Canal (marsh) |
| 2 | 00+424 | - | 24 | 09+011 | Canal (marsh) |
| 3 | 00+464 | - | 25 | 09+235 | Canal (marsh) |
| 4 | 00+495 | Canal (marsh) | 26 | 09+360 | Canal (marsh) |
| 5 | 00+790 | Canal (marsh) | 27 | 09+960 | Canal (marsh) |
| 6 | 00+850 | Canal | 28 | 10+430 | Canal (marsh) |
| 7 | 01+100 | Irregular flood area | 29 | 10+630 | Canal (marsh) |
| 8 | 02+480 | Canal (marsh) | 30 | 10+720 | Canal (marsh) |
| 9 | 02+810 | Canal (marsh) | 31 | 10+860 | Canal (marsh) |

| # | STA | Crossing type | # | STA | Crossing type |
|---|---|---|---|---|---|
| 10 | 03+030 | Canal (marsh) | 32 | 10+950 | Canal (marsh) |
| 11 | 04+110 | Canal (marsh) | 33 | 11+210 | Canal (marsh) |
| 12 | 05+200 | Canal (stream) | 34 | 11+410 | Canal (marsh) |
| 13 | 05+720 | Canal (marsh) | 35 | 11+450 | Canal (marsh) |
| 14 | 05+976 | Canal (marsh) | 36 | 11+590 | Canal (marsh) |
| 15 | 06+000 | Canal (marsh) | 37 | 11+720 | Canal (marsh) |
| 16 | 06+450 | Canal (marsh) | 38 | 11+781 | Canal (marsh) |
| 17 | 06+550 | Canal (marsh) | 39 | 12+520 | Canal (marsh) |
| 18 | 06+760 | Canal (marsh) | 40 | 12+830 | Canal (marsh) |
| 19 | 07+900 | Canal (marsh) | 41 | 13+140 | Canal (marsh) |
| 20 | 08+220 | Canal (marsh) | 42 | 13+680 | Canal (marsh) |
| 21 | 08+440 | Canal (marsh) | 43 | 14+427 | Canal (marsh) |
| 22 | 08+675 | Canal (marsh) | | | |

The profile of the culverts is almost horizontal. Permeability is sufficient to avoid water logging. Flows are calculated for maximum capacity and for 100%, 80%, 50% and 20% flow conditions.

***Table 12. Maxium flow in culverts***

| BOX CULVERT | STATE | DIMENTION | GRADE | | | | |
|---|---|---|---|---|---|---|---|
| | | (m) | (%) | 100% | 80% | 50% | 20% |
| 1.1 | 1+125 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 1.1A | 0+900 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 1.1B | 0+343 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 1.2A | 0+143 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 1.3A | 0+017 | 1,5x1,0 | 0.20 | 1.88 | 1.78 | 0.94 | 0.24 |
| 1.6A | 0+156 | 2,0x2,0 | 0.40 | 9.96 | 9.15 | 4.98 | 1.37 |
| 1.7B | 0+590 | 1,5x1,0 | 0.10 | 1.33 | 1.26 | 0.66 | 0.17 |
| 4.1 | 4+150 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 4.1C | 4+150 | 1,5x1,0 | 0.10 | 1.33 | 1.26 | 0.66 | 0.17 |
| 5.6B | 0+310 | 1,5x1,0 | 0.20 | 1.88 | 1.78 | 0.94 | 0.24 |
| 5.7C | 0+220 | 1,5x1,0 | 0.10 | 1.33 | 1.26 | 0.66 | 0.17 |
| 5.7 | 5+732 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 5.7A | 0+132 | 1,5x1,0 | 0.10 | 1.33 | 1.26 | 0.66 | 0.17 |
| 5.9B | 0+112 | 1,5x1,0 | 0.20 | 1.88 | 1.78 | 0.94 | 0.24 |
| 5.9B | 5+934 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 6.5 | 6+545 | 1,5x1,5 | 0.20 | 3.27 | 3.00 | 1.64 | 0.45 |
| 7.0 | 7+000 | 2,0x2,0 | 0.50 | 11.14 | 10.23 | 5.57 | 1.53 |
| 7.9 | 7+935 | 2,0x2,0 | 1.00 | 15.75 | 14.47 | 7.87 | 2.17 |
| 8.8 | 8+850 | 2,0x2,0 | 1.10 | 16.52 | 15.18 | 8.26 | 2.27 |
| 8.9A | 0+202 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9.0 | 9+055 | 2,0x2,0 | 1.50 | 19.29 | 17.72 | 9.64 | 2.66 |
| 9.0A | 0+055 | 2,0x2,0 | 1.50 | 19.29 | 17.72 | 9.64 | 2.66 |
| 9.2B | 0+230 | 1,5x1,5 | 0.20 | 3.27 | 3.00 | 1.64 | 0.45 |
| 9.2 | 9+290 | 1,5x1,5 | 0.70 | 6.12 | 5.62 | 3.06 | 0.84 |
| 9.2C | 0+290 | 1,5x1,5 | 0.70 | 6.12 | 5.62 | 3.06 | 0.84 |
| 10.1 | 10+125 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 10.4 | 10+410 | 2,0x2,0 | 1.70 | 20.53 | 18.87 | 10.27 | 2.83 |
| 10.9 | 10+945 | 2,0x2,0 | 2.00 | 22.27 | 20.46 | 11.14 | 3.07 |
| 11.7A | 0+008 | 2,0x2,0 | 0.10 | 4.98 | 4.58 | 2.49 | 0.69 |
| 11.8 | 11+795 | 2,0x2,0 | 0.10 | 4.98 | 4.58 | 2.49 | 0.69 |
| 12.1A | 0+082 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 12.4 | 12+450 | 2,0x2,0 | 0.20 | 7.04 | 6.47 | 3.52 | 0.97 |
| 12.8 | 12+850 | 2,0x2,0 | 0.30 | 8.63 | 7.93 | 4.31 | 1.19 |
| 13.1 | 13+155 | 2,0x2,0 | 0.30 | 8.63 | 7.93 | 4.31 | 1.19 |
| 13.4A | 0+215 | 4,0x3,0 | 0.20 | 30.27 | 28.44 | 15.13 | 4.01 |
| 13.6 | 13+690 | 4,0x3,0 | 0.10 | 21.40 | 20.11 | 10.70 | 2.83 |
| INCREASE | | 4,0x3,0 | 0.40 | 42.80 | 40.21 | 21.40 | 5.67 |

### 3.3.3. TYPICAL CROSS SECTIONS AND LONGITUDINAL PROFILES

Typical design drawings (plane view and longitudinal sections) of the bridges are shown in Figures 13-21.

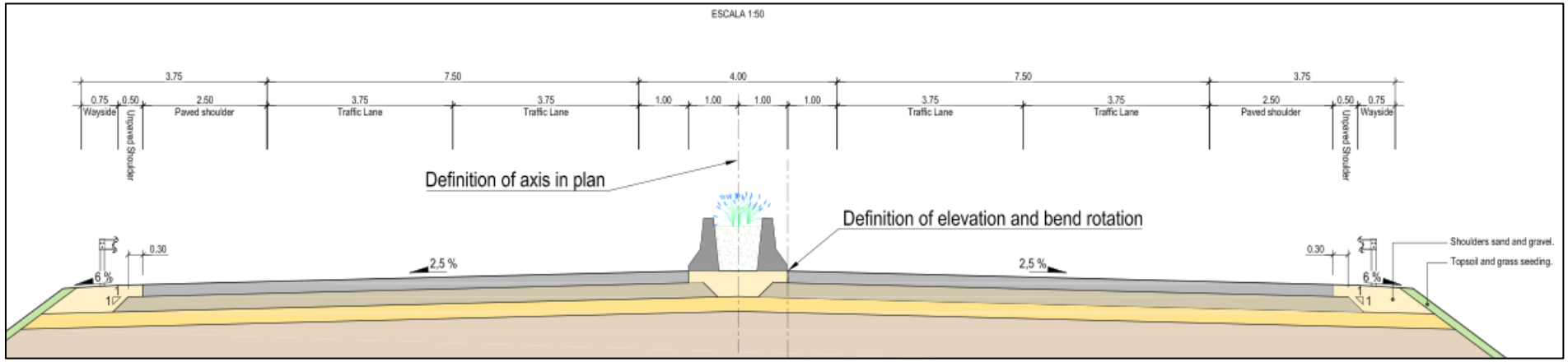



***Figure 13. Double carriageway***

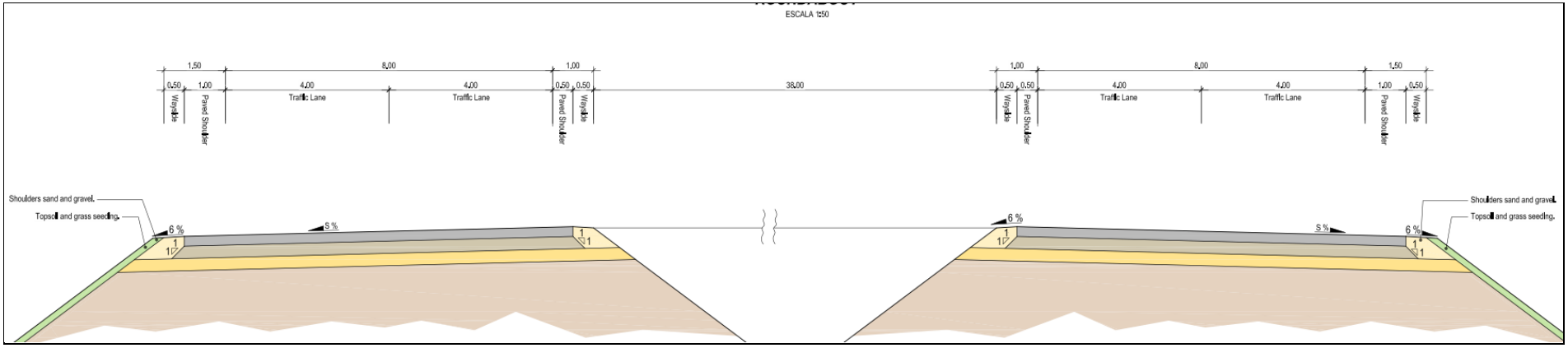



***Figure 14. Roundabout***

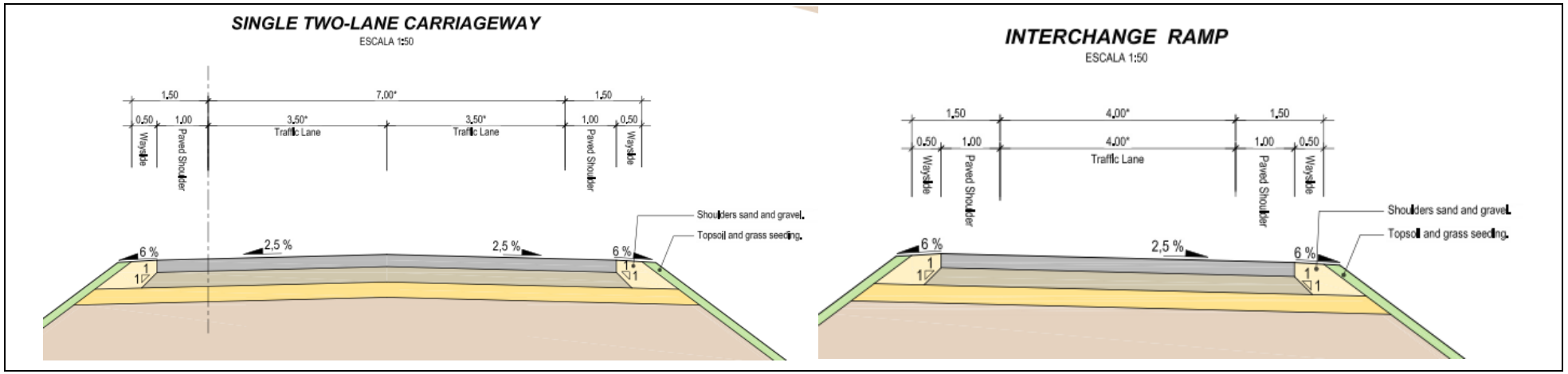



***Figure 15. Single two lane carriageway and interchange ramp***

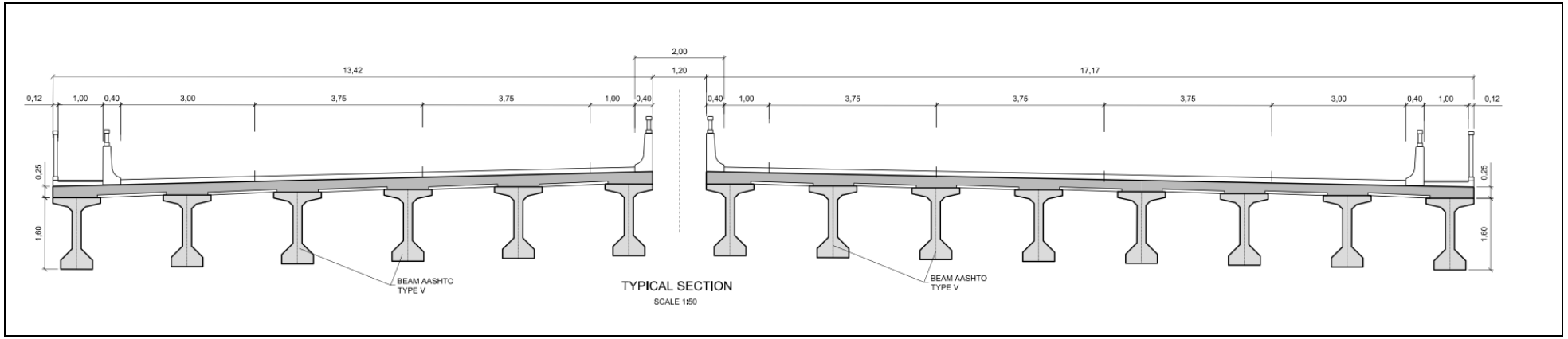
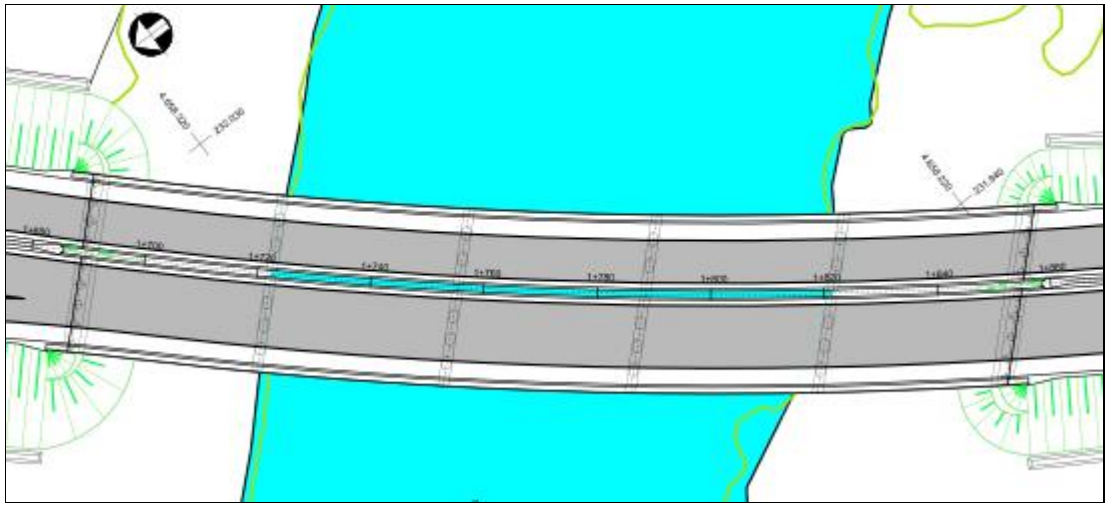
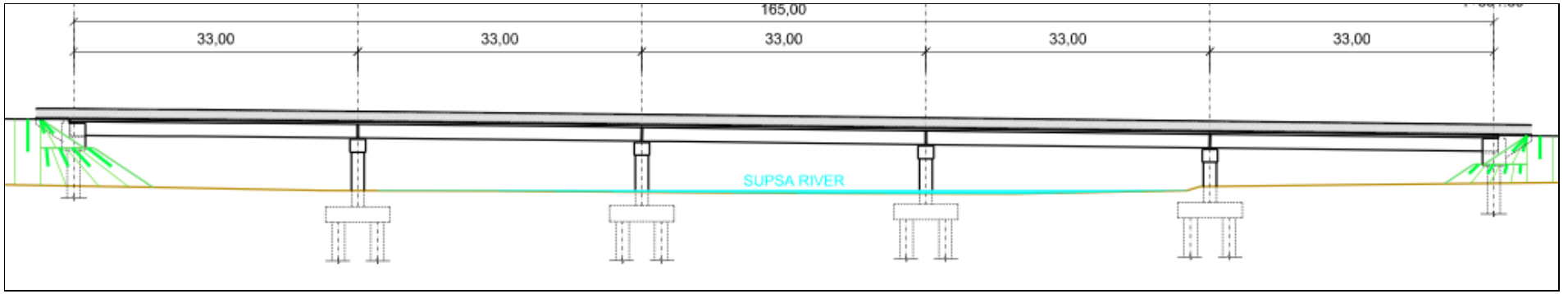



***Figure 16. Typical cross section of a bridge***

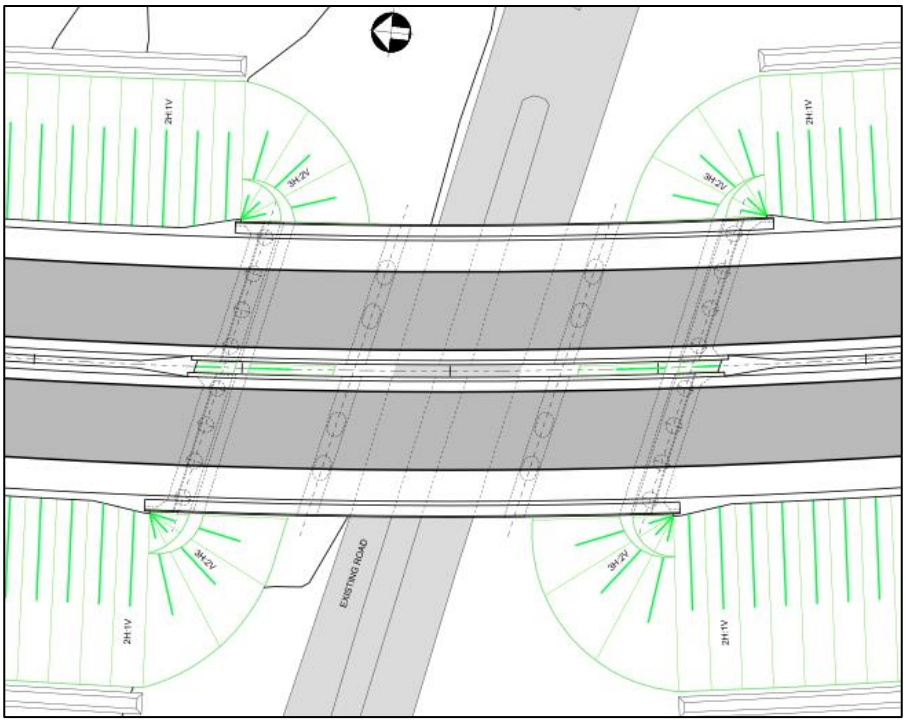


Plane view

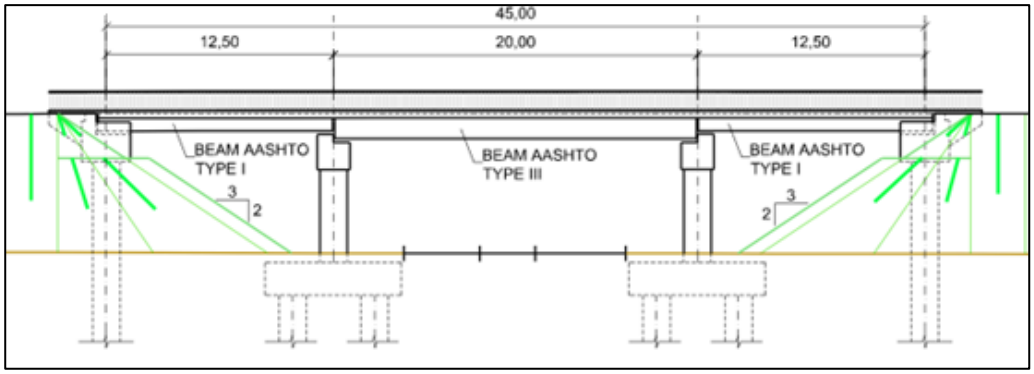



Longitudinal section

***Figure 17. Bridge over the Supsa River***

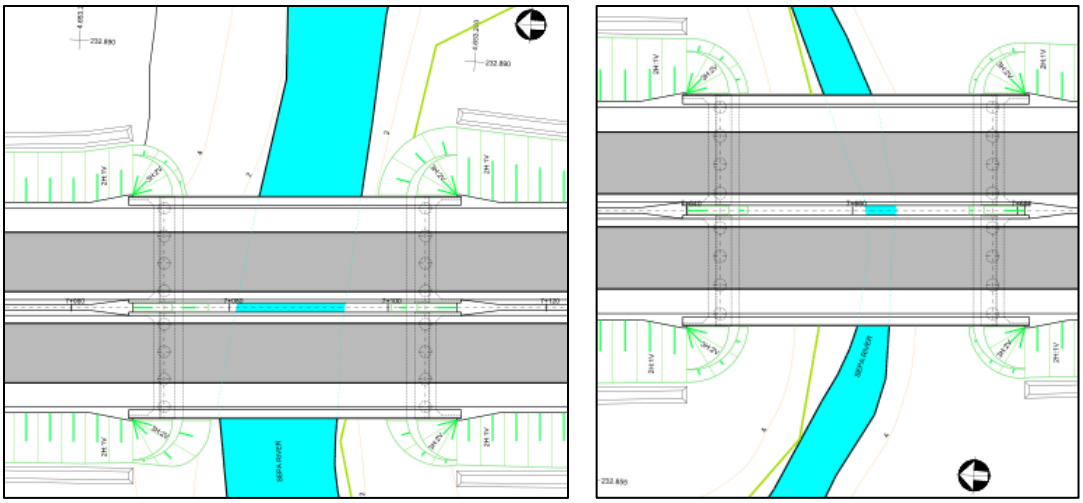



Plane view



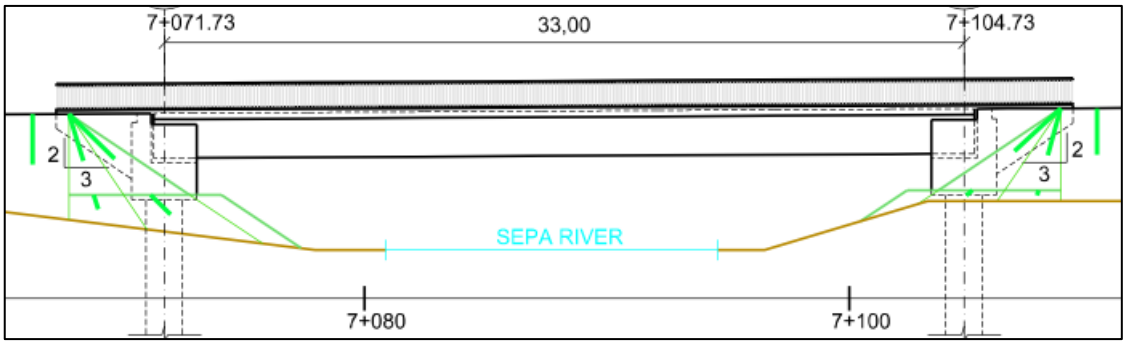

Longitudinal section

***Figure 18. Typical underpass***

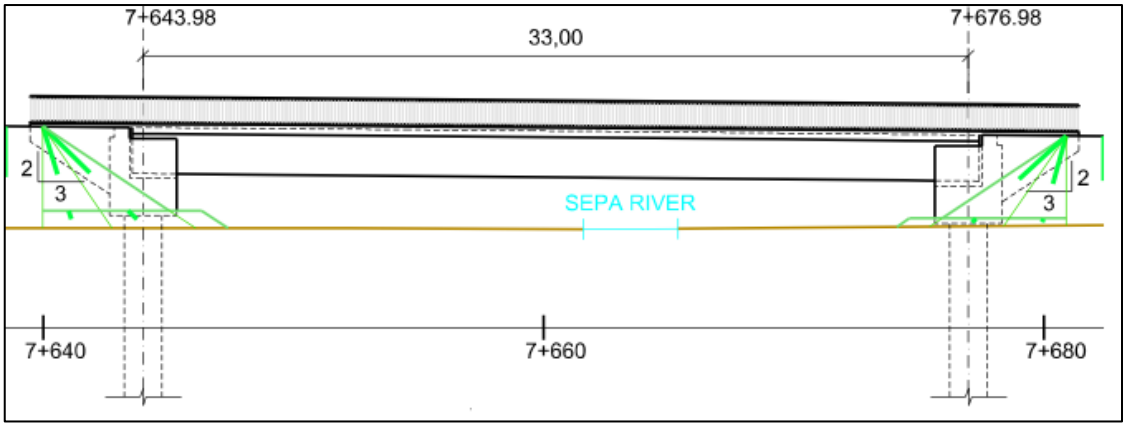


a b

Bridge over Sepa River (a); bridge over Sepa tributary (b) – plane view

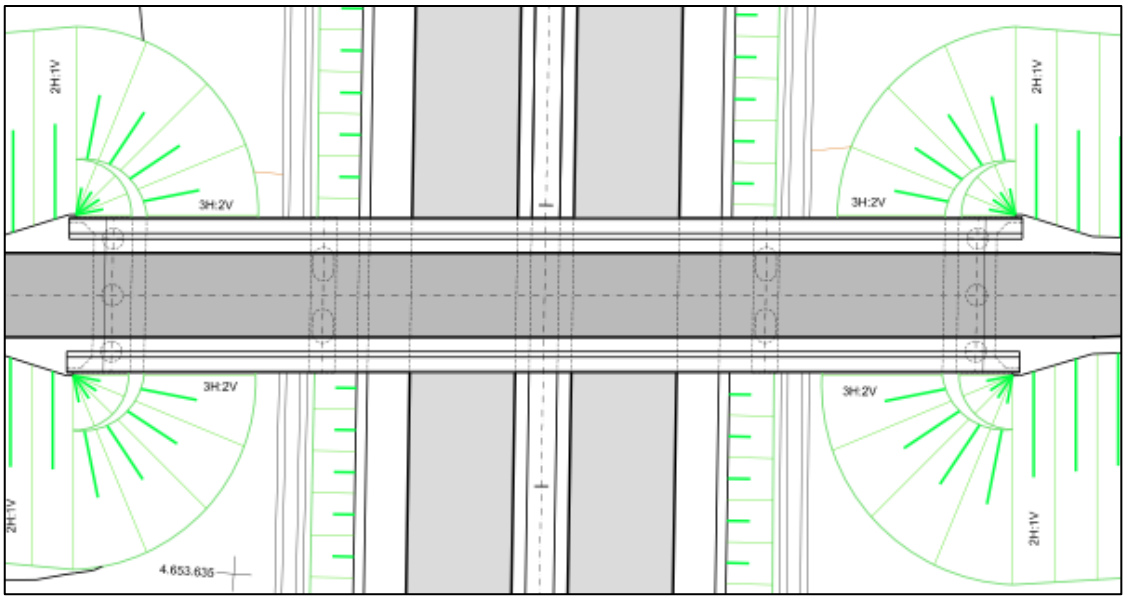



Bridge over Sepa River –Longitudinal section

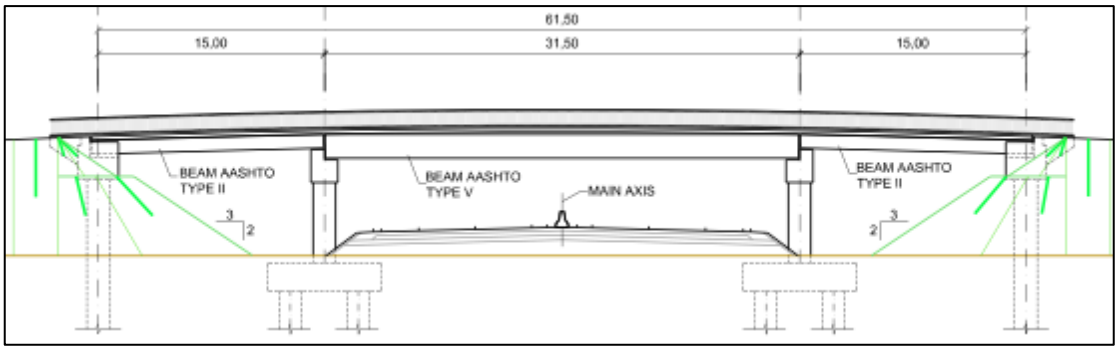



Bridge over Sepa River tributary –Longitudinal section

***Figure 19. Bridge over the Sepa River and its tributary***

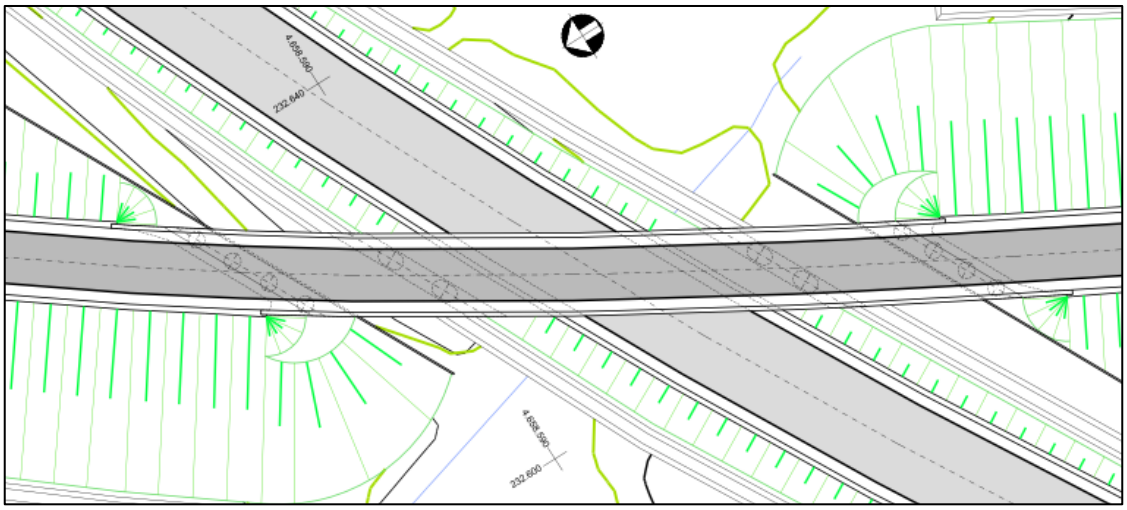



Overpass

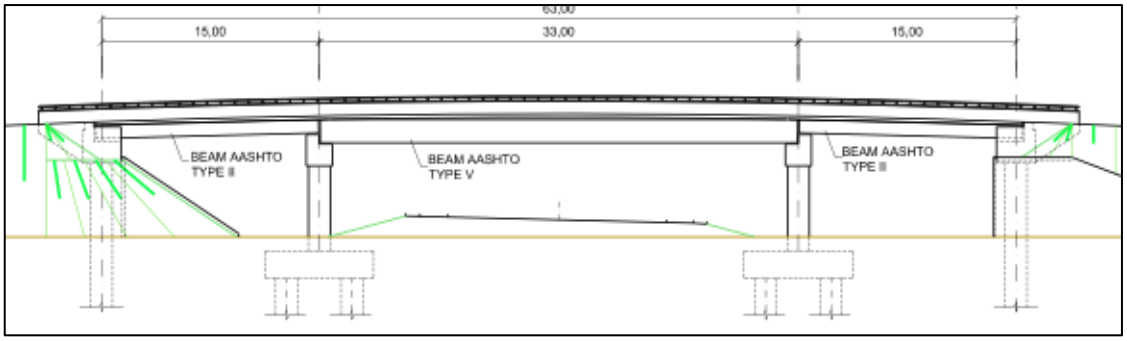



Longitudinal section

***Figure 20. Typical road overpass***



Plane view




Longitudinal section

***Figure 21. Typical interchange overpass***

### 3.4. INTERCHANGES

Locations of interchanges have been determined with consideration of the national and international standards taking into account:

- Traffic Intensity;
- Distance between interchanges;
- Size of urban areas;
- Land use;
- Cost of interchange construction;
- Maximum flood level.

The types of the interchanges proposed for design road section are as follows:

- IC1-L1 (pk1+490) – Trumpet like;
- IC1-B (pk3+000) - Partial clover type;
- IC2-L1 (pk5+690 ) - Clover modified using nearby quadrants';
- IC3-L1 (pk9+090) – Diamond type;
- I-L1-A1-14+400 - existing interchange adopted to the new conditions –adding one ramp and few changes of two ramps required.

### 3.4.1. INTERCHANGE IC1 WITH GRIGOLETI ROAD AND SAMTREDIA-GRIOLETI HIGHWAY

IC1-L1 (pk1+490) (**Figure 4**)
The interchange is on the right bank of the Supsa River. Grigoleti-Khidmaghala road has been diverted to allow the lacet for the traffic from Lot 1 to Lot 2, north direction (ramp 3).

Configuration of the interchange has been developed according to expected traffic volumes of each direction, where the flow from and to Samtredia are the most important. Samtredia - Lot 1 traffic will be through the own highway and Samtredia-Lot 2 - through the ramps speeds.

- **Ramp 1** (Samtredia-Lot 2 direction). Alignment uses existing Samtredia-Grigoleti road ROW along the section which is going to be useless after the construction of the realignment projected for the road in this alternative.
- **Ramp 2** starts in the alignment of the Samtredia-Grigoleti road, crosses the main highway via the same underpass of the realignment, goes upward, overpasses Samtredia-Grigoleti road, and finally connects to Samtredia-Grigoleti highway.
- **Ramp 3** makes a lacet for Lot 1 to Lot 2 movement. The radius of the lacet is 45 m (the minimum used in the project). Geometry of this ramp alignment is constrained by limited area available between the highway and the river Supsa where the realignment of Samtredia-Grigoleti road and ramp 2 must be placed.
- **Ramp 4** (with a minimum radius of 120 m for a design speed of 60 km/h) heads to south joining the Lot 1 highway before the viaduct over Supsa River. Acceleration lane of the ramp is placed along the viaduct so, structure width in south direction is enlarged to allocate the additional lane.

### 3.4.2. INTERCHANGE IC-1B NEAR SUPSA TERMINAL

IC_1B (pk3+000) (

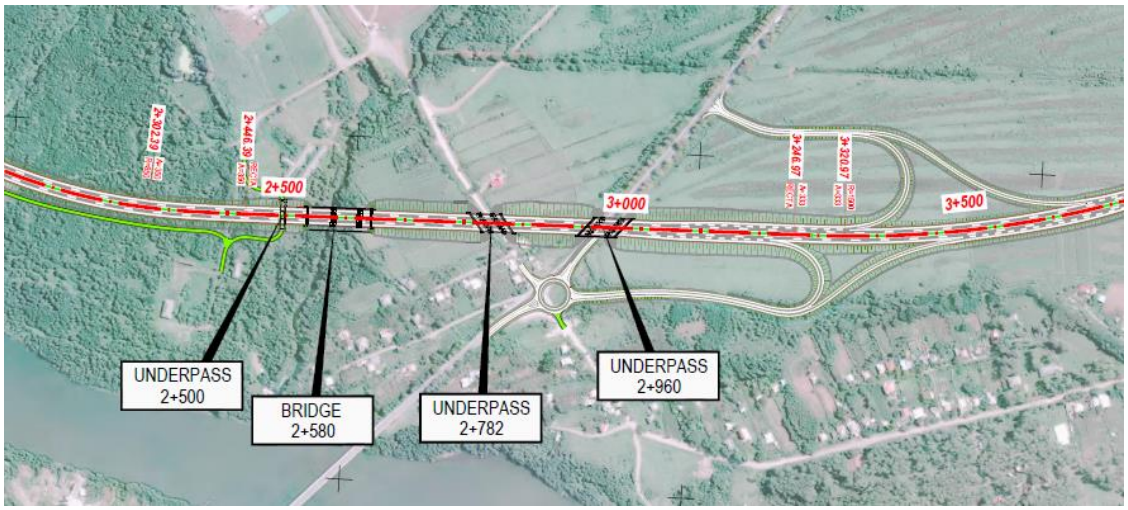



Figure **5**)

The lacets have parameters for a design speed of 40 km/h, meanwhile the rest of the ramps have parameters for 60 km/h. A roundabout is necessary in the West side, because of the great number of existing connections. Nevertheless, eastbound of the interchange has been designed a T junction with the current road.

### 3.4.3. INTERCHANGE IC2 WITH UREKI-MAGNETITI ROAD

IC2-L1 (pk5+690 ) (**Figure 22**)

At this point the alignment has a 'fixed point' crossing the existing local road between Ureki and Magnetiti, which has a lot of buildings at both sides.

The design, avoiding impact on buildings on the Southern side, has been designed. This is a 'Clover modified using nearby quadrants' type of interchange in the eastbound, and direct ramps connected with a roundabout in the westbound.

Originally, the interchange has been thought to be developed as a single diamond interchange with two roundabouts in the intersection of ramps with Magnetiti-Ureki road. Nevertheless, to minimize impact on the buildings, eastbound of the interchange has been designed with a lacet and a direct ramp connected with the Magnetiti-Ureki road with a T junction in the north area of the local road, where there is more land available.

Direct ramps 1 and 2 have been developed for a design speed of 60 km/h, whereas ramps 3 and 4 are configured as a partial cloverleaf, with ramp 3 making the loop with

a minimum radius of 65 meters, according to permissible values for a design speed of 40 km/h.

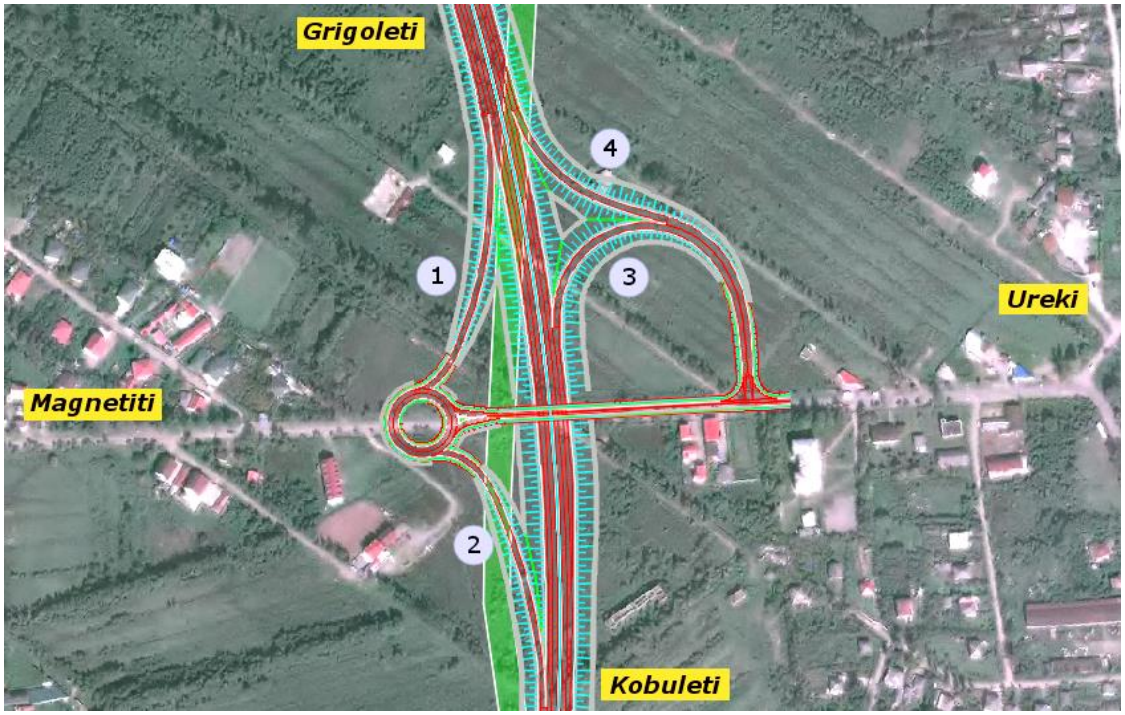



***Figure 22. Ureki-Magnetiti interchange***

### 3.4.4. INTERCHANGE IC3 WITH EXISTING GRIGOLETI-KOBULETI ROAD

IC3-L1 (pk9+090) (**Figure 23**)

The third interchange is a full diamond interchange with double roundabout to solve intersections with the existing Grigoleti-Kobuleti road.

The design for the interchange has been done with the main alignment (with double carriageway) near the terrain, and elevating the road with an overpass, in order to decrease the earthworks, and the expensive soil geotechnical treatments, and then, minimizing the construction costs.

Design speed for all ramps is 60 km/h.

Roundabouts solution for the intersections has been chosen instead of T-junction due to safety reasons since the local road has a curved alignment in this zone. With the proposed solution, the same curved alignment could be used to reduce the velocity of vehicles arriving at the circular intersection

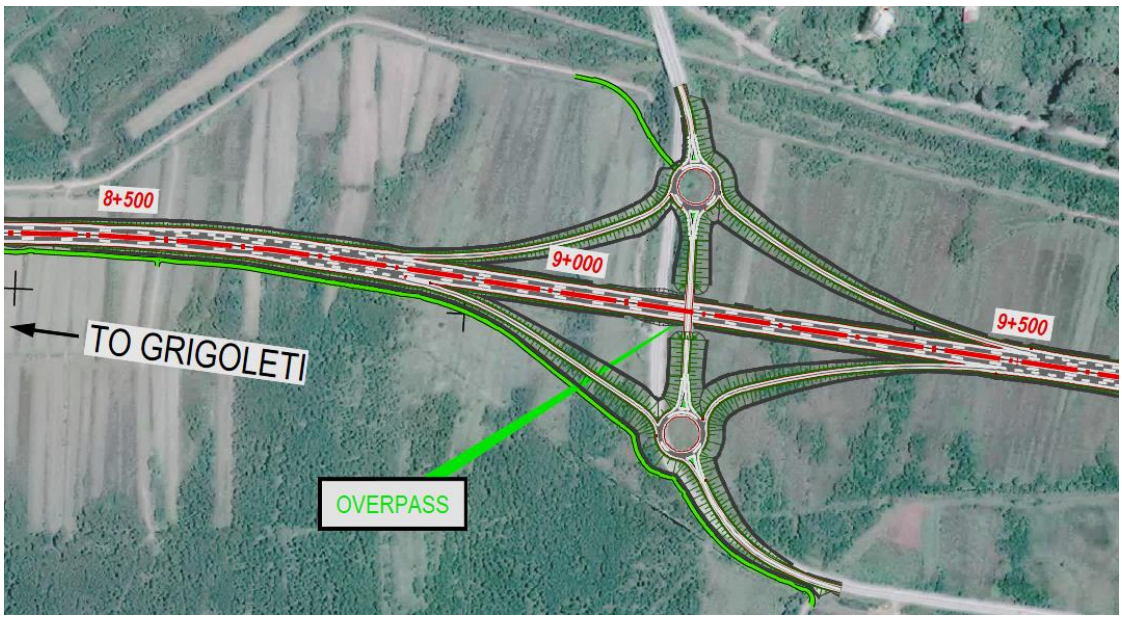



***Figure 23. Interchange with existing Grigoleti-Kobuleti Road***

### 3.4.5. INTERCHANGE IC4 WITH KOBULETI BY-PASS AND EXISTING GRIGOLETI-KOBULETI ROAD

I-L1-A1 (pk14+400) (**Figure 24**)

The continuity between the new highway and the Kobuleti by-pass is a clear requirement in order to provide the proper connectivity and functionality, so the interchange have been designed using existing interchange, and adopting it to the new conditions.

Only a new ramp (1) and few changes in other two ramps (2 and 3) are needed. as it is shown in the picture on the right side.

At km 13+300, the right lane separates, connecting with existing E70 Road (1). The acceleration lane joining the left roadbed is incorporated at km 14+100 (2), two left lanes on the carriageway are maintained until km 14+100. After this section, the road continues as conventional road, with only one lane in each direction. A stretch of about 800 m length has to be replaced to give continuity to the existing road (4).

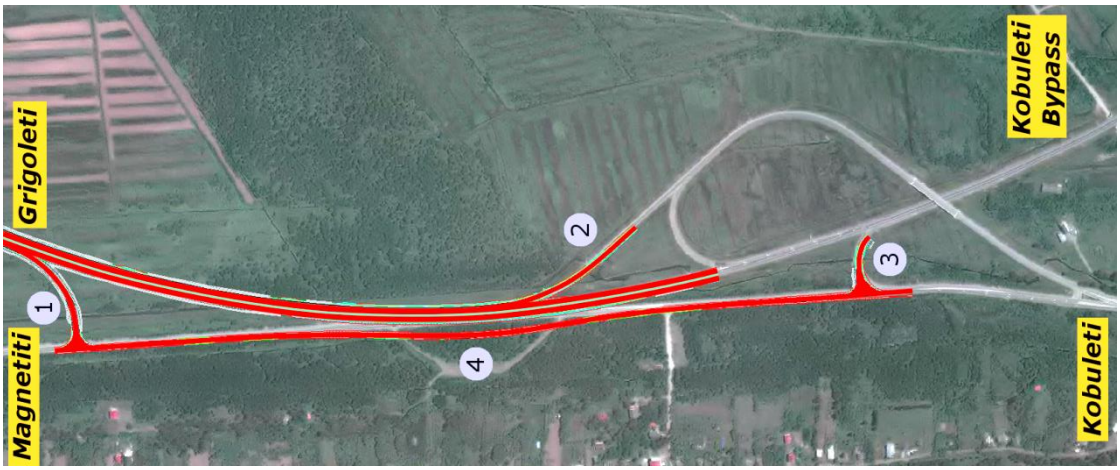



***Figure 24. Interchange with Kobuleti by-pass and existing Grigoleti-Kobuleti road***

### 3.5. ROAD PAVEMENT

The software ALIZE-LCPC, developed by the IFSTTAR, representing a computation tool for admissible values (stresses and strains) according to the traffic and the materials was used for design of pavement structures. For Grigoleti-Kobuleti bypass alignment asphalt pavement was selected because of the soil conditions. The pavement structure will be as follows:

| | | |
|---|---|---|
| Asphalt concrete | 280mm | 110mm, a/c wearing course<br>170mm, a/c binder course |
| Crushed aggregate base course | 200mm | |
| Crushed aggregate sub-base course | 200mm | |

Construction of embankments is envisaged from rock and gravel. The lower part of the embankment is envisaged from rock, the maximum size of which shouldn't exceed 2/3 of the compacted layer. Compaction should proceed in layers, paying special attention to the quality of compaction. The base of the embankment requires strengthening as it is represented by soft soils. Strengthening of embankment base in high embankments, mainly at the approaches to bridges, is envisaged by stone (gravel) columns, whilst in relatively low embankments strengthening is envisaged by high strength geotextile. In both cases, layer of separation geotextile is envisaged between the existing soil and the embankment. Construction of side (drainage) channels is envisaged in the design on both sides of the highway. Design envisages filling of top soil on the embankment slopes, followed by levelling and seeding of grass.

### 3.6. TRAFFIC VOLUME

Design was developed based on traffic flow data analysis. Information from the Roads Department for 2015, automatic counts (ACC), manual classification (MCC) counts and original destination survey (O/C). The field study was done in winter and summer periods. Traffic flow values (counted) are given below:

***Table 13. Traffic flows (automatic count data) in winter and summer periods, 2016***

| Location | Winter, working day | | | Summer, working day | | |
|---|---|---|---|---|---|---|
| | LV | HGV | Total | LV | HGV | Total |
| 1 Lanchkhuti Grigoleti | 5.819 | 655 | 6474 | 11437 | 1080 | 12517 |
| 2 Sanaki Zugdidi | 8615 | 816 | 9431 | 6776 | 700 | 7476 |
| 3 Shekvetili Kobuleti | 2687 | 98 | 2785 | 5563 | 93 | 5658 |
| 4 Kobuleti Batumi | 13730 | 1144 | 14874 | 20750 | 1765 | 22515 |
| 5 Senaki Poti | 5701 | 934 | 6635 | 13051 | 1608 | 14659 |

Note: for location of the control points see **Figure 25**)

Manual Classification Counts to collect information were undertaken at 1 location over a two-day period to collect information for expanding the O/D surveys and confirm existing traffic volumes and vehicle composition along the corridor. The following vehicle types were categorized:

- Car - private cars, and all other small vehicles such as 4-wheel drive vehicles, passenger vans, etc.
- Van - minibuses and small buses of up to 15 seats being used for the transport of fare paying passengers, vans and pick-ups used predominantly for the transport of goods.
- Bus - standard and large buses with more than 15 seats being used for the transport of passengers.
- Light goods vehicle (4-wheel).
- Light goods vehicle (6-wheel). Six-wheel vans used for the transport of goods.
- Two and three axes goods vehicle. Trucks with a total of two axes and six wheels, or three axe trucks with a single axle at the front and two axles at the rear.
- Four or more axes goods vehicles. Trucks or truck - trailer combinations with four or more axles in any formation.

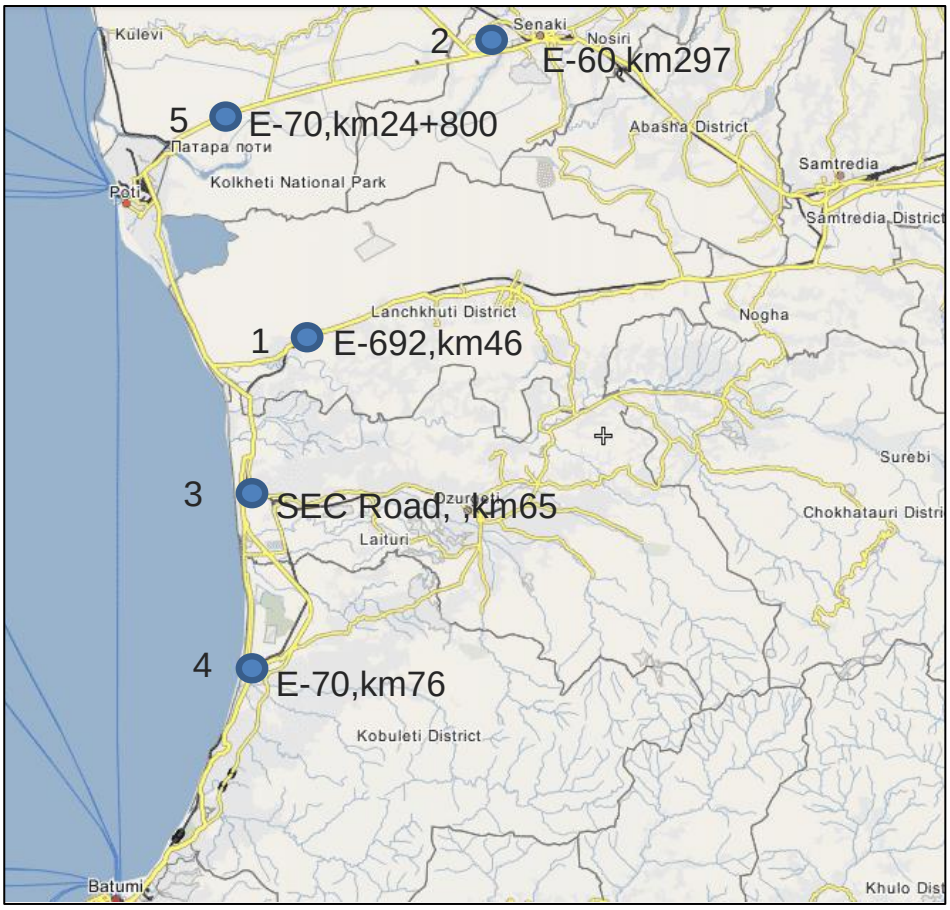



***Figure 25. Automatic traffic count sites***

Both automatic and manual counts showed that traffic in summer nearly double the winter traffic in the coast corridor and some of its access roads. Light cars dominate,

Modelling of future traffic was done for various scenarios (up to year 2050). It was observed that Grigoleti-Kobuleti section has a very similar demand in all scenarios.

The analysis has been made by means The Highway Capacity Software (HCS), based on the Highway Capacity Manual 2010 methodology for two lane highways.

## 3.7. MOBILIZATION AND CONSTRUCTION PHASE

### 3.7.1. MOBILIZATION

Works will be carried out by the contractor selected through international tendering. Prior to the commencement of works, the contractor will specify location of the camp, equipment stationing area, material stockpiling sites and agree on/receive a permit for

its use from the state or the land owner. Potential sites suggested for this purpose are indicated on the map (**Figure 26**).

***Table 14. Location of the sites for temporary use during the project***

| Site | Location | Area, $m^2$ |
|---|---|---|
| Area 1 | pk1+400 | 12.880 |
| Area 2 | pk5+600 | 9.245 |
| Area 3 | pk9+200 | 7.275 |

After selection of construction company through tendering, *preconstruction activities* connected with the highway construction works to be implemented by the latter 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 topsoil and subsoil, 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 plants (in case contractor plans to run his own plants);
- Approval of quality characteristics (allowable limits of discharge) 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;
- Developing traffic management plan;
- Developing work camp or construction yard site map;
- Relocation/protection of existing infrastructure.

### 3.7.2. Construction stage

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

- Removal of vegetation from the RoW;

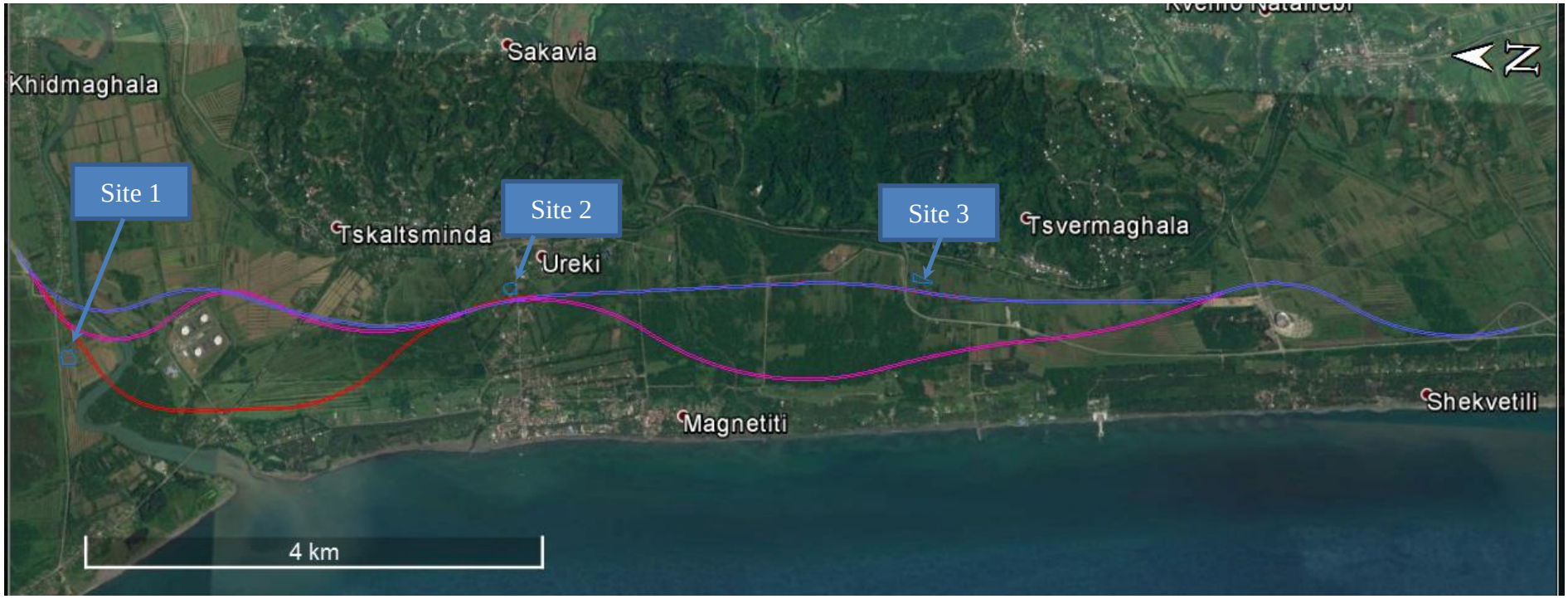



***Figure 26. Location of site for camp, machinery stationing and material stockpiling areas***

- Stripping and stockpiling of topsoil until reuse during reinstatement of temporarily disturbed sites (Note: a) the height of the stockpile must not exceed 2m, b) all sites temporarily disturbed/used for the needs of the project must be reinstated);
- Removal and stockpiling of subsoil to agreed location until reuse;
- Grading of the area 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;
- Reinforcement of soil with gravel columns and/or Prefabricated Vertical Drains (PDV);
- 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;
- Concrete works, arrangement of foundations and bridge structures, including arrangement of sheet piles for construction of the piers in the riverbed;
- Construction of span bridges;
- Providing of road furniture and marking in accordance with international standards;
- Landscape harmonization and tree planting/grass seeding of temporarily disturbed areas according to the reinstatement plan.

Volume of earthworks is calculated in accordance with the design cross-sections.

***Table 15. Volume of earthworks***

| | Unit | Quantity | Total quantity |
|---|---|---|---|
| Volume of topsoil to be removed | $m^3$ | 262,677.6 | 262,677.6 |
| Cuts | $m^3$ | Main road: 434.541.59<br>Interchanges: 146,573.78 | 581,115.37 |
| Embankments | $m^3$ | Main road: 1,416,723.44<br>Interchanges: 449,667.91 | 1.866.391.35 |

Construction works will be carried out in conformity with valid standards, norms, recommendations and instructions, in accordance with typical technological diagrams, design specifications, following the Best Available Technology practice.

The construction phase is anticipated to take up 18 months.

### 3.7.3. Operation stage

Operation of the road involves activities, such as maintenance of the pavement and the road infrastructure/marking, clean up and management of roadside waste, maintenance of compensatory plantations (if the case).

### 3.7.4. 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.

Contractor will be requested to provide copies of licences obtained from material provider to the client before commencement of works.

During the design stage licensed quarries were defined in 40 km from the site. The inert material in the project area, in general, fits the requirements for fillers, pavements and base materials, but may need sieving. There is a range of sand gravel sourcing sites in the area (***Figure 27***- ***Figure 29***), Licences for abstraction of gravel and sand from these areas has expired or will expire soon.

***Table 16. List of sand-gravel abstraction sites in the region***

| # | Municipality | Area, ha | License # | Issued | Period | Owner | Total abstraction |
|---|---|---|---|---|---|---|---|
| 1 | Lanchkhuti | 1.25 | 00715 | 13.07.2007 | 5 | JMM Ltd | 79600 |
| 2 | Lanchkhuti | 3.1 | 0000147 | 21.12.2005 | 10 | I Betoni Ltd | 135300 |
| 3 | Lanchkhuti | 0.7 | 0000147 | 21.12.2005 | 10 | I Betoni Ltd | |
| 4 | Lanchkhuti | 16.4 | 498 | 14.11.2002 | 10 | Bako Ltd | 200000 |
| 5 | Lanchkhuti | 5.1 | 00302 | 12.09.2006 | 15 | Kvachadze Shromis Ubani | 180000 |
| 6 | Lanchkhuti | 1.28 | 00473 | 19.02.2007 | 5 | Vakhtang Rokava | 75000 |
| 7 | Lanchkhuti | 0.52 | 00473 | 19.02.2007 | 5 | Vakhtang Rokava | |
| 8 | Ozurgeti | 4.9 | 00315 | 19.9.2006 | 10 | International company 2005 | 10000 |
| 9 | Ozurgeti | 9.35 | 100835 | 2.06.2008 | 5 | Nino Ltd | 10500 |

| # | Municipality | Area, ha | License # | Issued | Period | Owner | Total abstraction |
|---|---|---|---|---|---|---|---|
| 10 | Ozurgeti | 0.37 | 01107 | 30.01.2008 | 5 | Giga Makharadze | 11100 |
| 11 | Ozurgeti | 1.7 | 100841 | 28.03.2006 | 10 | Kartuli cementi Ltd | 50000 |
| 12 | Ozurgeti | 5.7 | 00503 | 05.04.2007 | 5 | Union Association ATU | 100000 |
| 13 | Ozurgeti | 1.47 | 01008 | 31.1.2008 | 5 | Giga Makharadze | 83100 |
| 14 | Ozurgeti | 1.3 | 01108 | 30.01.2008 | 5 | Giga Makharadze | |
| 15 | Ozurgeti | 7.25 | 100010 | 05.08.2007 | 5 | Gza Ltd | 217500 |
| 16 | Ozurgeti | 1.4 | 00444 | 29.01.2007 | 5 | Nino Ltd | 134000 |
| 17 | Ozurgeti | 2 | 00444 | 26.01.2007 | 5 | Nino Ltd | |
| 18 | Ozurgeti | 1.5 | 100758 | 11.10.2006 | 20 | VA-Go Ltd | |
| 19 | Ozurgeti | 0.74 | 100322 | 30.10.2008 | 5 | VA-Go Ltd | 29700 |
| 20 | Ozurgeti | 0.59 | 01096 | 25.01.2008 | 5 | Emzar Makharadze | 17708 |
| 21 | Ozurgeti | 2.25 | 100592 | 30.10.2008 | 5 | VA-Go Ltd | 89700 |
| 22 | Ozurgeti | 0.89 | 01106 | 30.01.2008 | 5 | Giga Makharadze | 26700 |
| 23 | Ozurgeti | 5 | 621 | 07.06.2005 | 10 | Tengo Ltd | |
| 24 | Ozurgeti | 1.72 | 0005 | 20.12.2007 | 5 | Gabroni Ltd | 103200 |
| 25 | Ozurgeti | 1.96 | 00444 | 26.01.2007 | 5 | Nino Ltd | 134000 |
| 26 | Ozurgeti | 3.95 | 100361 | 22.08.2006 | 10 | Gora Ltd | 130000 |

The contractor may run own quarry, but in this case obtaining licence from MENRP will be required. Contractor may decide to use the same sites indicated above (under condition that MNRP licence is obtained). Location should comply with requirements set out in the Law on regulation and engineering protection of the sea and river banks and Governmental decree #136, on approval of Rules and conditions of issuance of mineral resources abstraction licence. Only a licensed quarry may be used. (For additional information see sub-section 2.7).

Material removed in cut section can be used for embanking.

Several cement plants have been identified in the project area (***Figure 30***).

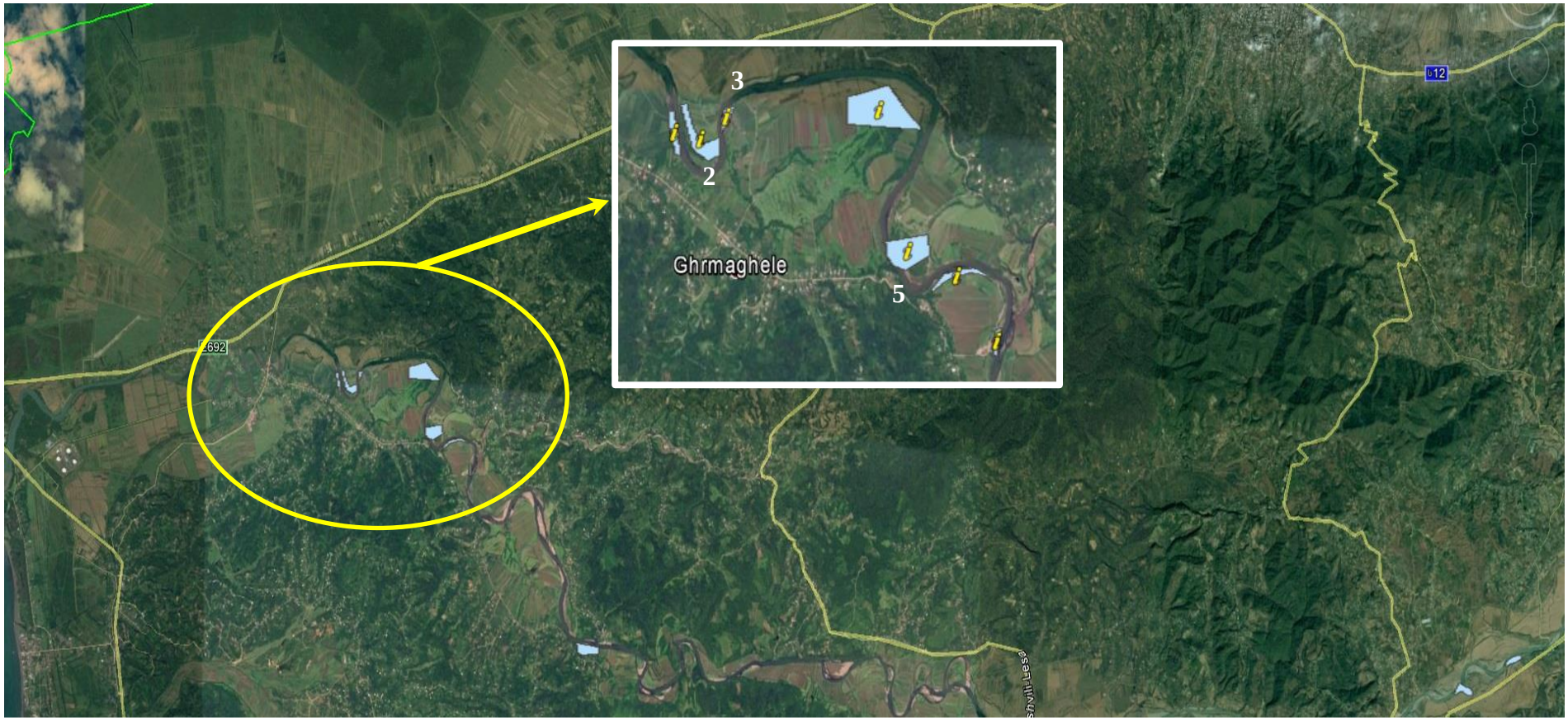



***Figure 27*. Licenced sites of gravel-sand abstraction - Supsa River (Lot 1)**


***Figure 28*. Licenced sites of gravel-sand abstraction - Natanebi River (Lot 1)**


***Figure 29. Gravel and sand extraction areas (licenced)***


CP1 CP2 CP3 CP4


***Figure 30. Cement plants within 40km from the project area***

## 4. METHODOLOGY

The ESIA process included two stages – Preliminary ESIA at Feasibility stage of the project and ESIA during development of detailed design. The process consisted of six main activities that are common to most ESIA studies conducted to the national and international standards comprising the following:

1 Collection of baseline data describing the existing environment (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 impacts are expected.
2 Identification of impacts, assessment of their significance and development of impact avoidance, reduction and/or mitigation measures (avoidance of impacts is preferred over mitigation by both IFI 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).
5 Stakeholder consultation and disclosure.
6 Drafting of the ESIA report.

Activities implemented by the team included desktop studies and field work for verification of available reference/literary data and additional data gathering, followed with analysis of information. Boundaries of project impact zone/survey boundaries have been set.

Field surveys involved sampling for soil and surface water quality analysis, measurements of background noise and radiation, faunistic and flora surveys, socio-economic data gathering and analysis.

Impact recipients and impact factors/sources have been identified. Assessment of impact significance have been carried out throughout the area of influence of the Project and its component activities. In each case the spatial boundaries comprise the areas within which significant impacts are likely to occur and take into account the physical extent of the planned activities, and the baseline status of recipient environment as well as ability of impact to propagate beyond the project boundary. Therefore these boundaries turned to vary depending on the type of impact being considered.

The temporal boundaries of impacts have been identified and assessed for all phases of project development (mobilisation, construction, operation).

For the purpose of this ESIA, the area of influence has been defined as the area in which a direct and/or indirect impact on the biophysical and social (including cultural heritage, occupational health and safety issues) environment might occur.

The areas of influence have been set as 100m to 500m (depending on the type of impact; location, type and sensitivity of recipient). For impact on archaeological heritage 50m corridor along the RoW was considered as the area of influence.

It was considered that the settlements/population within 1 km from the project sites will be most significantly affected by direct impacts (resettlement, infrastructure and transport system, reduced environmental quality).

Description of impact assessment methodology is given in Annex 1.

# 5. BASELINE DATA

## 5.1. PHYSICAL CONDITIONS

### 5.1.1. Climate and meteorology

Western 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. The Caucasian ridge, located north-east to the site protects the area from cold air masses coming from the north. At the same time high ridges favour condensation and therefore humidity is rather high. The area is known for high level of precipitations.

According to construction-climatic characterizations the project region belongs to III-b climatic sub-region.

Seasonal pattern of wind direction is predetermined by location of Lesser Caucasus and Likhi ridges which are responsible for regulation of air circulation regime. Winds directions are characterised by seasonal variations and depend on topography of the area. According to the meteorological station of Supsa, in the Supsa area north-east and south-west winds dominate. The winds have a seasonal character: in winter is characterized north-east whereas in summer south-west winds are prevailing.

Climatic characteristics of the project area, based on Construction Climatology (PN 01.05-08, Tbilisi 2009) are given below:

***Table 17. Air temperature***

| Location | Average monthly | | | | | | | | | | | | Aver.Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Supsa | 4.5 | 5.2 | 7.9 | 11.4 | 16.2 | 20.0 | 22.5 | 22.6 | 19.4 | 15.2 | 10.5 | 6.5 | 13.5 |
| Ureki | 5.8 | 6.4 | 8.6 | 11.8 | 16.2 | 20.3 | 22.6 | 23.0 | 20.0 | 16.4 | 12.3 | 8.1 | 14.3 |
| Kobuleti | 4.8 | 5.5 | 7.6 | 10.9 | 15.4 | 19.5 | 22.4 | 22.6 | 19.5 | 15.4 | 10.7 | 6.7 | 13.4 |

| Location | Abs min | Abs max | Aver max, hottest month | Coldest month 5-day aver | Coldest month aver | Coldest period average | Period with average monthly T<8C | | Aver T at 13:00 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Duration day | Aver T | Coldest month | Hottest month |
| Supsa | -13 | 41 | 26.8 | -4 | -6 | 4.2 | 106 | 5.5 | 6.5 | 25.3 |
| Ureki | -16 | 40 | 26.9 | -2 | -5 | 5.5 | 84 | 6.3 | 7.2 | 25.1 |
| Kobuleti | -16 | 41 | 26.6 | -3 | -6 | 4.6 | 109 | 5.8 | 7.5 | 25.1 |

**Air temperature amplitude**

| Location | Average monthly $^0$C | | | | | | | | | | | | Max monthly $^0$C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| Supsa | 7.1 | 7.8 | 8.8 | 9.6 | 10.3 | 9.1 | 8.0 | 8.2 | 9.7 | 10.2 | 9.1 | 7.7 | 15.0 | 17.9 | 19.6 | 20.4 | 21.2 | 20.0 | 19.0 | 18.8 | 21.2 | 21.5 | 20.5 | 16.0 |
| Ureki | 7.1 | 7.5 | 8.0 | 9.0 | 9.1 | 8.1 | 7.0 | 7.3 | 8.3 | 8.8 | 8.3 | 7.1 | 15.2 | 16.2 | 17.5 | 18.0 | 18.2 | 17.4 | 15.5 | 16.0 | 17.9 | 18.2 | 18.0 | 16.2 |
| Kobuleti | 8.3 | 9.0 | 8.7 | 9.0 | 8.6 | 8.5 | 7.5 | 8.0 | 9.0 | 10.2 | 9.8 | 9.5 | 17.0 | 17.8 | 17.5 | 17.8 | 17.0 | 16.7 | 19.0 | 16.6 | 17.7 | 21.1 | 20.0 | 19.5 |

***Table 18. Relative humidity***

| Location | Relative air humidity, % | | | | | | | | | | | | | Average relative humidity at 13:00 | | Aver.daily amplitude of relative humidity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | Aver Annual | Coldest month | Hottest month | Coldest month | Hottest month |
| Supsa | 80 | 80 | 79 | 79 | 80 | 82 | 84 | 86 | 86 | 84 | 80 | 78 | 82 | 72 | 74 | 12 | 19 |
| Ureki | 72 | 73 | 76 | 78 | 81 | 80 | 81 | 82 | 81 | 78 | 76 | 72 | 78 | 66 | 73 | 9 | 14 |
| Kobuleti | 80 | 80 | 79 | 80 | 82 | 80 | 80 | 82 | 84 | 84 | 82 | 80 | 81 | 69 | 71 | 16 | 21 |

***Table 19. Precipitations***

| Location | Precipitation per year, mm | Daily maximum, mm |
|---|---|---|
| Supsa | 2379 | 260 |
| Ureki | 2078 | 227 |
| Kobuleti | 2352 | 240 |

***Table 20. Snow cover***

| Location | Weight of the snow cover, kPa | Number of days with snow | Water content, mm |
|---|---|---|---|
| Supsa | 0.50 | 10 | - |
| Ureki | 0.50 | 7 | - |
| Kobuleti | 0.50 | 7 | - |

Ground freezing depth, 0

***Table 21. Wind characteristics***

| | Max speed possible once in 1,5,10,15,20 years, m/sec | | | | | Recurrence of direction (%) January, July | | | | | | | | Average max and min velocity, m/sec | | Wind direction and calm recurrence (%) per year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 5 | 10 | 15 | 20 | N | NE | E | SE | S | SW | W | NW | Jan | Jul | N | NE | E | SE | S | SW | W | NW | Calm |
| Supsa | 21 | 26 | 29 | 31 | 32 | 1/1 | 71/7 | 2/1 | 2/5 | 4/19 | 10/37 | 8/28 | 2/2 | 6.4/1.2 | 4.0/0.5 | 2 | 42 | 2 | 2 | 10 | 24 | 16 | 2 | 51 |
| Ureki | 17 | 21 | 23 | 25 | 26 | 3/0 | 24/3 | 30/12 | 12/16 | 12/17 | 9/3 | 7/17 | 3/4 | 4.7/3.0 | 3.9/2.6 | 3 | 15 | 20 | 13 | 14 | 20 | 11 | 4 | 5 |
| Kobuleti | 18 | 22 | 24 | 25 | 26 | 2/3 | 36/8 | 15/11 | 8/10 | 7/9 | 23/40 | 5/17 | 4/2 | 4.4/1.5 | 5.1/1.7 | 2 | 23 | 13 | 8 | 7 | 30 | 11 | 6 | 20 |

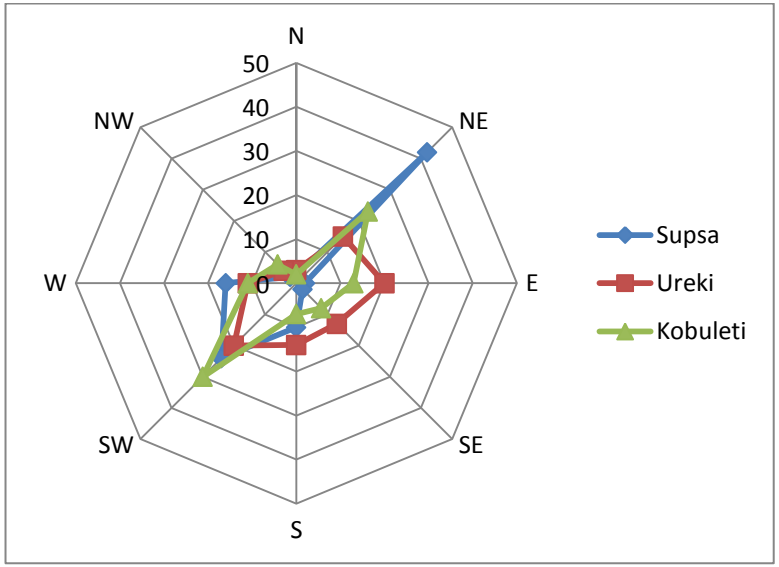



***Figure 31. Wind rose***

During the last 50 years average annual temperature on the whole territory of Georgia showed growing trend. Its maximum increment in West Georgia was (+0.6$^0$C) was registered in Poti. According to forecast, by 2050, as compared with 1986- 2010, warming will mostly occur in coastal zone and mountainous regions of Adjara (1.6-1.7$^0$C), and by 2100 the biggest increment of temperature (+4.2$^0$C) is anticipated in Batumi. In general, precipitation increased in most regions of West Georgia. Up to 2050, according to the forecast, sustainable trends of increase of precipitation is anticipated. Decrease by 10-20% will begin till 2100. Relative humidity of air in the period of 1961- 2010 increased by 2% on the entire territory of Georgia, although change of this trend in declining direction is anticipated in the region under consideration in 2050-2100. Average annual wind speed significantly decreased on the whole territory and according to the forecast, this decrease will continue till the end of the century.

### 5.1.2. 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.

There are no permanent air quality observation points in the project area. Background values in Ureki, Tskhaltsminda and Kvavilnari are of the following range: nitrogen dioxide - 0.008 mg/m$^3$; sulphur dioxide - 0.02 mg/m$^3$; carbon oxide - 0 .4 mg/m$^3$ and dust 0.1 mg/m$^3$.

### 5.1.3. 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. There are no stationary noise and vibration source within the study area. The road and the railway are likely to be the main sources of noise in the study area. 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.

Background noise was measuring using ИВШ-1 device. The measurements were done in daytime (from 10:00 to 18:00 hr). Average values measured three times in each of 3 control points are given below.

***Table 22. Noise levels (daytime) measured in the study area***

| # | Description | Noise level and equivalent noise level, dBA |
|---|---|---|
| 1 | Kvavilnari Settlement | 32.0 |
| 2 | Tskaltsminda Village | 36.0 |
| 3 | Ureki | 40.0 |
| 4 | Magnetiti | 32.0 |
| 5 | Shekvetili | 38.0 |


***Figure 32. Air quality and noise measurement points***

The obtained results show that noise levels are significantly below permissible values[4]. It shoud be mentioned that traffic on the roads was low. During the summer season higher noise levels are expected.

### 5.1.4. NATURAL BACKGROUND RADIATION

Background radiation of the investigated area was measured to check gamma-background and detect uncontrolled radioactive sources if any. Measurements were done with scintillation dosimeter СРП-68-01, allowing to measure gamma-radiation current within 0-

[4] Sanitary Standards on Noise at Work Places, Residential and Public Buildings and Residential Territories.

10000 S-1 and exposition dose within 0-3000 μR/hr. Measured values of gamma radiation were found to be within the range of 7-15 μR/hr. The value is in the natural background limits for the area (which in Poti and the area equated 8-15 μR/hr). No uncontrolled radioactive sources and radioactive pollution were registered.

### 5.1.5. LANDFORM

The study area is located within the limits of Kolkheti lowland. The landform of the area is flat. Geotechnologically it is a depression where a lot of surfacial origin terrigeneous matters are accumulated. The main terrain types within the Kolkheti lowland are:

(a) the coastal dune strip, which follows the sea cost and consists of 1-3 m high and 30-100 m wide sand dunes;
(b) alluvial lowland of the Rioni River, with flat, slightly westwards descended (0.0003-0.0005) terrain and absolute altitudes of 0-18 m; and
(c) alluvial and alluvial-marine lowland with almost flat surface dissected by old river beds and interfluve depressions, slightly outlined riverbeds and drainage canals.

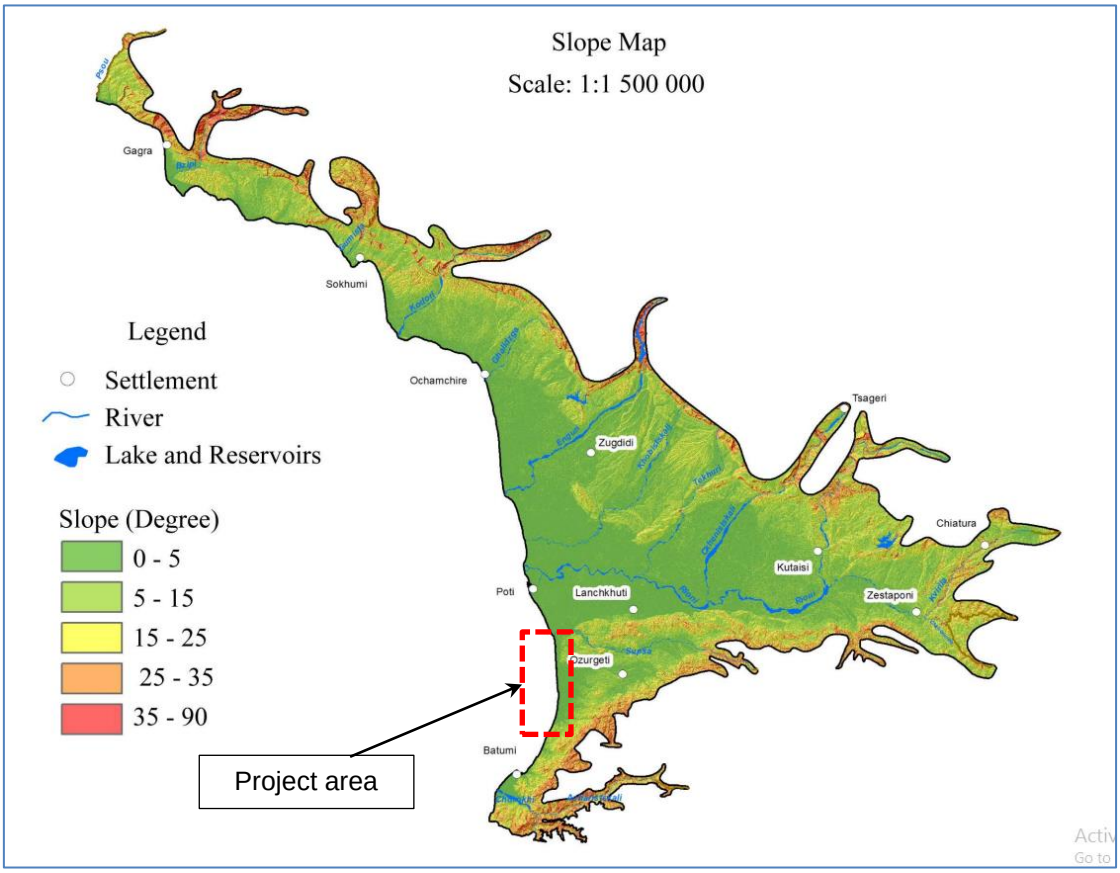



***Figure 33. Slope map***

The lowland is slightly descended towards the sea with average gradient of 0.0005. Its western part is composed of wetland. The absolute altitudes vary from 10-18 m to 0-3 m from the east to the west. Within the zone of boggy deposits, the terrain is composed of the peat domes elevated above the wetland surface.

Many areas in Kolkheti Lowlands are prone to subsidence, which is exacerbated by human activity, such as drainage of peatland and river impoundment. The subsidence rate of the region varies from 2 to 6 mm per year. Subsiding cities like Poti and Batumi are facing inundations by the sea already. In the section of interest subsidence is not observed.

For the area south to the Supsa River historically terrain uplift trend is observed. The strip from Rioni city channel up to the environs of Maltakva, because of the deficit in sediments is subject to wash-out. The wash away rate totals 4-5m/sec. Near Maltakva and farther up to Grigoleti the cost is stable. Starting from Grigoleti to the Supsa River mouth, about 3-4km, the coast is being washed away. Erosion rate equals 2-3m per year.

The study area is located within the boundaries of Kolkheti lowland – the landform is flat, representing depression buit of terrigeneous material.

### 5.1.6. GEOMORPHOLOGY AND GEOLOGY

Geologically, most of Kolkheti lowland is built of Quaternary alluvial and fluvioglacial sediments, derived from massifs of Eocene volcanics in the Anticaucasus and the complex folds of the Main Caucasus Range.

Geotectonically, the area belongs to the Kolkheti sub-district of the western depression zone of the Georgian Block. The geological structure of the district is represented by Quaternary deposits - marine and continental accumulations. Marine sediments are met mainly in the coastal zone and are overlaid with alluvial, proluvial and morass sediments. In east direction these accumulations are substituted for continental faces. Alluvial sediments are met north of the coastal area, while morass sediments are presented in the coastal strip of the Black Sea and Rioni River lowland.

Marine sediments - Chaudian strata (Q1cd) lithology consists of grey clays, sandstones, seldom conglomerates. In lowlands the upper part of the mentioned strata is composed of dark and grey clays, sandstones with coarse grain sandy interlayers. Capacity of Chaudian layers is raising in the east to west direction with a maximum in the outskirts of Poti. Lower Euxinic layers overlay Chaudian strata and consist of sandy clays and fine grain sands. Capacity attains 100 m and increases in the north to south and the east to west direction.

Uzunlar horizon in Poti city area is 6 m thick. Caragane layers are found in Paliastomi lake environs. The stratum is composed of sandy clays and is 27 m thick. Upper Euxinic horizon is presented by grey and black clays and sands (Capacity 80-100m). Lower Black Sea stratum is composed of clays, black sandy clays and pebbles (20-25m).

Continental sediments - Quaternary sediments (Q1-3) consist of pebble – boulders, sandy clays and clay formations. In the east part of Kolkheti lowland pebble – boulders are widespread. In sea direction these formations are dipping. They are covered with clayeys and dismembered. Capacity – 10-70 m. At the same time, the rocks are substituted for sands and clay formations. Similar pattern is characteristic for Paliastomi lake area (up to 70-80 m depth). Dominating are sandy and clayey formations. Overall capacity of the Quaternary sediments is 300 m and higher. Capacity raises from the periphery towards the central area and in east to west direction, where capacity is changing in compliance with the structure of pre-Quaternary sediments.

Modern alluvial sediments are widespread in the ravines of Supsa and Rioni rivers. 15-20 m capacity pebbles, sands, clays, clayeys are met here. Upper Quaternary alluvial and alluvial marine sediments are covered with morass lowland sediments composed of silt and sandy clayey formations substituted with humus substances. Peat lenses and layers are formed. The latter are met at 10-12 m depth.

Overall capacity of these sediments is 30-40 m. Modern alluvial-marine formations are located along the littoral strip. Lithologically they are presented by medium and large grain sands and pebbles, whereas in river confluences clayey small grain sands and clays are met. The dunes are 3-4 m high. Frequent winds cause in land transition of dunes, their surface is wavy. Dunes are wedging in marshes.

The geology of Kolkheti depression (Poti and Supsa area) is dominated by sedimentary deposits from the Holocene period which are of lacustrine origin. These sediments form the entire central part of the lowland and reach several hundred meters in thickness. Lithologically, these formations consist of clays, silts and peat, whereas the underlying strata include sands, silty sands and silts. The main founding strata of the structure are the silts with occasional lenses of sand and peat.

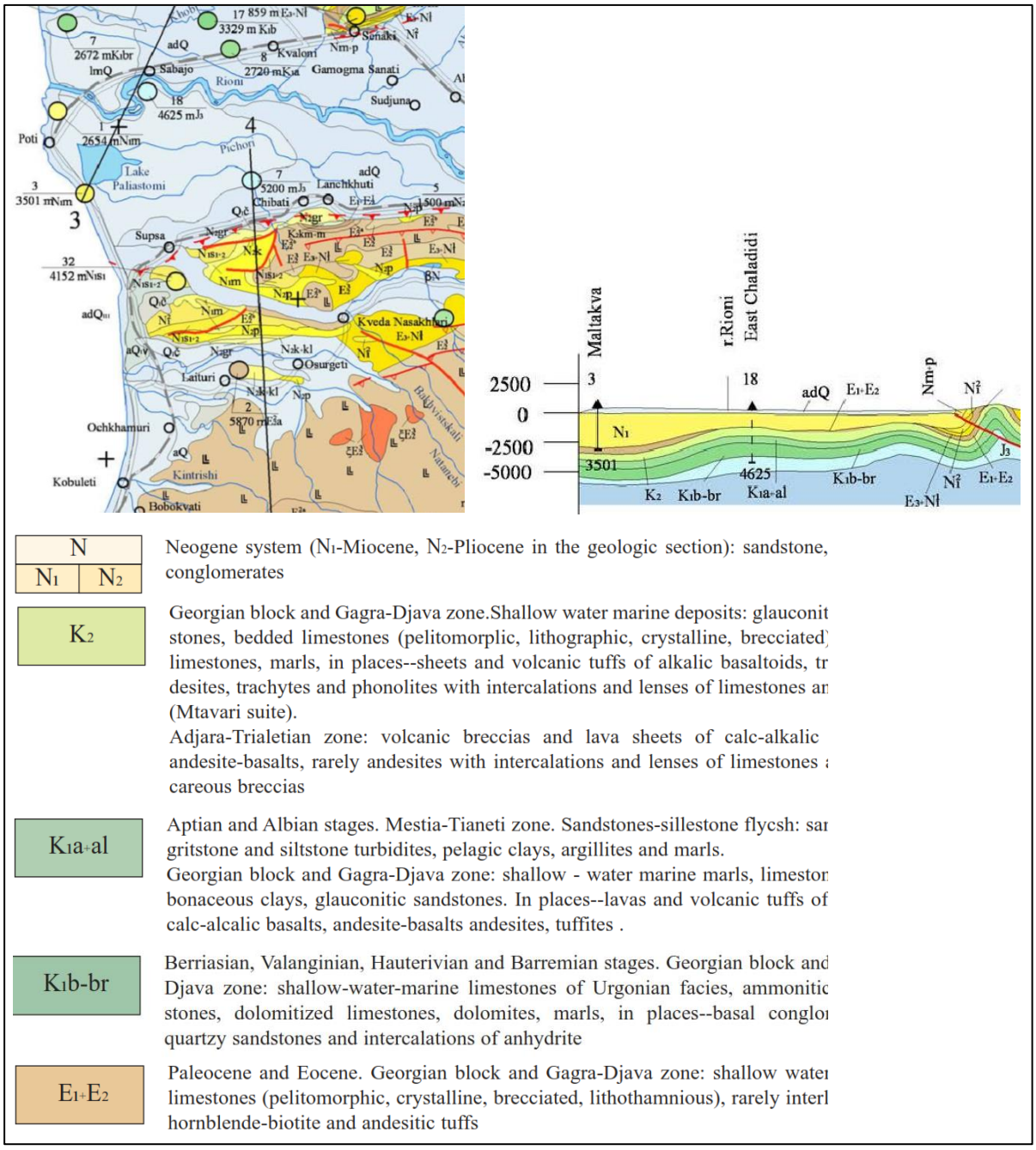



***Figure 34. Fragment of geological map of Georgia***

### 5.1.7. LITHOLOGY

In the course of the design in order to obtain information of lithology in along the project alignment 58 boreholes (including 27 – 15m deep, 22 – 30m deep and 4 – 40 m deep) and 52 pits were arranged, penetration tests carried out in 34 locations. (Maps with indication of the survey points are given in Annex 2).

The area is built of the by recent (Q4) contemporaneous alluvial marine, Holocene (sand and silty sand) and Upper Quaternary Q3 new Euxine, beach and deltaic loose sediments. Accumulation of the sediments in the area was conditioned by transgression and regression processes. 30m to 100m stratum represent result of new Euxine regression, the younger deposits (from 15-30m) are connected to Pontic and Colchic regressions; whereas the upper layer 0m to 15m is related to Lazian transgression. Natural soil, especially in the boundaries of the residential areas, is covered by 0.15-1.3m thick technogenic soils (cobbles, gravel, sand). Clays are characterized by local distribution. In addition to the soils mentioned above, several types of various density and grain size sand is observed.

Lithological description of the study area is given below:

| | |
|---|---|
| ***MIOCENE. Molasse deposits (Mm)***<br>These deposits are formed by marine and continental molasse: sandstones, clays and conglomerates. On the slopes around 10 cm thick sandstone with clay interlayers are visible.<br>  <br>Sandstones | **QUATERNARY. Delta deposits (QD)**<br>Represent the products of erosion and drift from the hills. They are composed of gravel, sands and silt. The lithological column greenish grey muddy clay with interleaves of vegetal rest, fine sands with gravel interlayers have been observed.<br>  <br>Grey sand (BH-5). |

**QUATERNARY. Coastal deposits (QC)**

These formations are represented by medium to fine grain sands with gravel, forming coastal bars, due to the action of the tides.

Grey sand, pit-5

**QUATERNARY. Paludal deposits (QP)**

These deposits have formed in anoxic conditions which favoured degradation and conservation of organic matter. They are represented mainly by peat. Peat and moisture loving plants are spread on the surface.

Peat, pit-8

**QUATERNARY. Alluvial deposits (Qal)**

These deposits are found in the fluvial courses ( such as the Rioni, Supsa and Natanebi rivers). They are formed by gravel, sands, silt and clays

Grey sand - the Supsa River.

Gravel - the bed and terraces of the Natanebi River

**QUATERNARY. Alluvial fan deposits (QAF)**

These deposits are formed by eroded material carrying in from the surrounding hills. They are represented by gravel, sands, clay and silt. Depending on distance from the source the size of particles varies. The finest grain is material carried in from the remote areas. The upper stratum formed by greyish silty clays overlays several tens of meters strong fine- to medium- grain greyish sands. Decimetre and/or centimetre thick layers of shells are also observed.

Grey sand with broken shells from BH-1

| | |
|---|---|
| **QUATERNARY. Glacis deposit (QG)**<br>The deposits are represented by gravel, sand, clay and the silt, grey and brown silty clays. Underlaid by a layer of coarse to fine gravel with argillaceous matrix. Beneath this gravel stratum greyish fine sand, with interlayers of crumbled shells is found.<br>  <br>Gravel and sand from BH-2. | **QUATERNARY. Valley bottom deposits (QFB)**<br>They are located inside narrow valleys, located in the relief tertiary, next to the coast. They are formed by sands, silt and clays. |

**FILLS**

Two types of fillings are distinguished:

- **Infrastructure fillings (FI).** Corresponding to linear infrastructures like roads, highways or railroads.
- **Construction fillings (FC).** Corresponding to those zones used for the construction of buildings, esplanades, etc.

Groundwater levels in the project area ranges from 0.3 to 2.0 m depths.

**Description of several geotechnical groups (Feasibility Study)**

- Group QD

Lithology. The lithologic column of the delta deposits is characterized by the greenish grey muddy clay presence with interleaves of vegetal rest. Underneath, the presence of fine sands has been observed grey. Gravel interleaves have also been detected.

The geotechnical parameters of QDc are :

| | |
|---|---|
| Particle Size Distribution #0,008) | 70.2 |
| Liquid Limit | 53.2 |
| Plastic Limit | 27.9 |
| Plasticity Index | 25.4 |
| Humidity (%) | 66.9 |
| Dry Density (T/m$^3$) | 1.5 |

| | |
|---|---|
| Organic Matter (%) | 6.1 |
| CBR (100% PN) | 10.5 |
| Unconfined Compression (kp/cm$^2$) | 3.4 |
| Shear Strength c´ (kp/cm$^2$) | 0.5 |
| Shear Strength ϕ (kp/cm$^2$) | 17 |
| Shrinkage (%) | 1.53 |
| Cv (Oedometer) (cm$^2$/s) | 0.00073 |

The geotechnical parameters of QDs aret:

| | |
|---|---|
| Particle Size Distribution (#0,008) | 25.8 |
| Liquid Limit | 49.4 |
| Plastic Limit | 32.7 |
| Plasticity Index | 24 |
| Humidity (%) | 29.5 |
| Dry Density (T/m$^3$) | 1.4 |
| Organic Matter (%) | 0.8 |
| Unconfined Compression (kp/cm$^2$) | 2.7 |
| Shear Strength c´ (kp/cm$^2$) | 0.5 |
| Shear Strength ϕ (kp/cm$^2$) | 16.7 |
| Shrinkage (%) | 2 |
| Cv (Oedometer) (cm$^2$/s) | 0.00035 |

- Group QG

Lithology. The materials that forme the slope deposits characterize by grey and brown silty clays. Underneath, a layer of coarse to fine gravel is observed with enough argillaceous matrix. Under gravel, there appear greyish fine sand, with interleaves of rest of shells.

The geotechnical parameters of QGc are:

| | |
|---|---|
| Particle Size Distribution (#0,008) | 92.1 |
| Liquid Limit | 57.2 |
| Plastic Limit | 27.7 |
| Plasticity Index | 29.5 |
| Humidity (%) | 48 |
| Organic Matter (%) | 4.4 |
| CBR (100% PN) | 14.2 |

The geotechnical parameters of QGs are:

| | |
|---|---|
| Particle Size Distribution (#0,008) | 20.2 |
| Liquid Limit | 34.7 |

| | |
|---|---|
| Plastic Limit | 16.8 |
| Plasticity Index | 18.5 |
| Humidity (%) | 26.3 |
| Dry Density (T/m$^3$) | 1.5 |
| Organic Matter (%) | 0.1 |
| CBR (100% PN) | 28 |
| Unconfined Compression (kp/cm$^2$) | 2.6 |
| Shear Strength c´ (kp/cm$^2$) | 0.4 |
| Shear Strength ϕ´ (kp/cm$^2$) | 17.3 |
| Shrinkage (%) | 2.4 |
| Cv (Oedometer) (cm$^2$/s) | 0.0021 |

- Group QAF

Lithology. The deposits of alluvial fan are characterized by a superior layer, formed by greyish silty clays. Underneath, it appears a thickness of fine-medium sands of greyish colour of several tens of meters. Levels of shells of decimetre and centimetre thickness have been observed.

The geotechnical parameters of QAF are:

| | |
|---|---|
| Particle Size Distribution (#0,008) | 31.9 |
| Liquid Limit | 44.7 |
| Plastic Limit | 25.2 |
| Plasticity Index | 19.5 |
| Humidity (%) | 22.3 |
| Dry Density (T/m$^3$) | 1.5 |
| Organic Matter (%) | |
| CBR (100% PN) | |
| Unconfined Compression (kp/cm$^2$) | 1.8 |
| Shear Strength c´ (kp/cm$^2$) | 0.4 |
| Shear Strength ϕ´ (kp/cm$^2$) | 12.5 |
| Shrinkage (%) | 2.1 |
| Cv (Oedometer) (cm$^2$/s) | 0.00085 |

### 5.1.8. SOIL

Georgia is notable for diversity of soils. According to the features of soils, 3 different soil areas, with sub-areas, zones and regions may be distinguished. The Western Georgia soils are represented by:

I. Sub-area of Intermountain Plains - Zone of podzol and swampy soils:

- The region of swampy soils of the western lower part of the Kolkheti lowland;
- The region of podzol and alluvial soils of Abkhazia-Samegrelo;
- The region of podzol and alluvial soils of the eastern part of the Kolkheti plain (Imereti);
- The region of podzol and alluvial soils of the southern part of the Kolkheti plain (Guria-Adjara).

II. Sub-area of the Greater Caucasus:

1. The zone of red and yellow soils of hilly foothills;
   - The region of yellow and humus-carbonate soils of the foothills of Abkhazia;
   - The region of yellow, red and humus-carbonate soils of the foothills of the southern Abkhazia-Samegrelo;
   - The region of red soils of the Okriba depression;
   - The region of humus-carbonate soils of the Imereti hills.
2. The zone of mountain-forest soils:
   - The region of humus-carbonate soils of the karst-limestone belt of the southern slope of the Greater Caucasus;
   - The region of mountain grey and podzol soils of the medium mountainous zone of the western part of the Greater Caucasus;
   - The region of grey, podzol and humus-carbonate soils of Zemo Imereti and the Surami ridge;
   - The region of humus-carbonate and forest grey soils of Racha-Lechkhumi.
3. The zone of mountain-meadow soils:
   - The region of mountain-meadow turfy, turf-peaty and primitive soils of the high mountainous crystal massif of the western part of the Greater Caucasus (Abkhazia, Svaneti);
   - The region of mountain-meadow soils of the Samegrelo-Racha ridges (Zemo Imereti).

III. Sub-area of Transverse Ridges of the Southern Highlands - The zone of red and yellow soils of hilly foothills:

- The region of yellow, mountain grey and humus-carbonate of the northern slope of the Meskheti ridge;
- The region of red soils of hilly foothills of Adjara-Guria;
- The region of mountain grey soils of the medium mountainous zone of the Meskheti ridge;

- The region of mountain grey soils of the medium mountainous zone of Adjara-Guria and the Shavsheti ridge;
- The region of mountain-meadow turfy and turf-peaty soils of the high mountainous zone of the Adjara-Imereti and Shavsheti ridges.

In the project area the soils are represented by Sub-area of intermountain plains – the region of podzol and alluvial soils of the southern part of the Kolkheti Lowland (Guria-Adjara). In the area of interest gleysols dominate, in narrow strip along the Supsa River – Eutric fluvisols are present.

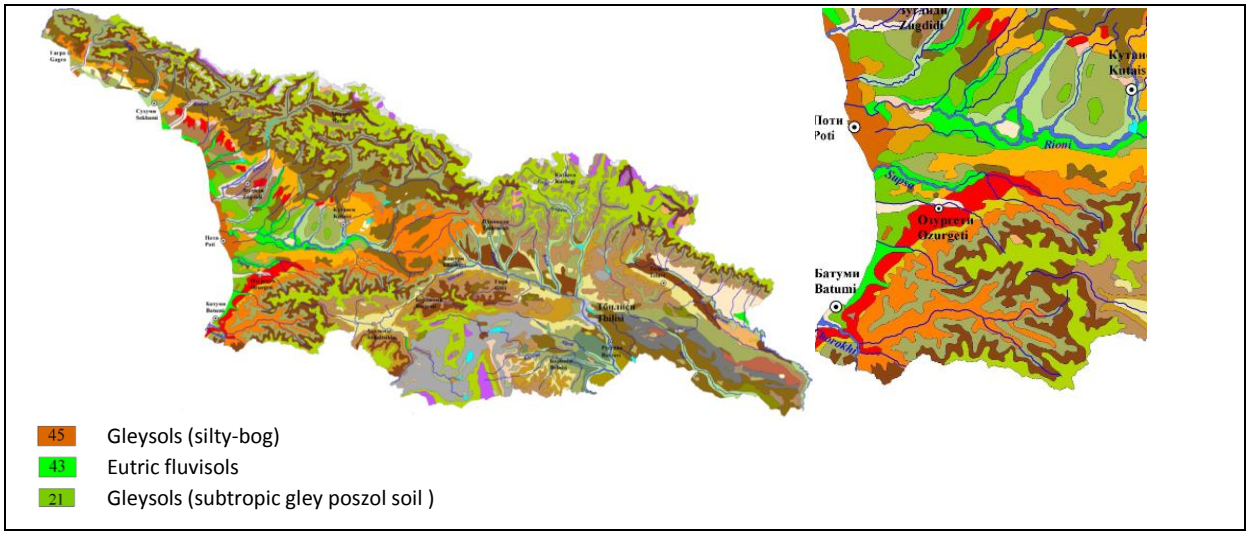
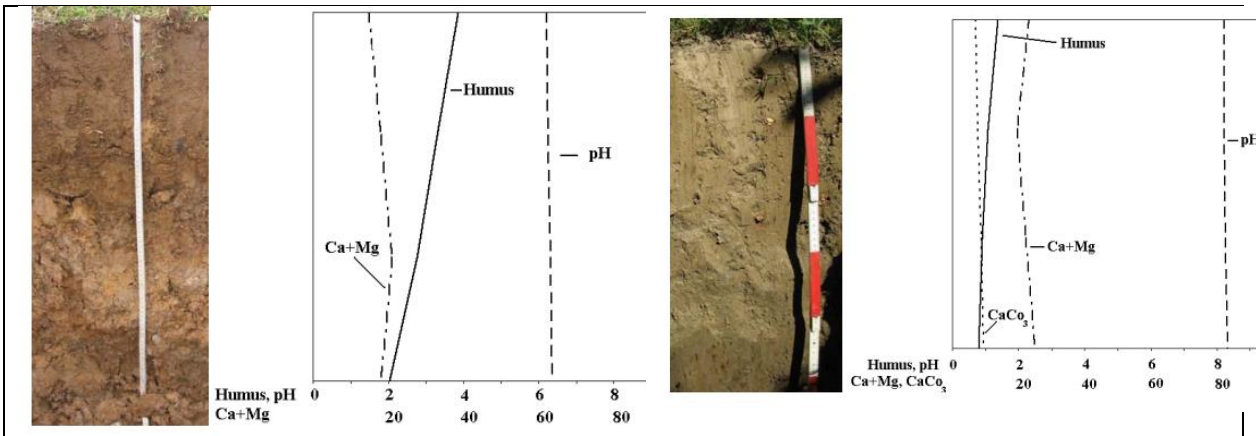



***Figure 35. Soil map***

Gleysols (subtropic gley podzol soil) account for 1.8% (119.04ha) of the total area of Georgia. Humus content is moderate. Moderate is content of hygroscopic water. Specific weight is in 1.24-1.41 interval. Content of hydrolyzable nitrogen is moderate or low. Soils are rich in absorbed phosphorus and poor in exchangeable potassium. Pollution with radionuclides is often observed.

Gleysols (silty-bog) are typical for Kolkheti lowland. They account for 0.6% (417km$^2$) of the total area of Georgia. Are poor with total nitrogen, moderately or rich in hydrolysable nitrogen, poor or moderately contain in phosphorus, poor in total and exchangeable potassium. Pollution with radionuclides is often observed.




Gleysols (subtropic gley podzol soil) Gleysols (silty-bog)

***Figure 36. Soils in the project area***

According to the suitability (source: Cadastre and land register project co-funded by KfW) for agriculture (crops such as citrus and tea) soil belongs to medium class.

The survey revealed that the topsoil in most of the areas is 0.3m thick.

Silty podzol soils are typical for the uplift areas of Kolkheti lowland. In Grigoleti, Maltakva and towards the north, peat fen soils are registered. North and south to the Supsa delta, in the narrow strip along the coastline, meadow sod sandy soils are present. Within the terraces of the riverbeds alluvial soil dominates. All of the mentioned soils in flat areas are water saturated or waterlogged.

Soil quality in the project area differs depending on location of the sampling point. In vicinity to existing road (near Supsa crossing 1, Ureki-Magnetiti 2, Kobuleti bypass 3). Typical soil quality data are given below.

***Table 23. Soil quality data***

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

Except for the lead (Pb), 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.

### 5.1.9. Natural hazards

Natural disasters take place on quite a large scale in Georgia and with a high frequency of recurrence due to the complex geological and geographical conditions in Georgia. The frequency of natural disasters has increased in the recent past and this increase is considered to be a consequence of the effects of global climate change as well as human activities, such as deforestation, overgrazing of pastures, land use changes without proper evaluation etc. In general information on geohazards is available from reference information. For the area of interest flooding is the main hazard.

Kolkheti lowland and respectively the study area have negative tectonic movement (see section 5.1.5.). Ingression of the sea caused by reduction and deficit of sediments introduced by the rivers in to the Black Sea is also worth to mention.

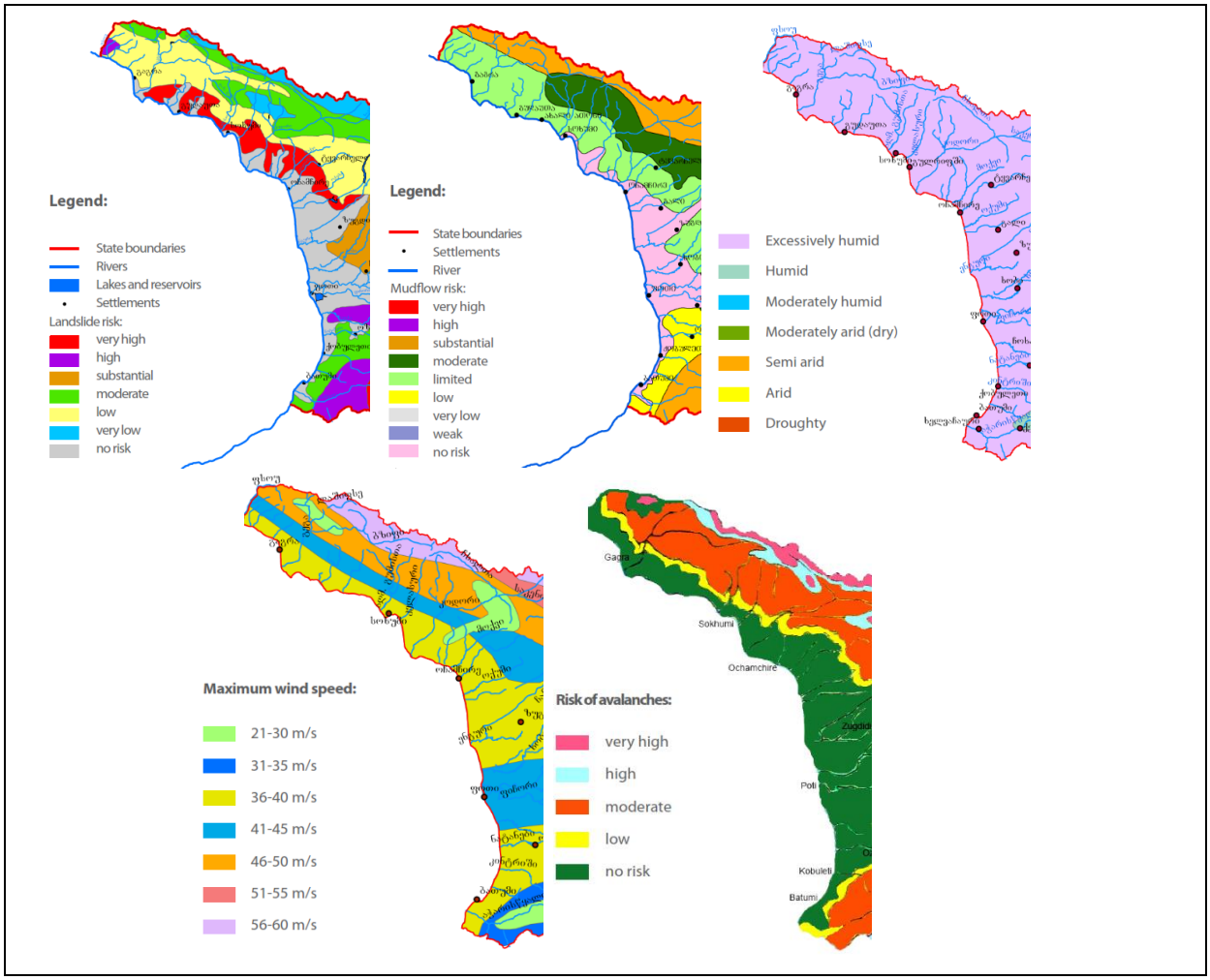



***Figure 37. Landslide, mudflow, drought, high wind speed, risk of avalanches***

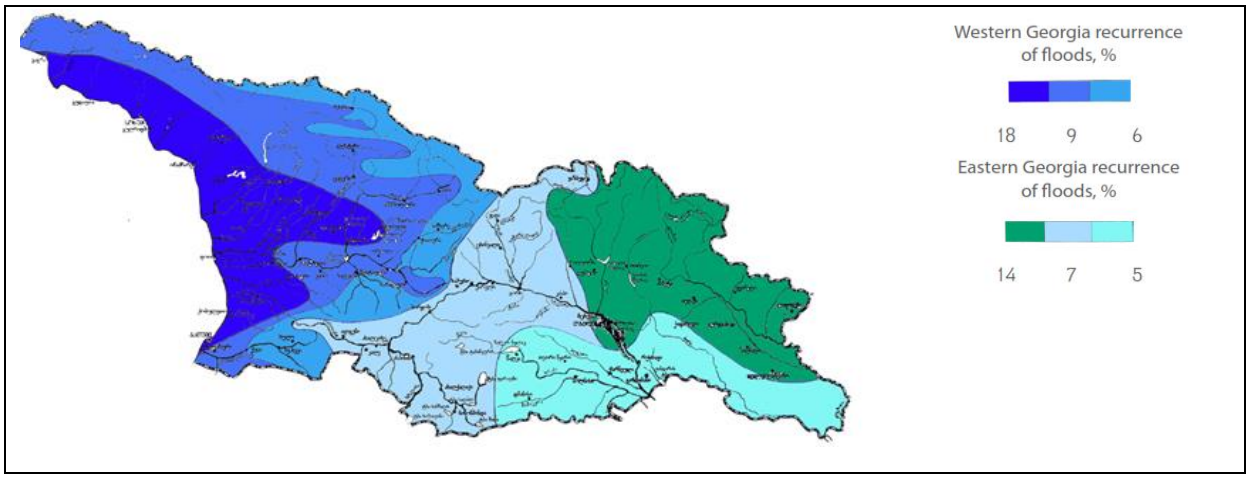



***Figure 38. Flooding risk***

Seismic conditions. Kolkheti depression which, from the tectonic point of view, is the western end of the Georgian depression is bounded by major folds and active faults.

Georgia is located within the Mediterranean seismic belt, in the active seismic zone of the Caucasus. Its architectonical movement and activity is connected with the movement of the neighbouring Eurasian and Afro-Arabic rocks. Seismicity magnitude in the project area varies from 7 to 8 units MSK64 scale. (see ***Figure 39***)

***Table 24. Seismicity within the project area***

| Settlement | Region | Municipality | Community | A- Seismicity coefficient | Magnitude (MSK64 scale) |
|---|---|---|---|---|---|
| Ureki | Guria | Ozurgeti | Ureki | 0.12 | 8 |
| Shekvetili | Guria | Ozurgeti | Natanebi | 0.14 | 8 |
| Tskaltsminda | Guria | Lanchkhuti | Grmaghele | 0.11 | 7 |

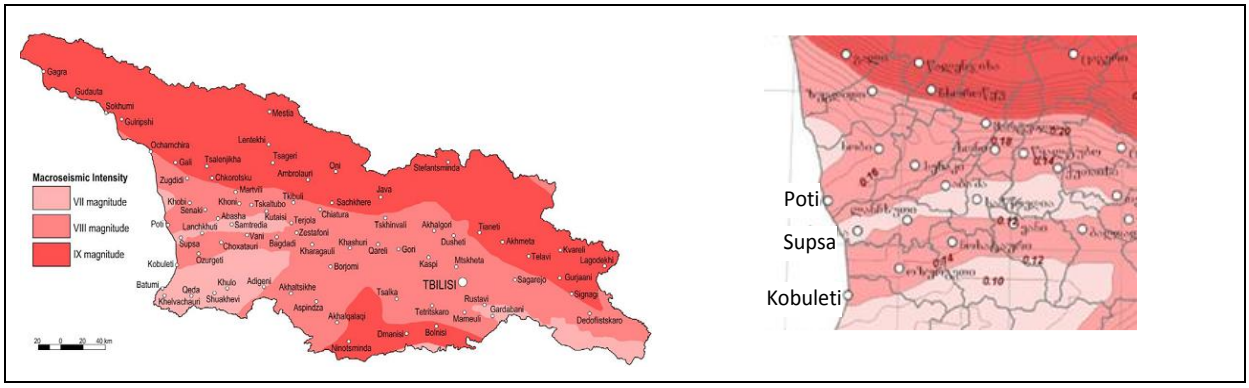



***Figure 39. Seismic zoning map***

### 5.1.10. HYDROGEOLOGY

According to hydrogeological zoning of Georgia, the project area belongs fractured and fractured/karstic artesian water basin of Georgian Block. In particular: III5 Porous, fractures and fractured/karstic artesian basin of Kolkheti (Poti area) and III6 Porous and fractures water artesian basin of Guria. Area of artesian basin is 1500km2, it comprises hilly depression of Guria and adjacent coastal lowland. Within the basin strongs Quaternary stratum (sands and bepples) has the highest water content. The Quaternary stratum is located above the Cretaceous, Palaeocene and Miocene roacks. On Kolkheti lowland capacity of this aquifer is 40-50m, in the coastal area – 300m.

Ground waters of Kolketi lowland are linked to the base rocks (Mesosoic and Tertiary sediments). These are deep circulation waters (500-4500m). They do not crio out, however along with this aquifer shallow circulation waters (deluvial, alluvial Quaternary sediments) are also present.

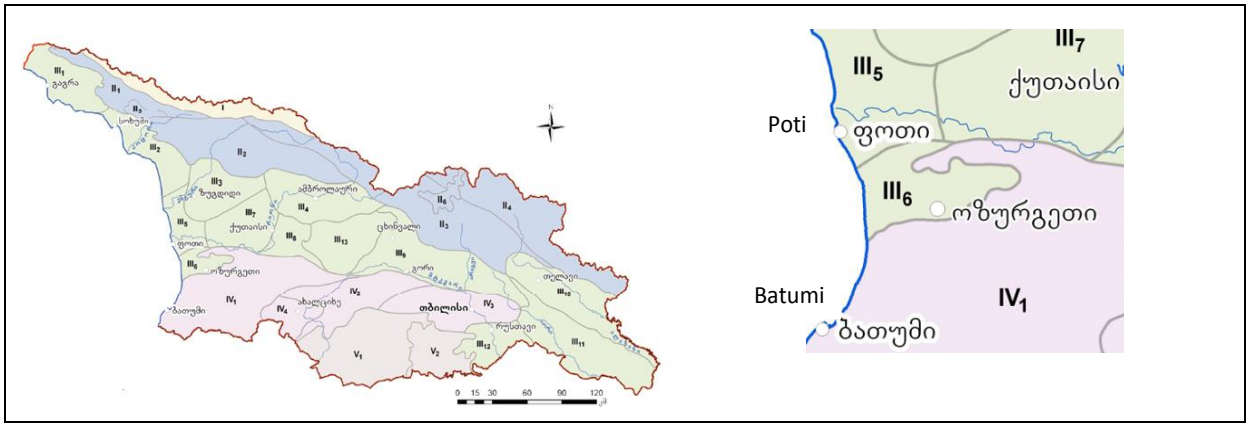



***Figure 40. Hydrogeological zoning map***

Aquifers of the southern part of Kolkheti arterial basin include: a) aquifer of modern alluvial formations (alQIV); b) Black Sea coastal aquifer of modern marine and alluvial deposits (amQIV); c) aquifer of modern marsh formations (bQIV). Ground water level in the project area varies from 20cm to 2m, depending on the site. In Ureki area the ground water level ranges from 1.5 to 7m.

Although groundwater is considered to be naturally protected from human impact, pollution of this water has been observed. Pollution is due to hydraulic connection of the groundwater with polluted surface waters, landfills or stocks of industrial wastes, fertilized agricultural lands, etc.

Similarly to other lowlands and intermountain regions, Kolkheti lowland, in particular the shallow subsoil and pressure waters, within the boundaries of the lowland are at risk of

pollution caused by industrial, infrastructure development and other developments in the area. In Guria artesian basin, for instance, concentrations of phenols, nitrates and nitrites was found to exceed the maximum permissible levels. In areas like Poti, Supsa risk of pollution with petroleum products exist.

### 5.1.11. HYDROLOGY

Kolkheti lowland has dense network of rivers with the various types of feeding, morphology and catchment capacity. Over 150 large and small rivers with their numerous tributaries discharge to the Black Sea. The rivers play vital role for the functionality of Kolkheti wetlands. The large rivers like The Rioni and Khobi, run next to the Kokheti National Park territory. The small ones including the Pichora, Dedabera, Tsiva, Churia, originate in the lowland marshes or in the band of hills or small mountains and are mainly fed by rain water. The other surface water bodies include Paliastomi, Imnati, Patara Paliastomi, Parto Tskali Lakes, etc.

The main surface water bodies in the section between Grigoleti and Kobuleti bypass are Supsa, Tskaltsminda, Sepa and the tributaries.

**Supsa River** is the third according to the length river in west Georgia. The river originated at 2,800m, near the mountain Mepistskaro, the north slope of Meskheti ridge. It flows into the Black Sea near vil.Tskhaltsminda. The river is 108km long and has average inclination 28‰, the catchment area totals 1,130 $km^2$, average elevation is 970 m. The Supsa River basin comprises 790 rivers. Of them the largest are the rivers of Baramidzetskali (21 km long), Gubazeuli (47 km long), Bakhvistskali (42 km long), Shutiti (12 km long). Density of the river system is 1.26 $km/km^2$.

The upper reaches area has complex mountain topography with narrow and deep canyons. Within the rest of the basin, below the vil.Bukistsikhe, the landform is smoother, hilly, however deep with numerous canyons of the tributaries. The upper part of the basin is built of tuffs, granular quartzite, sandstones and sand-clayey slates. In the rest of the basin sand-conglomerates and clays with marl, pebble and sand layers dominate. The base rocks are mainly topped with clayeys. In the upper reaches of the river alpine vegetation is observed. Below 2000 m mixed forest (fir, pine, beech and oak) are found. Lower, below vil.Bukiskhevi, the lands are arable. Forest accounts for about 70% of vegetation within the basin.

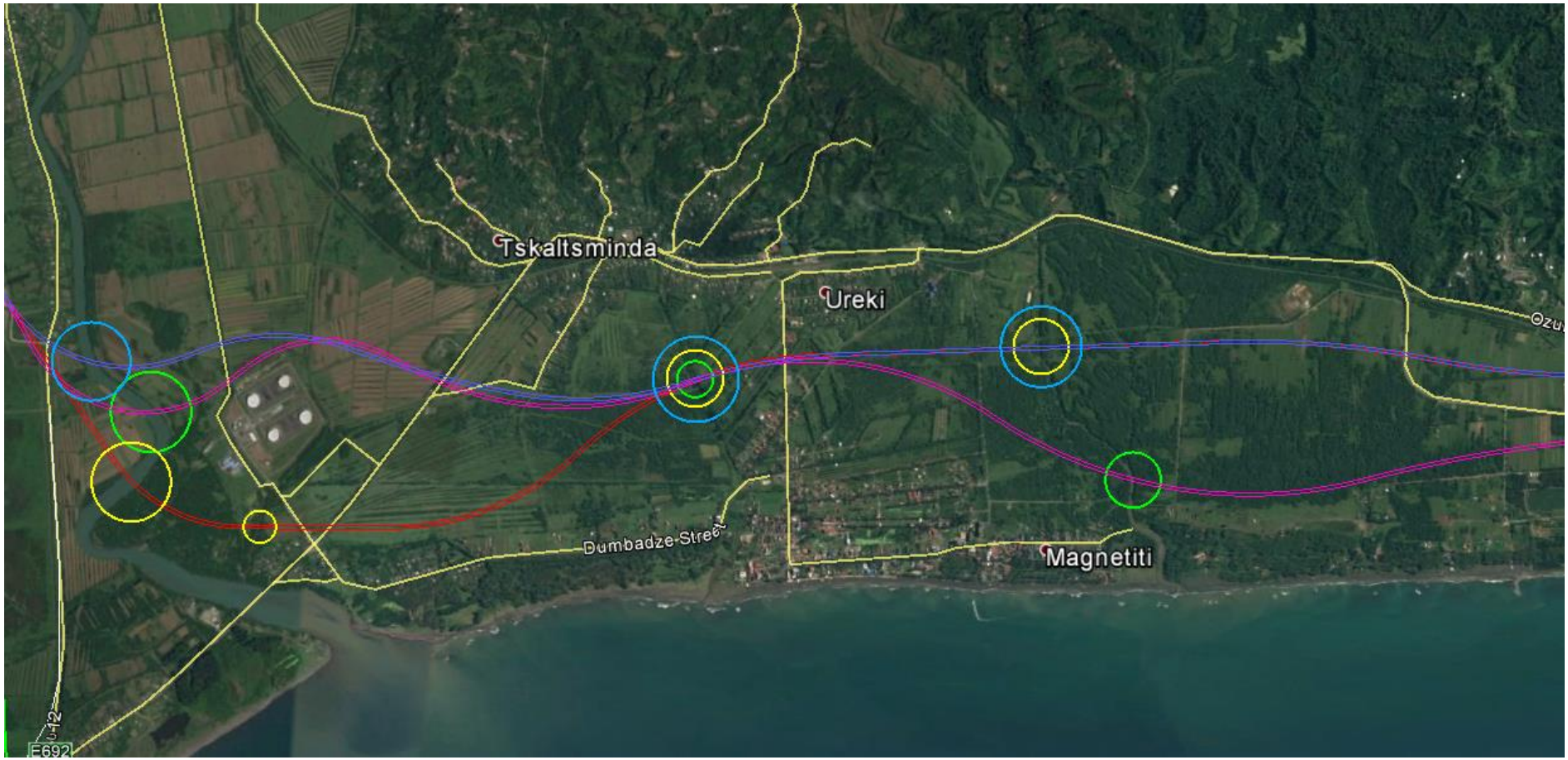



***Figure 41. River crossings (yellow circle – Alt 1, green circle – Alt 2 and blue circle – Alt 3)***

Supsa belongs to the Black Sea river basin. For the river frequent high water events are typical (around 15-27 events per year are generally observed). Average water level is 1.0-1.5m in the head area, 1.5-2.0m in the mid- and 2.5-3.0m in the lower flow.

***Table 25. Number of floods by seasons***

| Winter | Spring | Summer | Autumn |
|---|---|---|---|
| 3-4 | 4-8 | 2-3 | 6-12 |

Floods are mainly observed in autumn. Water level uses to increase the average value by 0.1-0.9 m. High water starts in mid-March and lasts until the end of May. Highest flows are as follows: near Chokhatauri - 246 $m^3$/sec, near Khidmaghala - 692 $m^3$/sec. The lowest, totals 0.4 $m^3$/sec in the upper and 4.08 $m^3$/sec in lower flow respectively.

Flow near vil.Chokhatauri and vil.Khidmaghala by seasons distributes as follows:

***Table 26. Total flow %***

| Location | Winter | Spring | Summer | Autumn |
|---|---|---|---|---|
| Chokhatauri | 15-17 | 36-50 | 18-25 | 17-23 |
| Khidmaghala | 26 | 20-34 | 12-20 | 20-43 |

Several peaks use to be observed, water level increases by 0.3-0.6m and lasts from 5 to 10 days. Summer flood is unstable. Amplitude of level variation in this period reaches 0.2-0.6 m.

Flow regime depends on precipitation level and intensity. Average modulus of the flow in the upper and the lower reaches totals 44.3 l/sec.$km^2$ and 41.1 l/sec.$km^2$.

In January-February, in the upper flow, water near the banks freezes. The ice “persists” for a short time only. Temperature of the coldest month is from 1.4 to 8.5$C^o$. Maximum temperature, 24.2$C^o$ is observed in August.

Major hydrological characteristics of the river are given in **Error! Reference source not found.**.

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

***Table 27. Water quality data***

| 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 |

Sediments of Supsa River. Annual sediment flow may vary from 110 to 230 thou t. The highest turbidity makes 2,300g/m$^3$. The sediments form along the longitudinal profile of the river. Formation of sediments is conditioned by modern tectonic movement as well as related seismicity and gravity processes. The river brings sandy sediments in the estuary, however in contrast to the Khobistskali, Rioni and Natanebi Rivers its sediments are coarse-grained and contain significant amount of magnetite sands.

Characteristics of sediment flow of the main rivers in the project area are given in ***Table 28***.

***Table 28. Sediment flow in the rivers in the area***

| River | Suspended sediments, ths.t | Bottom sediment, thou.t | Total Sediments | | | |
|---|---|---|---|---|---|---|
| | | | including fractions, thou t | | ∑ ths.t | ∑ ths.m$^3$ |
| | | | d> 2 mm | d> 20 mm | | |
| Khobi | 198.8 | 74.8 | 90.1 | 0.0 | 273.6 | 156.3 |
| Rioni | 7 843.5 | 1 129 | 1125.1 | 0.0 | 8972.5 | 4946.1 |
| Supsa | 217.4 | 87 | 30.4 | 0.0 | 304.4 | 170 |
| Sepa and other small rivers | 9.8 | 4.6 | 7.11 | 4 | 14.3 | 9.7 |
| Drift | 131 | 65.1 | 79.2 | 53.3 | 191 | 105.6 |

***Table 29.* Grain size of suspended sediments %%**

| River | 1-0.5 | 0.5-0.25 | 0.25-0.1 | < 0.1 |
|---|---|---|---|---|
| Khobi | 1.5 | 10.9 | 12.6 | 75 |
| Rioni | 1.1 | 9.8 | 13.5 | 75.6 |
| Supsa | 0.7 | 9.9 | 14.0 | 75.4 |
| Sepa | 7.2 | 11.5 | 37.8 | 43.5 |
| Natanebi | 0.5 | 6.4 | 25.0 | 68.1 |

(Source: Sh.Jaoshvili)

***Table 30.*** **Annual volume of the beachforming sediments**

| River | Suspended sediments, thou $m^3$ | Bottom sediments, thou. $m^3$ | Annual, thou $m^3$ | Annual volume of beachforming sediments, ths.$m^3$ |
|---|---|---|---|---|
| Khobi | 120 | 13 | 133 | 39 |
| Rioni | 4 000 | 400 | 4 400 | 1 350 |
| Supsa | 103 | 14.8 | 117.8 | 39 |
| Sepa | 1.1 | 0.55 | 1.65 | 0.7 |
| Natanebi | 34 | 7 | 41.9 | 18 |

(Source: Sh.Jaoshvili)

**Tskaltsminda River** originates at a south-west piedmont of Meskheti ridge, at 85 m asl and falls into the Black Sea, north to Ureki. The river is nourished by atmospheric (snow, rain) and groundwater.

**Sepa River** originates on the western slopes of west branch of the Meskheti ridge, at 220 m asl and falls into the Black Sea at the vil.Magnetiti. For the river spring floods are typical. The river is fed by rainfall, snowmelt and ground water. Therefore high-water is observed in spring and autumn. During other periods of the year water level is low.

***Table 31. Baseline water quality – Sepa River***

| # | Parameter | Value |
|---|---|---|
| 1 | Suspended solids, mg/l | 40 |
| 2 | BOD, mg/lO2 | 105 |
| 3 | Total N, mg/l | 0.47 |
| 4 | Total P, mg/l | <0.1 |
| 5 | TPH, mg/l | <0.04 |

**Drainage system.**

In the past, in accordance with the general plan to dry the marshy, excessively damp lands of the Kolkheti lowland a network of drainage canals were arranged. Similarly to the area north to Grigoleti the project area is dissected with drainage canals.

### 5.1.12. LAND USE AND LANDSCAPES

The landscape of the lowland and adjacent hillock strip (up to 600masl) belongs to plain-hilly subtropic region. It comprises the lowland landscapes with swamp alder forest and sphagnum bogs and foothill Kolkheti lowland with hornbeam oak forest alternating with beech-chestnut, oak-zelcova and poly-dominant forest with evergreen underwood.

Most of the area belons to Kolkheti National Park. Coastal strip is used as recreation area.

In 1992, the process of privatization of agricultural lands has been introduced in the country. Since than, in many areas soil erosion due to the lack the necessary background to implement a sustainable agriculture is observed. The situation is worsened by the poor economic conditions of the majority of farmers which force them to meet the immediate needs rather than adopting a longer-term vision towards the environment.

Climatic conditions are favourable for agriculture. Arable lands make 2/5 of Kolkheti lowland. However, land per capita in the area is lower than average for Georgia. The main crops are cereal, beans, maize, tobacco, vegetables. The share of perennial plants accounts for about 34%.

## 5.2. BIOLOGICAL ENVIRONMENT

### 5.2.1. KOLKHETI PROTECTED AREA AND RAMSAR SITE

Protected areas in the Poti-Kobuleti bypass area borders with Kolkheti National Park, Ramsar site and IBA.
The study area (Grigoleti=Kobuleti bypass connecting road) is located away from protected areas. However, for description of sensitivity and importance of the area information of Kolkhrti protected area is given below.

These sensitive areas are located on the main migration routes for African and Eurasian waterfowls and waders. According to reference information over 194 different bird species, including 21 species of migratory birds, are found in the region. (see sub-chapter 5.2.2.2.)

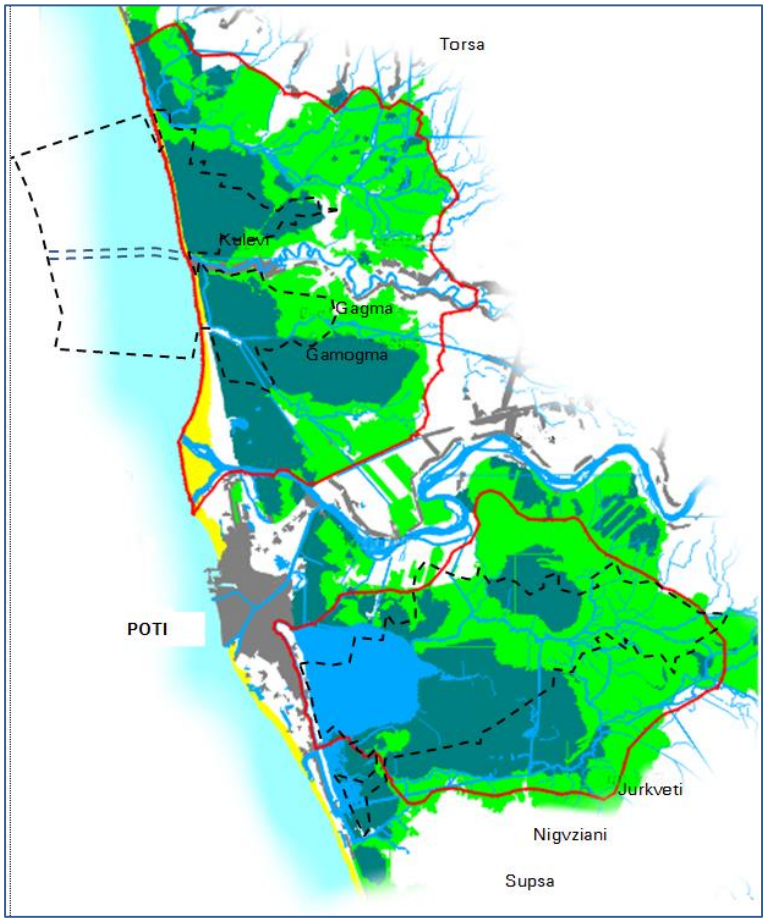
In 1935 unique Kolkheti wetlands were designated as protected. Now the area of Anaklia-Churia, Nabada, Imnati mires, Ispani peat lands, swamp forests, dunes, lake Paliastomi and marine area represents Kolkheti National park (IUCN category II – land and marine area), Kobuleti National Reserve (IUCN category I) and managed area (IUCN category IV). Recognized as an important natural area, a 500-hectares of the swampy forest and mire between the Rioni and Pichori Rivers was established as Kolkheti Nature Reserve.

The wetland areas within the Kolkheti lowland important for wintering, nesting and migratory birds were identified as Ramsar sites of international importance. “Ispani-II” mire, later became Kobuleti Nature Reserve and “Wetlands of Central Kolkheti”, later became Kolkheti National Park. In 1999 law on the creation and management of the Kolkheti protected areas was enacted. The national park began full-scale operation in 2000.

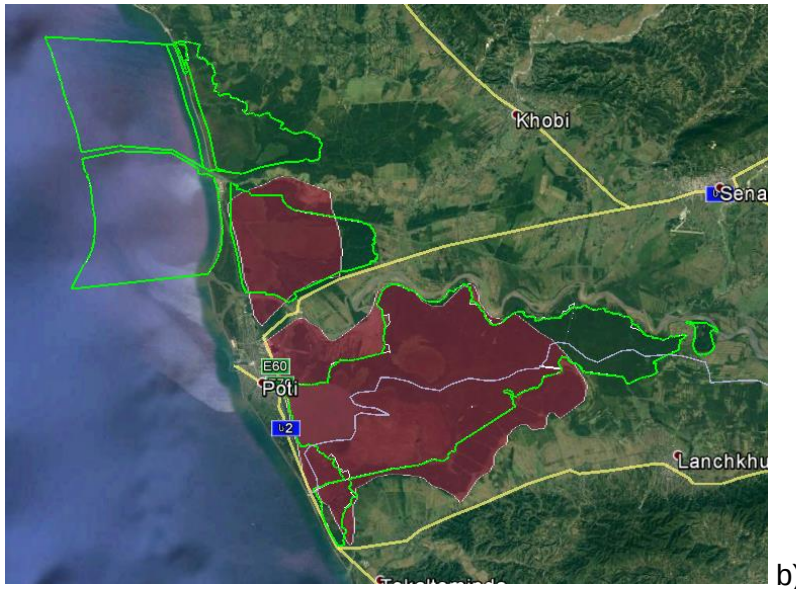
Kolkheti National Park includes the areas with well-preserved wetland ecosystems: Anaklia-Churia (13713ha, between the coastline sections of ravines of the Churia River and the Khobistskali River), Nabada (10697ha, between the western sections of the ravines of the Khobistskali River and the Rioni River) and Imnati (19903ha, between the western sections of the ravines of the Rioni and the Supsa rivers). Besides, the protected area includes the sea water area located between the estuaries of the rivers of Rioni and Churia. In total, the land area of the National Park is 28571 ha, and the sea water area – 15 742 ha. Geographically the national park area belongs to five administration districts – Zugdidi, Khobi, Senaki, Abasha and Lanchkhuti municipalities.

Paliastomi lake (a part of the protected area), former gulf of the Black Sea isolated from the sea by sand dune several thousand years ago, provides a vital environment for many fish species, invertebrates and plankton.

Kolkheti mires, first of all, are important for their relict origin. This lowland is a remainder of the tropical and subtropical landscapes, which were stretched along entire Eurasian continent as continuous belt in Cenozoic age about 10 million years ago.




a)




b)

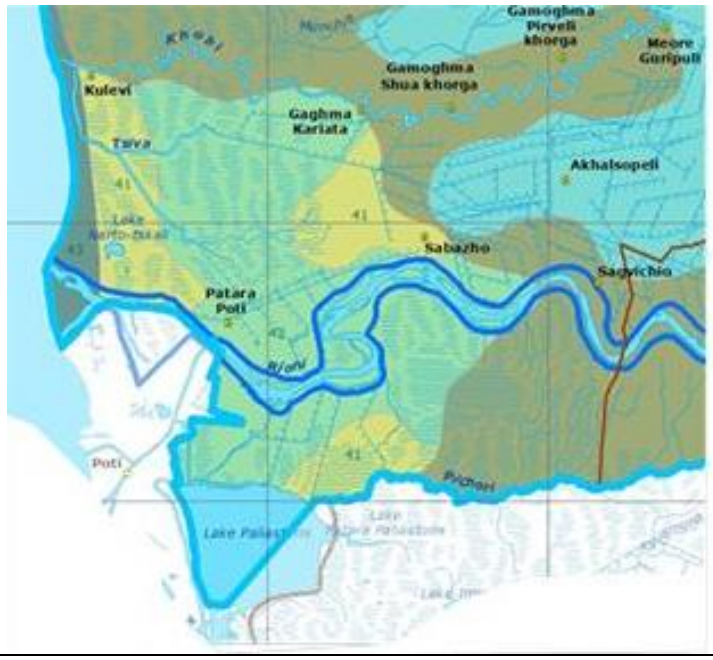
a) Red line – Ramsar site; Dotted black line – Kolkheti National Park
b) Green line – Kolkheti National Park; violet contour – Important Bird Area (IBA)

***Figure 42. Kolkheti protected area, Ramsar site and IBA***

The Kolkheti national park area is notable from botanic point of view. The complexes of phytocenosis rich in quite diverse, relict and endemic species, and various compositions have remained there till present – they are the different plant communities of the mires, swampy forests and sand dunes located along the coastline. Vegetation characteristic for swampy ecosystems of tundra and taiga of the far North; boreal species such as Sphagnum mosses (*Spagnum imbricatum, Sp. palustre, Sp. acutiflium*), Round-leaved sundew (*Drosera rotundiflora*), Woollyfruit sedge (*Carex lasiocarpa*); plants of alpine zone - Sedge and Pontic rhododendron (*Rhododendron ponticum*), etc. are widely met.

Swampy and humid forests include: Alder trees, Caucasian wingnut, Imeretian oak and Colchis oak with well-developed evergreen underbrush. In the sandy zone of dunes grow Sea-buckthorn and Jerusalem thorn. Composition of species of algae is diverse. Plant species include: Spurge, Eringo, Colchis sedge, Imeretian cogongrass, Astragalus, Marsh woundwort, Catchfly, etc. Along the lakes and marsh rivers in the wetlands: Colchis water-lily and Yellow water-lily, Colchis water chestnut and Lesser duckweed are present. In the peaty mires together with the north tundra species Royal fern and Imeretian sedge can be met.

The area is the place where Georgia Red List species: Yellow poppy, Water lily, Colchis oak (*Quercus hartwissiana*), Caucasian wingnut (*Pterocarya pterocarpa*), Colchis box-tree (*Buxus colchica*) is preserved. Tree species are represented by Maple (*Fraxinus exscelsior*), Georgian oak (*Quercus iberica*) and Alder (*Alnus barbata*). In the forest, along the peripheral belt of peaty mires and the ravines of the marshrivers Colchis-Hyrcanic alder groves, sometimes mixed with Wingnut, Imeretian oak or Maple, Beech, Ash-trees and Hornbeam are registered.




| | |
|---|---|
| 6 | კოლხური ჭაობის ტყე - მურყანი (Alnus barbata), კავკასიური ლაფანი (Pterocarya pterocarpa), სხვ. |
| 7 | კოლხური ჭალი ტყე - მურყანი (Alnus barbata), იმერული მუხა (Quercus imeretina), კავკასიური რცხილა (Carpinus caucasica), ეკალღიჭი (Smilax excelsa), ღვედკეცი (Peripoloca graeca) |
| 41 | მეზოოლიგოტროპული სფაგნუმიანი ჭაობი - (Sphagnum palustrae), ჩრდილოეთის ისლი (Carex lasiocarpa), ცრუ-კოთხუჯისებრი ზამბახის (Iris pseudacorus), ლელი (Phragmites communis), სამეფო გვიმრა (Osmunda regalis) |
| 42 | ბორცვიანი ისლიანი ჭარბტენიანი ტერიტორია - ისლი (Carex leporina, Carex vulpine), ლერწამი (Juncus lampocarpus), მახრჩობელა (Deschampsia caespitosa), ხუჭუჭა (Beckmannia eruciformis) |
| 43 | სანაპირო ქვიშის დიუნები - ლურჯი ნარი (Eryngium maritimum), ზღვის შროშანი: (Pancratium maritimum) |

***Figure 43. Vegetation map = Kolkheti lowland (Poti area)***

The section of the highway under consideration (Grigoleti-Kobuleti bypass) starts in 1.5km south to the boundary of Kolkheti Protected area. In other section of alignment neither of alternatives border to protected sites.

### 5.2.2. PROJECT CORRIDOR- GENERAL DESCRIPTION (FIELD SURVEY DATA)

#### 5.2.2.1. VEGETATION/FLORA

Vegetation/flora survey was carried out by the project team in summer (August) and autumn (October) 2016 and early spring 2017. 200-300m wide strip along all alternative alignments have been studied. Objective of the survey was to identify sensitive communities and habitats within the project impact area.

Alternative alignments run through semi-waterlogged and swampy alder, shrub, sedge, rush and reed areas and grasslands; agricultural lands; residential areas; rivers and altered/transformed area.

Vast areas in the north-west and south sections of the project corridor, as well as in the coastal area are waterlogged. The mentioned areas are rich in relict and endemic Colchic flora species.

Natural vegetation in the area of interest has been transformed because of man-caused impact and development of the area. The natural floristic composition is strongly altered: part of phytocenosis became impoverished; in other areas vertical and horizontal structures are violated; in some – native floristic composition is ousted by alien advent species. In most cases primary phytocenosis are fully 'replaced' by grasses, shrubs and weeds - secondary cenosis, agricultural lands, elements of industrial landscapes or abandoned. Among introduced species, *Amorpha truticosa, Ambrosia artemisiafolia, Amaranthus retroflexus, Sorghum halepense, Setaria glauca, Digitalis, Plantago maior,* etc. are to be mentioned.

However, despite of the negative man-caused impact Kolkheti wetlands are still rich in biodiversity. In the project corridor wetland, water, forest and secondary meadow plant communities are found.

The situation in the project area (based on the reference information and the site survey data) is described below.

Wetland vegetation: wetlands are located in the lowest-sited sections of the river basins, in depression adjacent to the littoral dune and other areas where drainage is poor or does not happen at all. Wetland vegetation is represented by grasses, shrub-grass and grass-forest ecosystems.

Waterlogged areas within the project corridor are mainly found along Grigoleti-Supsa road (on the north-west side to the latter) and near Kobuleti. In the wetland areas Narrow-Leaved Cattail (*Typha angustifolia*), Common cattail (*Typha latifolia*), Marsh horsetail (*Equisetum palustris*), Arrowhead (*Sagitaria sagittiifoilia*), Knotgrass (*Paspalum paspaloides*), Frogbit (*Hydrocharis morsus-renae*), Flowering rush (*Butomus umbelatus*), Branched bur-reed (*Sparganium neglectum*), Triangular Club-rush (*Scirpus triqueter*) are known to be present. In addition to mentioned above, in the 'narionali' area wetland vegetation is dominated by: Sedge (*Carex gracilis*), paleyellow iris (*Iris pseudacorus*), Common rush (*Juncus effusus*), Water-pepper (*Polygonum hydropiper*), Dropmore Purple (*Lythrum vurgatum*), summer snowflake

(*Leucojum aestivum*), etc. Wetlands with domination of Common Reed (*Phragmites communis*), broadleaf cattail (*Typha latofolia*), sedge (*Carex gracilis*), common rush (*Juncus effusus*) are also met. Bi-dominant wetlands (common reed-bulrush, bulrush iris, Juncus Rush) swamps are seldom.

Peat wetlands near Kobuleti are worth mention. In these area peat moss is present.

In the area near Supsa terminal grasses like *Juncus effuses, Polygonum thunbergii, Lonicera sp.*are widely met. Shrubs are represented by *Rhamnus frangula, Gleditchia triacanthus, Morus nigra, Ficus carica.*

**Aquatic vegetation** of lakes and canals is particularly diverse, small communities are present is almost all, even shallow surface water bodies and bank of the rivers in the latent flow areas. These are 'floating' and/or 'dipped' plants. The floating plants sometimes use to 'combine' with lemna (*Lemna minor, Spirodela polyrhiza, Salvinia natans, Hydrocharis morsus ranae,* etc.). These groups are generally found in latent flow water sections of the river, edges of canals and ponds mixed with marsh vegetation.

Aquatic plants are met in the project area and Kolkheti lowland. In this zone two ecological groups can be marked out:

1) holophytic - ditch grasses (*Ruppia spiralis, R. maritima, Zostera Marina*), found in ponds and water bodies of the Black Sea coastal area;
2) fresh water plants widely spread in Kolkheti lowland - Eurasian Water-Milfoil (*Myriophyllum spicatum*), pondweed (*Potamogeton pusillus, P. natans*, *P. crispus, P.perfoliatus*), water lily (*Nymphaea colchica*) (Red List), yellow water lily (*Nuphar luteum*) (Red List), Colchis Water-Chestnut (*Trapa colchica*) (IUCN_CR, Red List), Maleev's Water-Chestnut (*Trapa maleevii*) (IUCN_VU, Red List).

During the sute survey aquatic plants were found to be widly met in the project impact area.

**Forest vegetation.** Forest in the project corridor is hygrophylic type – a kind of forested wetland. Vegetation is mainly represented by Alder (*Alnus barbata*) developed on the humid alluvial ecotopes, which distinguishes this kind of forest from the bog-peat alder one. Floristic composition is poor, represented by trees such as: willow, poplar, hornbeam, hazelnut, hawthorn, pear; lianas: blackberry (*Rubus sp*.), greenbrier (*Smilax excelsa*) and ivy (*Hedera*). In other area: fern (*Pteridium tauricum*), dane weed (*Sambucus ebulus*), and other grasses unfit for cattle grazing are found.

During the site survey in the underbush and shrub area *Lythrum vulgatum* and *Dictamnus caucasicus* (Georgian endemic species) were registered. In underbush sedge (*Carex gracilis*) dominates. The cutover areas are regrown with blackberry (*Rubus sp*.) and greenbrier (*Smilax excelsa*). Along with wetland and forest grasses in the edges of forests and meadows advent plants – in particular *Paspalum dilatatum* and *Oplismenus undulatifolius* are widely met.

**Secondary grass and bushes.** Secondary vegetation is developed in the lowland forest cutover areas. Dominant are alder schrubs, wing nut, blackberry, amorpha, ferns, meadow and forest herbaceous plants. Waterlogged meadows with rush-knotgrass vegetation and knograss filling up the spaces between sedge are to be mentioned. In the areas like that south Caucasian endemic - *Rhamphicarpa medwedewii* can be found. Knotgrass swamped meadow community uses to develop in the cutover sites, roadside areas, near the homesteads. For this communities dominance of weeds, in particular white-felted thistle (*Cirsium incanum*), Johnson grass (*Sorghum halepense*), rough cocklebur (*Xanthium strumarium*), Iberian knapweed (*Centaurea iberica*) and Moor grass (*Molinia litoralis*) is typical.

In the project corridor the landform of the meadow-like landscapes is raised and poorly drained. On the clay and podzol soil dallisgrass (*Paspalum dilatatum*) is dominant. These meadows have been formed in the formerly forested and with the course of time felt Colchic forests. Now the meadows are used as hayfileds, for keeping and grazing cattle.

In Kolkheti lowland various citrus species and ornamental plant have been introduced. Along the roads lines of pine, plane tree, cedar, oleander, eucalyptus, cypress and ornamental shrubs are planted. Some of these plant have been introduced to drain the waterlogged areas. Some of the mentioned plants (*Eucalyptus sp*.) are used for healing purposes and, on the same time, act as windbreak.

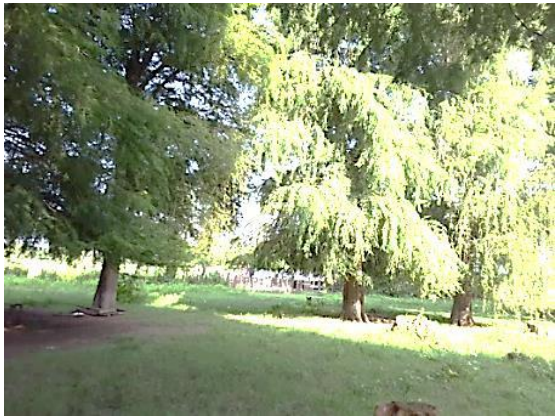
Photos showing vegetation and landscape view within the project corridor are shown overleaf.

Alder with rush and sedge meadows

Drainage canal owergrown with amorpha

Blackberry – smilax

Alder with weeds



Larch alley

Swampy area - Grigoleti

Eusj-sedge waterlogged area near Supsa

Drainage canal and abandoned cornfields near the Black Sea Arena

Sepa River

Field area

Kaprovani (Ureki)

Kaprovani (area under the project impacr)

#### 5.2.2.2. FAUNA

**Avian fauna** is rich. The Black Sea coastal region is important for avian fauna – including migratory raptors and waterfowls (see ***Figure 44***). As mentioned above 194 species of birds inhabit the Kolkheti National Park. The area is the resting place for migratory birds. The birds species use to be registered in the park area include: Small watercocks, Herons and Bright blue kingfisher. Common buzzards, Black kites, Common and Lesser kestrels, Eurasian hobbies, other falcons, European honey-buzzards, White-tailed, Steppe and Imperial Eagles.

From spring and late summer the bird species found in the area include quail (*Coturnix coturnix*), European turtle dove (*Streptopelia turtur*, IUCN_VU), Eurasian Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (*Accipiter nisus*), Short-eared Ow (*Asio flammeus*), Common Moorhen (*Gallinula chloropus*), Eurasian Woodcock (*Scolopax rusticola*), Baillon's Crake (*Porzana pusilla*), Northern Lapwing (*Vanellus vanellus,* IUCN_NT), Grey Heron (*Ardea cinerea*), ducks (*Anas sp*.), gulls (*Larus sp*.), cormorants (*Phalacrocorax sp*.), etc. Passerines are represented by: Common blackbird (*Turbus merula*), Great tit (*Parus major*), European robin (*Erythacus rubecula*), Common starling (*Sturnus vulgaris*), Common raven (*Corvus corax*), carrion crow (*Corvus corone*), Barn swallow (*Hirundo rustica*), etc.

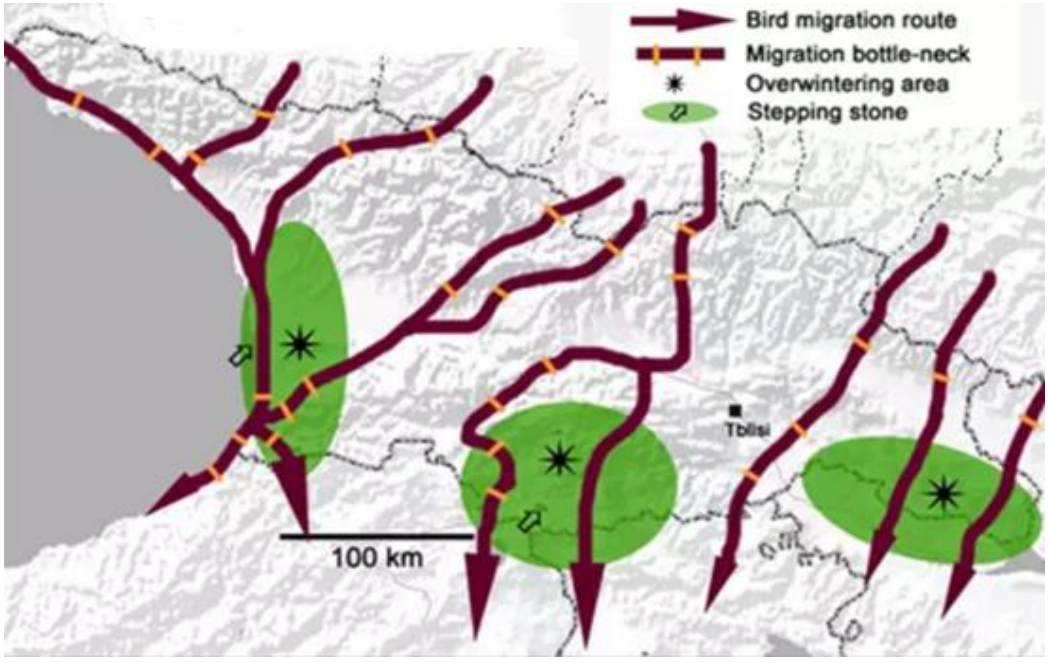



***Figure 44. Transcaucasian flyway of migrant birds (raptors, passerines and waterfowl)*** (Source: EcoNatura)

During the migration period (October) a wide diversity of sea birds use to be detected. A similar situation verifies in spring (April-May) however the quantity of individuals is lower. A rough figure indicates that from 25000 to 1 million birds winter in the Black sea and the near Mediterranean (Rose & Scott, 1994). Hereafter only the species occurring along the coastal sea waters are mentioned while there is no reference to those living in the wetland areas formed by the main rivers (and which are the most precious from a natural conservation point of view) since these are not going to be present in the study area.

The number of species which are potentially reproducing in the study area is quite low. These are presumably Great crested grebe (*Podiceps cristatus*), Great cormorant (*Phalacrocorax carbo*) and Mallard (*Anas platyrynchos*), Tufted duck (*Aythya fuligula*). The mentioned species reproduce in fresh water reservoirs located nearby. All of them feed in sea water.

Mediterranean shearwater (*Puffinus yelkouan,* IUCN_VU) has large feeding area and is often detected here. The area belong to recreation zone, thus there are no conditions for reproduction of Sternidae therein. (Andrews, 1996).

Black-throated loon (*Gavia arctica*) appears in the study area during the migration, while *G. stellata* winters there. Usually these birds do not live in large groups and are distributed along the coast making difficult to quantify their abundance, however larger groups can be found where there is abundance of food.

Representatives of Great crested grebe (*Podiceps cristatus*) are met along the shore in winter. Large flocks accumulate near the confluence of rivers, Mediterranean shearwater is met along the whole Black Sea littoral, far from the coast, seldom in the nearshore water and Great cormorant (*Phalacrocorax carbo*) usually inhabits the sea coast area.

Other migrating visitors include members of the Charadriidae family.

Several species of gulls (*Laridae*) are present in the Black Sea they include Pallas's gull (*Larus ichthyaetus*), common gull (*Larus canus*), Little gull (*Larus minutus*) Slender-billed gull (*Larus genei*), Mediterranean gull (*Larus melanocephalus)*. Except during the reproduction period presence of Black-headed gull (*Larus ridibundus*) and Caspian gull (*Larus cachinnans*) is detected. The latter follow fishing boats.

In winter, the groups of ducks, geese, and swans fly in from the north. Besides, the following species: Woodcock, Eurasian curlew, Common coots, Grebes, White-

fronted geese, Mute and Whooper swans, Dalmatian Pelican, Greater Spotted Eagle (IUCN_VU, Red List), etc. can be also found in the area. Pheasant is present, but seldom seen.

During the site visits (October) European honey-buzzard (50% of registered raptors), Steppe buzzards, Black kites, Booted eagles and a range of unidentified raptors have been registered. Grey herons (*Ardea cinerea*), Pygmy corcorants (*Phalacrocorax pygmaeus*) and Little egrets (*Egretta garzetta*) were met in various sections of the project area.

During the site visits, neither roosting places for bats, nor burrows have been identified within the 200m (each side from the central line) wide corridor.

Among **mammals** in the swampy floodplains, forests and shrubs of Kolkheti Jackal (*Canis aureus*), Wild boar (*Sus scrofa*), Roe deer (*Capreolus capreolus*) and Eurasian otter (*Lutra lutra*, Red List), Coypu (*Myocastor coypus*) can be found. Swamp cat (*Felis chaus*, Red List) can be seldom registered. Of small mammals Striped field mouse (*Apodemus agrarius*), European water vole (*Arvicola terrestris*), Caucasian mole (*Talpa caucasica*), Least weasel (*Mustela nivalis*), European hedgehog (*Erinaceus europaeus*).

The **marine mammals** are presented by 3 species of dolphins (Aphalina – the Bottle-nose Dolphin (*Tursiops truncatus*, Red List), White-sided Dolphin (*Delphinus delphis*) and Herring hog (*Phocoena phocoena*).

Among **amphibians** Common tree frog (*Polypedates leucomystax*) and Marsh frog (*Pelophylax ridibundus*), European tree frog (*Hyla arborea*), European green toad (*Bufo viridis*) are registered. Besides, Smooth newt (*Triturus vulgaris*) and Banded newt (*Triturus. vittatus*) Newts can be found.

**Ichthyofauna.** The area of the marine part of Kolkheti National Park is considered as one of the most productive sections of the Georgian Black Sea coast, being important wintering, feeding and breeding grounds for many valuable fish species, including sturgeon, anchovy, flounder, red mullet to name a few. Ichthyofauna of the area is presented by 88 species, out of which 23 are transiting, 21 species live in fresh water and 44 species live in the Black Sea.

Among the cartilaginous fish the Atlantic sturgeon and beluga can be distinguished, and among the bony fish – the Black Sea salmon Herring, Striped mullet, Pike, Bonito, etc are present. Fish species protected internationally and included in

Georgia's Red List - Beluga (*Huso huso*), Sea sturgeon (*Acipenser sturio*), Sevruga sturgeon (*Acipenser stellatus*), ship sturgeon (*Acipenser nudiventris),* Russian sturgeon (*Acipenser gueldenstaedti),* Persian sturgeon (*Acipenser persicus)* are registered in particular in Rioni River. Sand goby (*Pomatoschistus minutus*) protected under the Red List of Georgia is often met.

The list of fish species in the rivers in the project impact zone is given below.

***Table 32. List of fish species in the project impact zone***

| | Common name | Latin name | Protection Status |
|---|---|---|---|
| **Supsa River** | | | |
| 1 | European eel | *Anguilla Anguilla* (Linnaeus, 1758) | IUCN_CR A2bd+4bd |
| 2 | Tench | *Tinca tinca* (Linnaeus, 1758) | IUCN_LC |
| 3 | Zarte | *Vimba vimba* (Linnaeus, 1758) | IUCN_LC |
| 4 | Colchian sturgeon | *Acipenser colchicus* (Marti, 1940) | |
| 5 | Persian Sturgeon | *Acipenser persicus* Borodin, 1897 | Red List, CMS, IUCN_CR |
| 6 | European Sturgeon | *Huso huso* | Bern Convension (appendix III), IUCN_CR, Red List |
| 7 | Trout | *Salmo trutta fario* (Linnaeus, 1758) | Red List, VU, A1d |
| 8 | Bream | *Abramis brama* (Linnaeus, 1758) | IUCN_LC |
| 9 | Leaping Mulle | *Liza saliens* (Risso, 1810) | IUCN_LC |
| 10 | Wild Common Carp | *Cyprinus carpio* (Linnaeus, 1758) | IUCN_VU A2ce |
| 11 | Flathead Mullet | *Mugil cephalus* (Linnaeus, 1829) | IUCN_LC |
| 12 | Wels Catfish | *Silurus glanis* (Linnaeus, 1758) | IUCN_LC |
| 13 | Bitterling | *Rhodeus sericeus* (Pallas, 1776) | IUCN_LC |
| 14 | Transcaucasian nase | *Chondrostoma colchicum* (Derjugin, 1899) | IUCN_LC |
| 15 | Northern Pike | *Esox lucius* (Linnaeus, 1758) | IUCN_LC |
| 16 | Dace | *Leuciscus leuciscus* (Linnaeus, 1758) | IUCN_LC |
| 17 | Palaeostome shad | *Alosa caspia palaeostomi* (Sadowsky, 1934) | Red List, VU, D2 |
| 18 | Perch | *Perca fluviatilis* (Linnaeus, 1758) | IUCN_LC |
| 19 | Monkey goby | *Neogobius fluviatilis* (Pallas,1814) | IUCN_LC, Red List, VU, B2a |
| 20 | Caspian shemaya | *Chalcalburnus chalcoides* (Guldenstadt, 1772) | IUCN_LC |
| 21 | Gudgeon | *Gobio lepidolaemus caucasica* (Kamensky,1901) | |

| | | | |
|---|---|---|---|
| 22 | Barbus | *Barbus tauricus rionica* (Kamensky, 1899) | |
| 23 | Asp | *Aspius aspius* (Linnaeus, 1758) | IUCN_LC |
| 24 | Caucasian scraper | *Capoeta capoeta* (Guldenstadt, 1773) | IUCN_LC |
| **Sepa River** | | | |
| 25 | Crucian Carp | *Carassius carassius* (Linnaeus, 1758) | IUCN_LC |
| 26 | Round goby | *Neogobius (Apollinaria) melanostromus* (Pallas,1814) | IUCN_LC |
| 27 | Leaping Mulle | *Liza saliens* (Risso, 1810) | IUCN_LC |

Key: *LC-Least Concerm, VU-Vulnerable, EN-Endangered, CR-Criticaly endangered*

***VULNERABLE (VU)***

*A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:*

*A. Reduction in population size based on any of the following:*

*1. An observed, estimated, inferred or suspected population size reduction of ≥ 50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:*
*(a) direct observation; (b) an index of abundance appropriate to the taxon; (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat;*
*(d) actual or potential levels of exploitation; (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.*

*2. An observed, estimated, inferred or suspected population size reduction of ≥ 30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.*

*3. A population size reduction of ≥ 30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.*

*4. An observed, estimated, inferred, projected or suspected population size reduction of ≥ 30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.*

***CRITICALLY ENDANGERED (CR)***

*A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:*

*A. Reduction in population size based on any of the following:*

*1. An observed, estimated, inferred or suspected population size reduction of ≥ 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:*
*(a) direct observation; (b) an index of abundance appropriate to the taxon; (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat;*
*(d) actual or potential levels of exploitation; (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.*

*2. An observed, estimated, inferred or suspected population size reduction of ≥ 80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.*

*3. A population size reduction of ≥ 80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.*

*4. An observed, estimated, inferred, projected or suspected population size reduction of ≥ 80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.*

*B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:*

*1. Extent of occurrence estimated to be less than 100 km$^2$, and estimates indicating at least two of a-c:*

*a. Severely fragmented or known to exist at only a single location.*

*b. Continuing decline, observed, inferred or projected, in any of the following:*

*(i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.*

*c. Extreme fluctuations in any of the following:*

*(i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals.*

*2. Area of occupancy estimated to be less than 10 km$^2$, and estimates indicating at least two of a-c:*

*a. Severely fragmented or known to exist at only a single location.*

*b. Continuing decline, observed, inferred or projected, in any of the following:*

*(i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.*

*c. Extreme fluctuations in any of the following:*

*(i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals.*

*C. Population size estimated to number fewer than 250 mature individuals and either:*

*1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR*

*2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):*

*(a) Population structure in the form of one of the following:*

*(i) no subpopulation estimated to contain more than 50 mature individuals, OR; (ii) at least 90% of mature individuals in one subpopulation.*

*(b) Extreme fluctuations in number of mature individuals.*

*D. Population size estimated to number fewer than 50 mature individuals.*

*E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).*

***Red List of Georgia***

*D2-very limited habitat*

*A1d-significantly reducing habitat*

*B2a - small, fragmented habitat*

**Reptiles.** The area is not rich in reptile species. The species registered here are mainly those related to water reservoirs. Out of 53 species registered in Georgia 9 can be found in the project region. These are: Slow worm (*Anguis fragilis*), Sand lizard (*Lacerta agilis*), Derjugin's Lizard (*Lacerta derjugini*) (IUCN NT), Dice snake (*Natrix tesselata*), Grass snake (*Natrix natrix*), Aesculapian snake (*Elaphe longissima*), Large-headed water snake (*Natrix megalocephala*), Smooth snake (*Coronella austriaca*). In all ponds and wetland area European Pond Turtle (*Emnus orbicularis*) (IUCN_NT) can be found.

**Invertebrates.** The following groups can be found in the project area: Nematoda, Hirudinea, Mollusca, Crustacea, Arachnida (lites, ticks, scorpions, spiders) and Insecta. Worth to mention are endemic - *Euscorpius migrelikus*, and migrant form - Italian Scorpio (*Euscorpius italikus*), which is met only in narrow coastal strip of the Black Sea. The area is rich in the representatives of the double-wings, in particular blood-sucking insects-mosquitoes and the carrion and faecal flies.

## 5.3. THE SOCIOECONOMIC AND CULTURAL ENVIRONMENT

### 5.3.1. POPULATION

The project area includes Ozurgeti, Lanchkhuti municipalities, Guria Region. The main settlements in the project area include: Tskaltsminda, Ureki (Magnetiti), Shelvetili.

According to the census of 2014, by the state of January the 1st, population in Guria region was 138.8 thousand.

***Table 33. Population by Municipalities for the beginning of the year (thous)***

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **GEORGIA** | **4,394.7** | **4,382.1** | **4,385.4** | **4,436.4** | **4,469.2** | **4,497.6** | **4,483.8** | **4,490.5** | **3,713.7** | **3,720.4** |
| **Guria total** | **139.0** | **138.8** | **138.8** | **139.8** | **140.3** | **140.3** | **139.2** | **138.8** | **113.3** | **113.0** |
| **Municipalities** | | | | | | | | | | |
| Lanchkhuti | 38.8 | 38.7 | 38.7 | 38.9 | 38.9 | 39.0 | 38.7 | 38.6 | 31.5 | 31.5 |
| Ozurgeti | 77.4 | 77.3 | 77.2 | 77.9 | 78.4 | 78.5 | 77.9 | 77.7 | 62.8 | 48.0 |
| Chokhatauri | 22.8 | 22.8 | 22.9 | 23.0 | 23.0 | 22.8 | 22.6 | 22.5 | 19.0 | 18.9 |

Majority of population is rural.

*Table 34. Main settlement and population in the project impact zone*

| | Settlement | Region | Municipality | Population |
|---|---|---|---|---|
| 1 | Ureki Magnetiti | Guria | Ozurgeti | 1422 |
| 2 | Tskhaltsinda | Guria | Lanchkhuti | 1352 |
| 3 | Grigoleti | Guria | Lanchkhuti | 235 |
| 4 | Shekvetili | Guria | Ozurgeti | 66 |

### 5.3.2. MIGRATION, IDPS

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 economic migrants are Turkey, Greece, Spain. Seasonal migration is also observed.

According to the Ministry of Internally Displaces Persons from the Occupied Territories, Accommodation and Refugees of Georgia number of IDPs currently living in municipalities of Guria region is as follows:

*Table 35. Main settlement and population in the project impact zone*

| | Locality (municipality) | Number of IDPs | Number of families |
|---|---|---|---|
| 1 | Chokhatauri | 105 | 38 |
| 2 | Lanchkhuti | 166 | 51 |
| 3 | Ozurgeti | 219 | 76 |

Source: http://www.mra.gov.ge

### 5.3.3. GENDER ISSUES

Out of interviewed residents males dominate with 50.6%, Households are headed predominantly by males. 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. In the study area, female earnings were found to be approximately 50% lower than male.

### 5.3.4. EMPLOYMENT, SOURCES OF INCOME

Unemployment rate is estimated as 9.8%.

Majority of population is self-employed. Employment in industry is shown in *Table 36*.

***Table 36. Employment in industry (persons)***

| | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| Georgia | 550,885 | 592,147 | 626,739 | 620,775 | 604,984 |
| Tbilisi | 344,982 | 372,009 | 395,716 | 408,665 | 392,898 |
| Adjara | 49,759 | 54,655 | 57,555 | 55,630 | 54,850 |
| Guria | 4,243 | 4,959 | 5,724 | 5,437 | 5,520 |
| Imereti | 43,122 | 46,897 | 46,934 | 42,939 | 41,191 |
| Kakheti | 17,791 | 18,402 | 19,414 | 17,093 | 17,288 |
| Mtskheta-Mtianeti | 6,687 | 7,539 | 8,348 | 8,705 | 8,609 |
| Racha-Lechkhumi and Kvemo Svaneti | 2,018 | 1,771 | 2,489 | 1,204 | 1,419 |
| Samegrelo-Zemo Svaneti | 24,004 | 26,709 | 27,304 | 22,501 | 23,583 |
| Samtskhe-Javakheti | 9,188 | 7,925 | 8,636 | 8,240 | 8,193 |
| Kvemo Kartli | 34,214 | 34,864 | 36,600 | 34,270 | 33,691 |
| Shida Kartli | 13,725 | 15,287 | 16,844 | 14,887 | 16,590 |

Source: National Statistics Office of Georgia

Information about the status of employment in the project area is given in ***Table 37***.

31.77% of interviewed 724 residents are employed, 23.76% is unemployed, 5.52% is student (school, higher educational institutions) and 20.58% is pensioner. Number of self-employed is high.

***Table 37. Employment status***

| Type | Number | % |
|---|---|---|
| Employed in the public service | 69 | 9.53 |
| Employed in the private sector | 123 | 16.99 |
| Self-employed | 36 | 4.97 |
| Farmer | 2 | 0.28 |
| Unemployed | 172 | 23.76 |
| Student/pupil | 40 | 5.52 |
| Pensioner | 149 | 20.58 |
| Housewife | 104 | 14.36 |
| Other | 29 | 4.01 |
| **Total** | **724** | **100.00** |

According to the survey carried out in the project impact zone, average monthly income of population is 638 Gel. Main sources of income are salaries, income from agriculture. Most of income is used for food and drink and healthcare,

***Table 38. Average monthly expenses***

| # | Type of expenses | Average monthly expenses |
|---|---|---|
| 1 | Food/drink | 298 |
| 2 | Health Care | 163 |
| 3 | Clothing/shoes | 92 |
| 4 | Utility bills | 50 |
| 5 | Education | 19 |
| 6 | Lease payments | 0 |
| 7 | Total/total | 622 |

In every second household at least one member has loan from bank, micro finance organization or from private person. Two households have all three types of the loan mentioned above. Four households of 203 receive money (at least 3 timed a year) from family members living abroad.

### 5.3.5. INDUSTRY AND BUSINESSES

The region ranks 9th among the 10 regions by number of employed in industry.

Industries in Guria region comprise food and construction materials production facilities. Local small businesses include essential goods outlets, chemist's shop, fuelling and maintenance stations. Other possibilities of employment are administration offices, schools, etc.

According to available statistics the number of businesses Guria region ranks 8$^{th}$ after Tbilisi and by regions (2017 data) .

***Table 39. Businesses***

| Regions | Quantity of business units | Active | % |
|---|---|---|---|
| Total | 652046 | 172532 | 100 |
| Tbilisi | 284129 | 72430 | 43.6 |
| Imereti | 89756 | 23864 | 13.8 |
| Adjara | 55217 | 16985 | 8.5 |
| Samegrelo-Zemo Svaneti | 51467 | 13172 | 7.9 |
| Kvemo Kartli | 48850 | 13200 | 7.5 |

| | | | |
|---|---|---|---|
| Kakheti | 41242 | 10861 | 6.3 |
| Shida Kartli | 28865 | 8448 | 4.4 |
| Samtskhe-Javakheti | 18832 | 4990 | 2.9 |
| **Guria** | 16056 | 4359 | 2.5 |
| Mtskheta-Mtianeti | 12034 | 2968 | 1.8 |
| Racha Lechkhumi-Kvemo Svaneti | 5427 | 1240 | 0.8 |
| Abkhazeti | 171 | 15 | 0 |

Source: National Statistics Office of Georgia

#### 5.3.5.1. AGRICULTURE

The agricultural land used in the region is as follows: 22.3 thou ha – plough land, 19.7 thou ha – pasture; 1.2 thou ha – grassland, 5.5 thou ha – not developed. Majority of the plough lands are located within the Kolkheti lowland. Significant problem is waterlogging of the land. In Ozurgeti and Lanchkhuti municipalities network of drainage canals used to cover 17.4 thousand ha. The canals are silted and overgrown with shrubs and grasses. The system needs rehabilitation and maintenance. Efficiency of the system diminished leading to secondary waterlogging of some areas.

Due to prevailed climatic conditions, the major production sector is an agriculture and related processing industry. Subtropical agriculture is a leading production sector, and includes crop husbandry, tee growing, citrus growing, viticulture, cattle breeding, poultry and beekeeping. The main crops cultivated in the region are: tea, citruses, beans, potatoes, grapes, hazelnuts, persimmon, kiwi, feijoa, laurel, other fruits and vegetables. The trout farms have been developed since the late 1980s on the mountain rivers of the district (rivers Bzhuzha, Natanebi, Supsa and their tributaries), cattle breeding, poultry and beekeeping are also developed.

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

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).

Land registration process finished in 2002, when relevant certificates were handed over to the owners. The majority of arable land is private. Pastures were no privatized and are under common ownership. Besides, farmers were allowed to lease or buy land from the state.

**Ozurgeti municipality** (total area 676.35 $km^2$). Municipality is mainly agriculture oriented, though arable land resources are rather sparse. Size of land plot per household does not exceed 0.75ha. The major crops include: maize, tea, citrus fruit, kiwi, persimmon and hazelnut. Households are involved in poultry breeding, cattle breeding, fishing. Beekeeping actively develops. Products are sold by sub purchaser at the farmers markets in the region. There are two agrarian markets in Ozurgeti municipality, several dozen markets and shops.

**Lanchkhuti municipality** (total area 498.609 $km^2$). Citrus-growing, cattle-breeding and nut-growing are leading agricultural branches. Products are sold by sub purchaser at the farmers markets in the region.

**Project area.** According to survey, 161 family has access to the arable land. Average acreage of land plots owned by the project affected households equates 3032$m^2$. Some families own several plots. 96% of the land is agricultural, only 4% - non-agricultural. 95% of land is registered, the rest – private, not registered. The list of cultivated crops (according to the social survey data) is given below:

***Table 40. Agricultural crops***

| | Product | Number households |
|---|---|---|
| 1 | Corn | 133 |
| 2 | Fruit | 173 |
| 3 | Potatoes | 73 |
| 4 | Vegetables | 126 |
| 5 | Nuts/nuts | 158 |
| 6 | Grapes | 140 |
| 7 | Hay | 54 |

59% of the project affected interviewed households own cattle. One family owns in average 1 cow, bull or buffalo, 10 chicken (hen, turkey, other). 9 households have pigs, two – sheep or goat, four – horse or donkey.

#### 5.3.5.2. INDUSTRIES

**Ozurgeti municipality.** Main industries in Ozurgeti municipality are - tea and hazelnut processing plants, dried fruits, beer and soft drinks productions, bentonite clay processing in vil.Askana.

**Lanchkhuti municipality** is rich in mineral resources. There are several peat quarries in the region, with Imnati quarry (east to Paliastomi lake) being the largest one; quarries in Maltakva, Grigoleti, Dedebera and Supsa. The coastline (Tsksaltsminda, Grigoleti, Maltakva) contains magnetite. Sapropel – in Paliastomi area. There are chalk-stone mines in Shukhuti and Junjuati; brick clay mines in Lanchkhuti and Sameba; gravel mine – in Supsa; sulphur water - in Guliani and Jurukveti and hydrocarbon sodium water - in Baghlebi. Baku-Supsa oil pipeline and Supsa terminal play an important role in the economics of the municipality.

**Project area.** Ureki and Shekvetili population is in hospitality business. Number of hotels, cafeteria/restaurants and small shops in 'permanently' growing. Of business facilities Supsa oil terminal is worth to mention.

### 5.3.6. VULNERABLE GROUPS

(individuals below poverty level, women (widows, single mothers) led families, IDP).

***Table 41. Recipients of subsidence aid***

| Location | Number of recipients of subsidence | | Percentage of subsidence recipients from total population | |
|---|---|---|---|---|
| | Household | Individuals | Household | Individuals |
| Lanchkhuti municipality | 1,748 | 6,399 | 19.6 | 20.4 |
| Ozurgeti | 827 | 2,391 | 12.6 | 10.4 |
| Ozurgeti municipali | 1,306 | 5,027 | 11.6 | 12.7 |
| Chokhatauri municipali | 1,260 | 4,893 | 24.7 | 25.6 |
| Guria region | **5,141** | **18,710** | **16** | **17** |

Source: Social Service Agency

According to information published by the Ministry of Labour, Health and Social Affairs of Georgia, total number of persons receiving social aid in the region of interest, by the state of December 2016, is 5595. The split by category is given in ***Table 42***.

***Table 42. Number of persons receiving social aid – breakdown by groups***

| Location | Handicapped | Families headed by women | Politically repressed | State compensation recipients | Household subsidies recipients | Total |
|---|---|---|---|---|---|---|
| Lanchkhuti municipality | 1,745 | 194 | 6 | 33 | 26 | 2,004 |
| Ozurgeti | 487 | 80 | 1 | 27 | 25 | 620 |
| Ozurgeti municipality | 1,660 | 324 | 11 | 39 | 68 | 2,102 |
| Chokhatauri municipality | 746 | 97 | 3 | 14 | 9 | 869 |
| Guria region | **4,638** | **695** | **21** | **113** | **128** | **5,595** |

**Project area.** Socio-economic survey showed that 20 families out of interviewed 203 are vulnerable. In the direct impact zone of the project there are 12 persons below poverty line, 3 lonely pensioners, 6 internally displaced person, 12 individuals with disability, 2 veterans. 3 families are is receiving state allowance for large families, two - orphanhood pension. There are war veterans in 4 families. .

### 5.3.7. EDUCATION

In Ozurgeti municipality there are 34 pre-schools, 37 public schools, 5 vocational and 2 higher (Ozurgeti Institute of Environmental Management, Guria Branch of Ivane Javakhishvili Tbilisi State University), education facilities, 11 libraries, 1 theatre and 1 museum. One school is located at 7 Takaishvili str., Ureki with 411 pupils and 39 teachers. According to data of the Ministry of Education of Georgia, no public school exists in village Shekvetili and this village children go to school located in village Natanebi.

In Lanchkhuti municipality there are 25 public school (total number of students 3719), 1 secondary vocational school and 32 libraries.

***Table 43. Number of schools and student (by the state of beginning of 2016 school year)***

| Location | Number of schools | | Number of pupils | |
|---|---|---|---|---|
| | 2014/2015 | 2015/2016 | 2014/2015 | 2015/2016 |
| Guria region | **101** | **101** | **14649** | **14405** |
| Lanchkhuti municipality | 25 | 25 | 3779 | 3719 |
| Ozurgeti municipality | 44 | 44 | 8353 | 8206 |
| Chokhatauri municipality | 32 | 32 | 2517 | 2480 |

Source: Education management information system

***Table 44. Number of private and public schools by municipalities of the region (2016 data)***

| | **Number of schools, unit** | |
|---|---|---|
| | **Public** | **Private** |
| Lanchkhuti | 24 | 1 |
| Ozurgeti | 42 | 2 |
| Chokhatauri | 32 | 1 |

Source: Education management information system

**Project area.** 41% of interviewed individuals (affected persons) have secondary education, 26% has higher education and 17% graduated the vocational college.

### 5.3.8. HEALTHCARE FACILITIES

Healthcare facilities available in Ozurgeti and Lanchkhuri municipalities include Medalfa Llc medical centres, Regional Health Centres. There is an outpatient clinic in each village. In addition PSP company builds a new private diagnostic centre in the city downtown. The healthcare facilities are financed from the central budget, by insurance companies or patients' payments.

There are 21 medical establishments in Lachkhuti, 25 in Chokhatauri and 42 in Ozurgeti municipality. According to the report of the Ministry of Labour, Health and Social Affairs there are 73 village physicians and 83 assistant doctor in Guria region. Each community is served by village doctor. The area is covered by Emergency aid service.

All large drugstore networks are present in the region.

### 5.3.9. CULTURAL RESOURCES

The area is interesting from archaeological point of view. There are typical ancient settlements in the Kolkheti lowland, called locally "Dikhagudzuba", which are still identifiable on aerial imagery. Their structure and physical dimensions were analysed from aerial and on site studies. Data from existing archaeological studies and recent field works were analysed to create a reliable database on the distribution of Bronze Age settlements.

A range of archaeological sites has been discovered in the late 20th century when Baku-Supsa oil pipeline was laid. These include: Burials dated 7th-6th centuries B.C. and remains of ancient settlements (vil.Nigvziani); medieval artefacts (vil.Akhalsopeli); remains of ancient settlements (vil.Tabanati, vil.Khidmaghala); remnants of the dune settlement and workshop, the $8^{th}$-$7^{th}$-$6^{th}$ and $4^{th}$ centuries B.C (vil.Grigoleti).

Presence of old settlements along Kulevi – Poti – Ureki coastal areas is known. These include: the Late Bronze – Early Iron period settlements in the estuary of the Khobi river (north of Poti); 6th– 4 th century B.C. settlement at the Tsiva river, at the estuary of the Supsa river, south to Poti.

Natekhebi, located south of Poti, near the small bay of Paliastomi lake is the place where some artefacts have also been unearthed, among them fragments of amphorae on the bottom of which semi-solid petroleum waste of asphalt-pitch was registered. An early period Sinopean amphora (rim diameter - 12cm) with tubular neck (15cm high), solid handles (ovoid in section) was uncovered near the Supsa river canyon in the sea. Another Heraclea Pontica amphora dating from the 4th century BC was found again in the sea at Maltakva.

Ureki and its surroundings are well-known with accidentally explored treasures (golden earning, necklace, buckle, rings, bracelets, coins and chains from late antique age).

Among the important architectural monuments of the project area are:

- Likhauri Church,
- Shemoqmedi Monastery complex,
- Petra settlement,
- Askana fortress (2nd-4th c.c.),
- Gurieli palace,
- King Tamara's Likhauri fortress,
- Vashnavi settlement,.
- ancient burials, settlements,
- remains of the metal casting workshops (e.g. Late Classic Period casting workshops in Askana);
- Medieval settlement and burial grounds in Baileti,
- Pre-Late Classic Period metal casting workshops and Medieval settlement in Bakhvi,
- burial ground, settlement and remains of metal casting workshop in Shemoqmedi,

- Otogvini cave of Middle Bronze Age in Vakijvari,
- Silver deposits in Pampaleti,
- Medieval cave in Jumati,
- Chinari treasure in Ureki,

Museums:

- Shalva Radiani ethnographical Museum,
- Ekvtime Takaishvili Museum,
- Giorgi Salukvadze House Museum,
- Guriant Memorial Museum.

There are 2 theatres in Lanchkhuti municipality.

### 5.3.10. TOURISM

Tourism in Guria is sporadic and weakly contributes to the local economy. The basic tourism infrastructure needs improvement. Despite infrastructural inefficiencies, Guria region is suitable for hosting the new tourism trends, including rural tourism. Tourism development in the region is one of the main priorities for all three municipalities in the region.

Main directions for tourism development in this region include sea resorts, mountain tourism, balneology, hunting and adventure tourism. Potential of the resort towns of Grigoleti, Ureki, Bakhmaro and Gomismta is worth to mention in particular. The seaside areas – Tsksaltsminda, Grigoleti, Maltakva, Grigoleti, Ureki are popular seaside summer resorts for Georgians.

***Table 45. Main parameters and peculiarities of the resorts within the study area***

| Resort name | Elevation, m asl | Type of the resort | Medical profile | Main recreational resources |
|---|---|---|---|---|
| Kobuleti | 5 | c | c, p, pr | mb, c, ns |
| Ureki | 4 | c | p, n, arth | mb, c, ms |
| Grigoleti | 3 | c | pr, p, n | mb, ns, ms |
| Maltakva | 3 | c | p, pr | mb, ns, ch, wr |

Key: c – climatic; b-balneological, cb -climatic – balneological;
Medical profile: arth _ arthrological; g _ gynaecological; cr _ cardiological; n _ neurological; pr _ prophylactic; p _ pulmonologic; Recreational resources: ns _ natural sightseeing; mb _ beaches; ch _ cultural-historical ; c _ climatic; mw _ mineral water; fr _ forestry; wr _ water reservoirs; ms _ magnetite (black) sands beach

There is a range of hotels and family hotels in the region. Most of them are in Ureki and Shekvetili. Hotels work seasonally – mainly in summer.

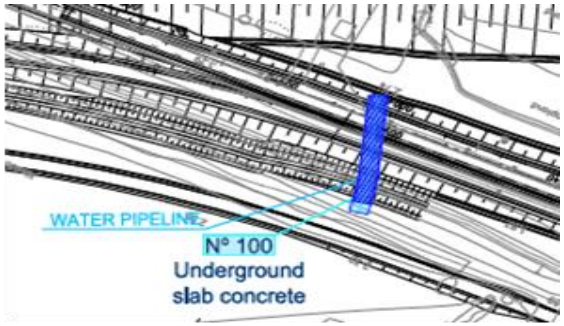
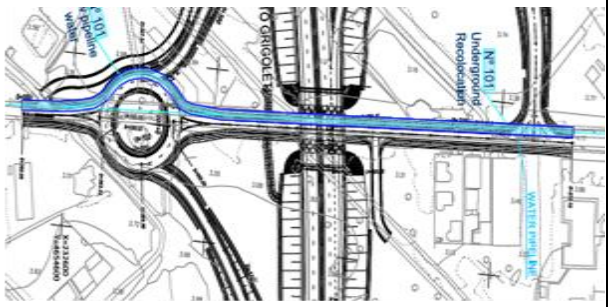
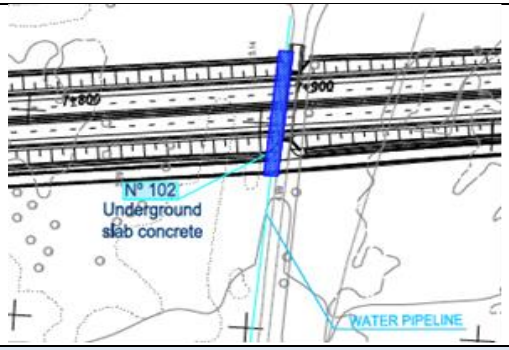
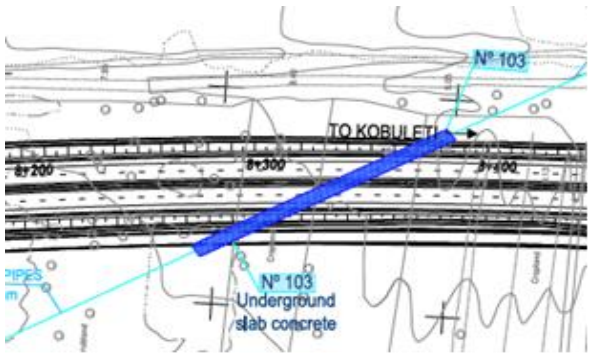
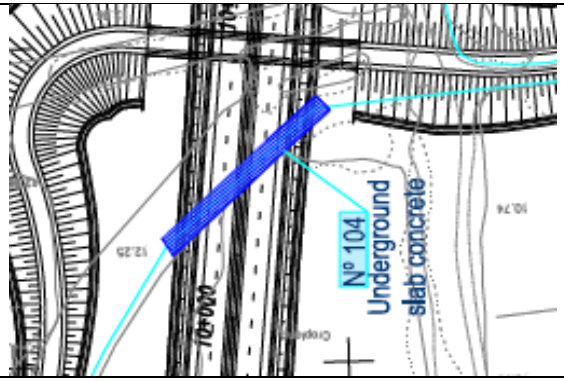
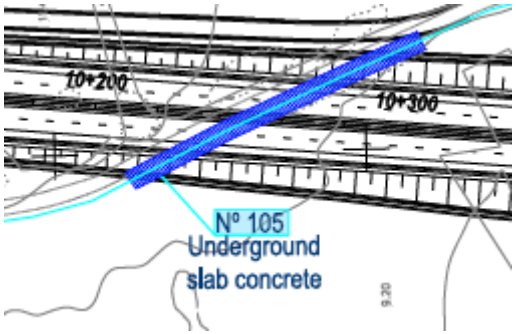
### 5.3.11. INFRASTRUCTURE

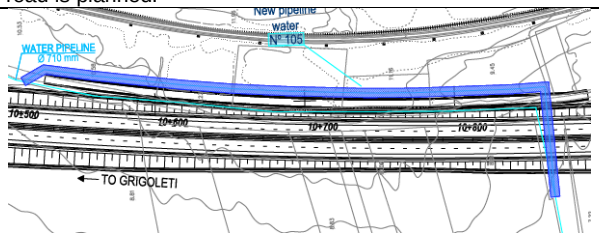
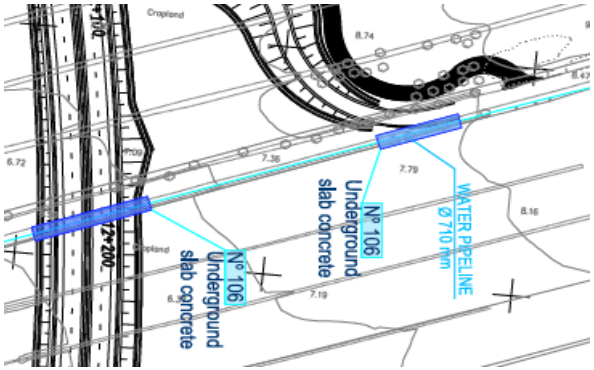
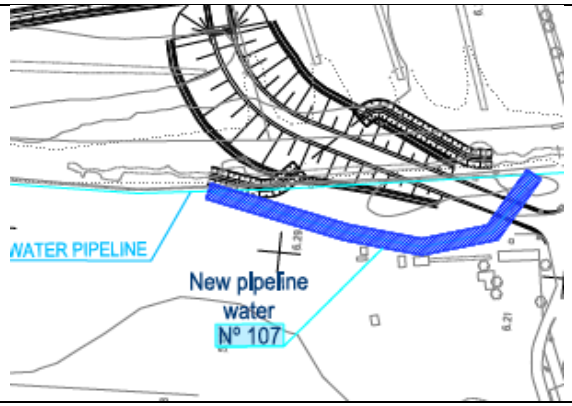
The area of the district is crossed by international importance roads E-692 and E-70. The district has well developed road network that in its most extent requires improvement of the surface course.

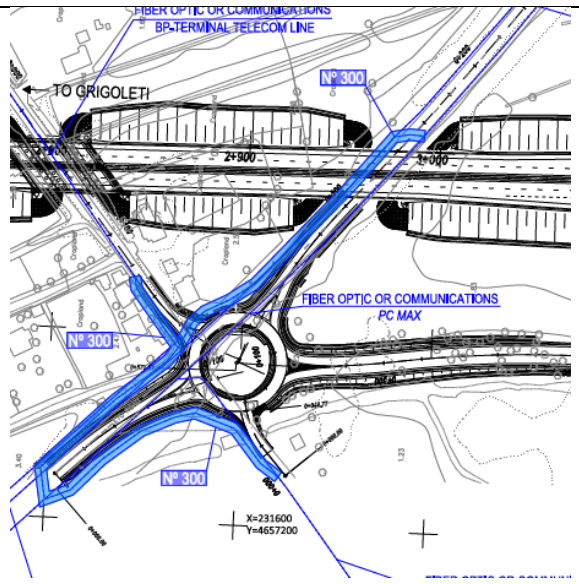
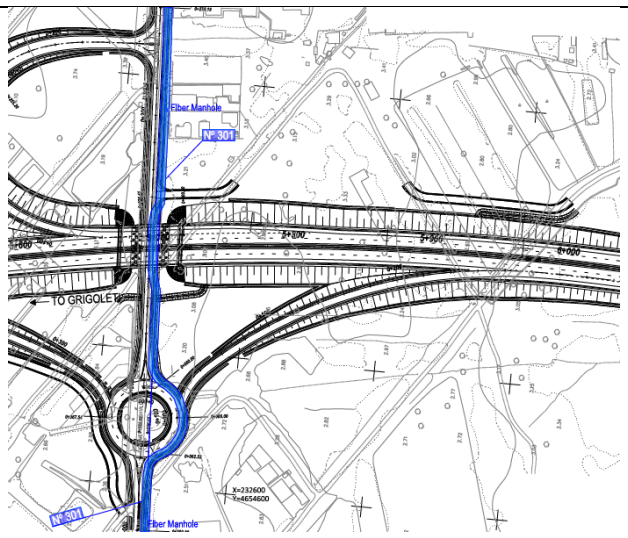
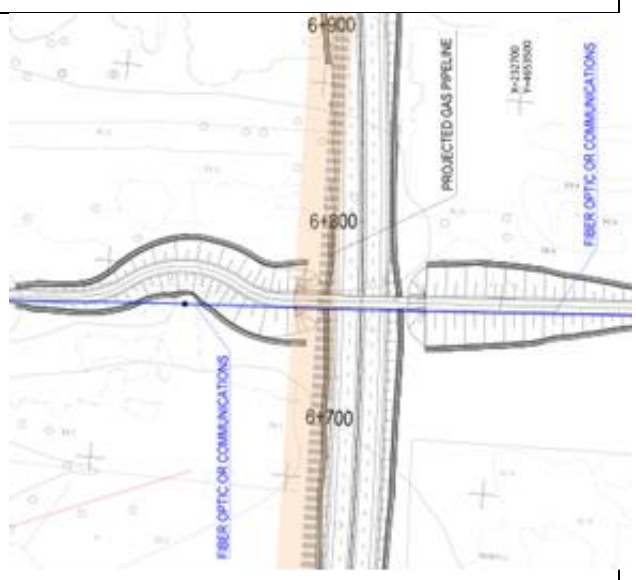
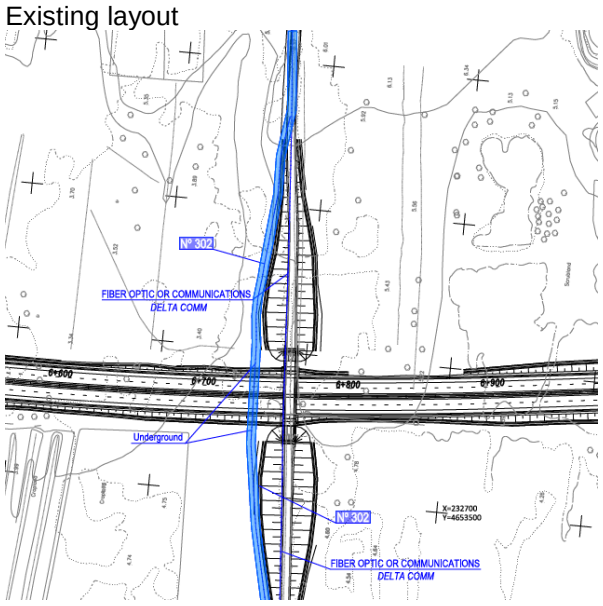
Other infrastructure includes – railways line, transmission lines, optic fibre cables, Supsa pipeline, gas pipeline, a network of drainage canals (see ***Figure 45***). The list of infrastructure is given in ***Table 46***.

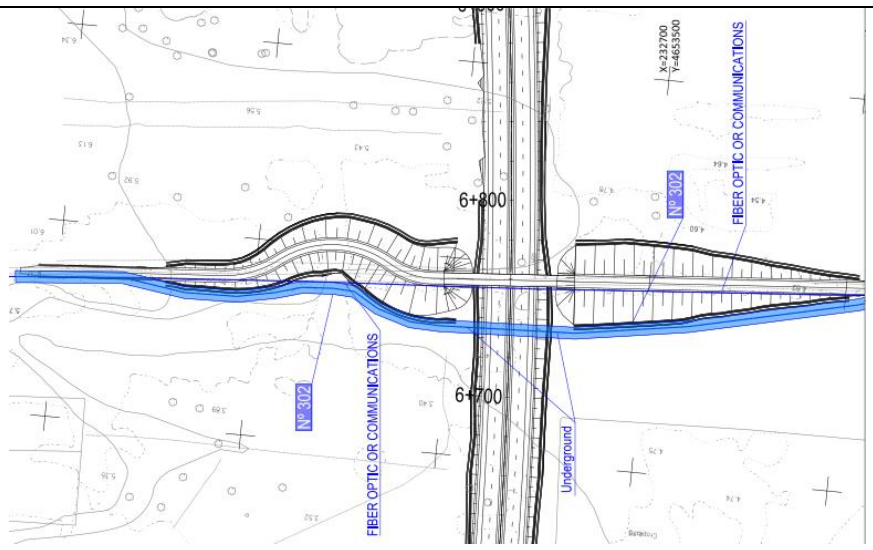
***Table 46. Infrastructure in the project area***

| **Water pipeline** | **High voltage OTL** |
|---|---|
| pk5+700 | pk 2+700 |
| pk7+900 | pk4+200 |
| pk12+180 | pk5+700 to pk6+700 |
| **Medium voltage OTL** | pk8+100 to 8+400 |
| pk0+000 | pk8+940 to 9+350 |
| pk1+000 | pk11+000 |
| pk2+420 | **Gas pipeline (Socar)** |
| pk3+100 | pk2+960 |
| pk3+680 | **Optic-fiber cable** |
| pk5+600 | pk2+960 |
| pk5+680 | **WREP (Baku-Supsa oil pipeline)** |
| pk5+850 | pk0+550 |
| pk6+320 | pk2+020 |
| pk9+080 | **New (projected) gas pipeline** |
| pk9+380 | pk1+150 |
| | pk5+000 to 5+500 |
| | pk6+100 to pk 7+500 |
| | pk9+150 |
| | pk10+400 to 10+950 |

| | Crossing #100 (KP -1+100) | Crossing #101 (KP -5+700) | Crossing #102 (KP -7+900) |
|---|---|---|---|
| Water pipeline | Water pipeline crossing existing road (perpendicular to it) will be affected by construction of an interchange. Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. | The new road will cross existing water pipeline in the interchange section. New water pipeline will be arranged along the design road. | Wwater pipeline crossing existing road (perpendicular to it) will be affected by construction of an interchange. Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. |
| |  |  |  |
| | **Crossing #103 (KP -8+350)** | **Crossing #104 (KP -10+020)** | **Crossing #105 (KP 10+300)** |
| | Water pipelibe crossing existing road (perpendicular to it) will be affected by construction of an interchange. Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. | Water pipeline (diameter 355 mm) crossing existing road (perpendicular to it) will be affected by construction of an interchange. Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. | Water pipeline (diameter 710 mm) crossing existing road (perpendicular to it) will be affected by construction of an interchange.Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. |
| |  |  |  |

| | **Crossing #105 (KP 10+840)** | **Crossing #103 (KP -12+200)** | **Crossing #103 (KP -12+100)** |
|---|---|---|---|
| | Water pipeline (diameter 710 mm) crossing existing road (perpendicular to it) will be affected by construction of an interchange. Arrangement of a new pipeline along the new road is planned. | Water pipeline (diameter 710 mm) crossing existing road (perpendicular to it) will be affected by construction interchange. Reinforcement with 1.5 m wide, 1.5cm thick concrete slab is planned. | Water pipeline (diameter 710 mm) will be affected by construction of interchange. New pipeline along the design overpass is planned. |
| |  |  |  |

| | Crossing #300 (KP -3+000) | Crossing #301 (KP -5+700) | Crossing #302 (KP -6+760) |
|---|---|---|---|
| Communications (optic fibre line) | Route of new road crosses the existing optical cable. New optical cable will be placed along the new roundabout including cable fibres and Polyethylene pipe d-40 mm into Polyethylene pipe d-90 mm thickness 5 mm for crossing the road and route and connection with existing optical cables.<br>Relocation not required | Route of new road crosses the existing optical cable underground road existing underpass KP 5+700, what is affected for the construction interchange so it is necessary to relocate.<br><br>**Relocation:**<br><br>New Optical cable are relocated along the new road including cable fibres and Polyethylene pipe d-40 mm into Polyethylene pipe d-90 mm thickness 5 mm for crossing the road and route and connection with existing optical cables<br><br>Optical cable should be arranged along the new road. The route of the cable will not change.<br><br>Fibre cable and polyethylene pipe d-40 mm into polyethylene pipe d-90 mm, thickness 5 mm shall be used for crossing the road. | Route of the new road crosses existing optical cable. Cable must be relocated. Fibre cable and polyethylene pipe d-40 mm into polyethylene pipe d-90 mm, thickness 5 mm shall be used for crossing the road. |
| |  |  |  <br>Existing layout<br>  <br>Relocated cable |
| | | | |
| | . | | |
| | | | |




**Crossing #303 (KP -9+100)**

Route of the new road crosses existing optical cable. Cable must be relocated.

– Fibre cable and polyethylene pipe d-40 mm into polyethylene pipe d-90 mm, thickness 5 mm shall be used for crossing the road.

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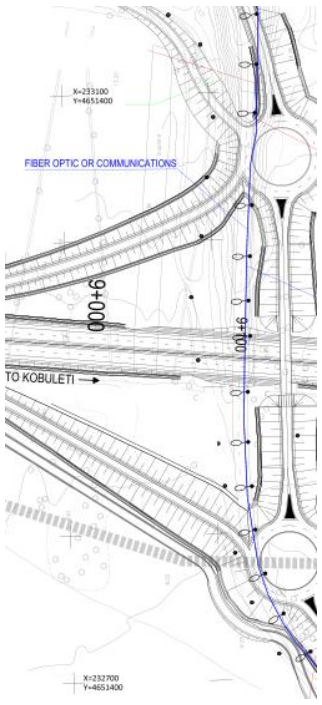
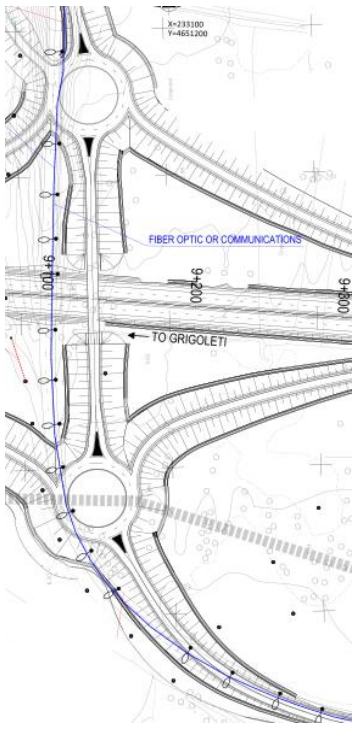
– **Crossing #303 (KP -9+100)**

Route of new road crosses the existing optical cable underground road existing Interchange KP 9+100, what is affected for the construction interchange so it is necessary to relocate.

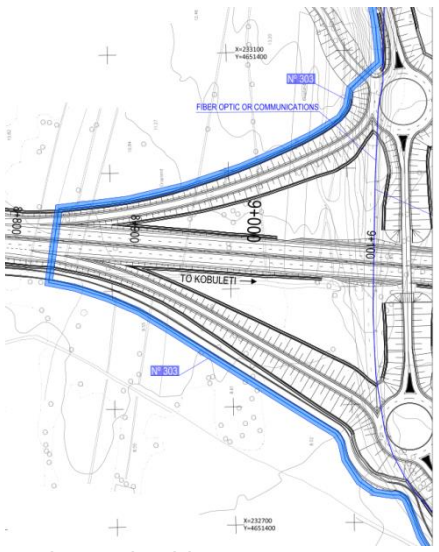
**Relocation:**

New Optical cable are relocated along the new road including cable fibres and Polyethylene pipe d-40 mm into Polyethylene pipe d-90 mm thickness 5 mm for crossing the road and route, and connection with existing optical cables




Existing layout

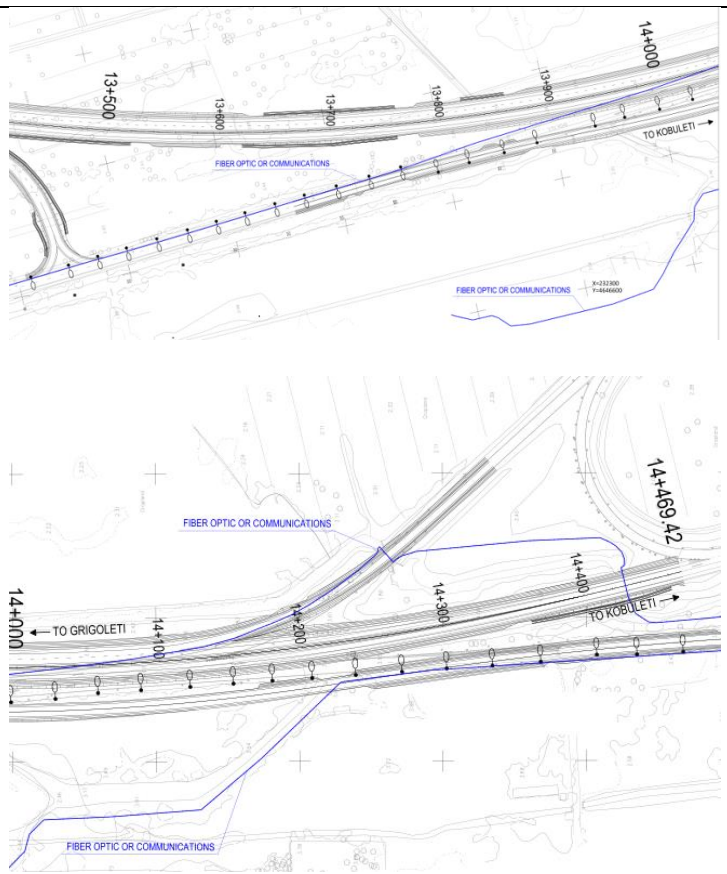




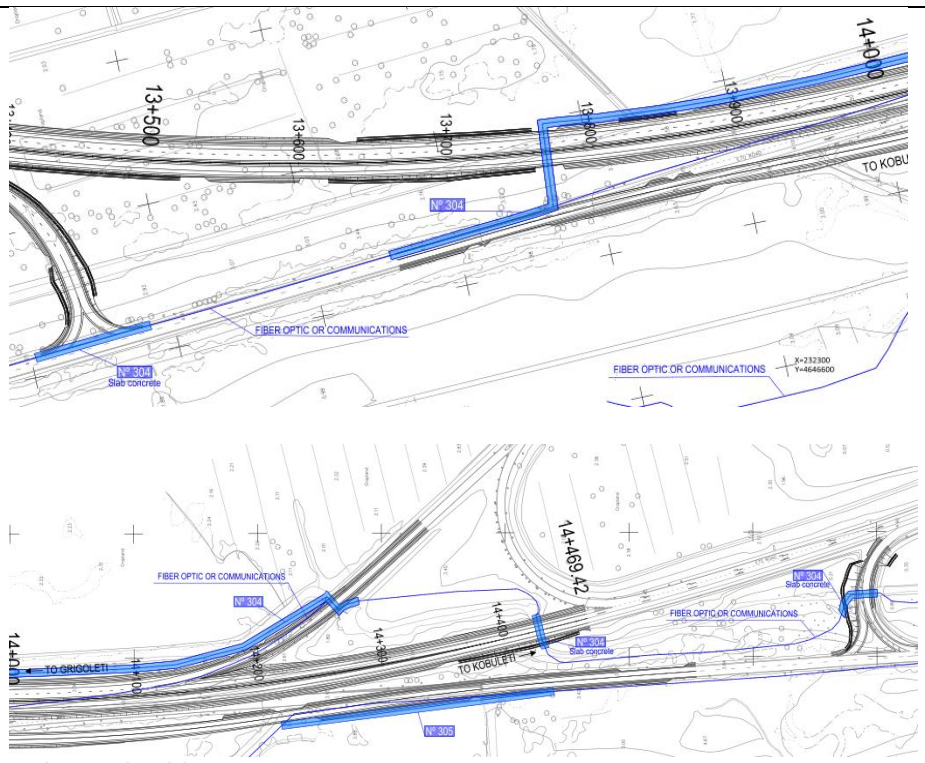
Relocated cable

**Cr os**

Route of the new road crosses existing optical cable. Cable must be relocated. Fibre cable and polyethylene pipe d-40 mm into polyethylene pipe d-90 mm, thickness 5 mm shall be used for crossing the road.

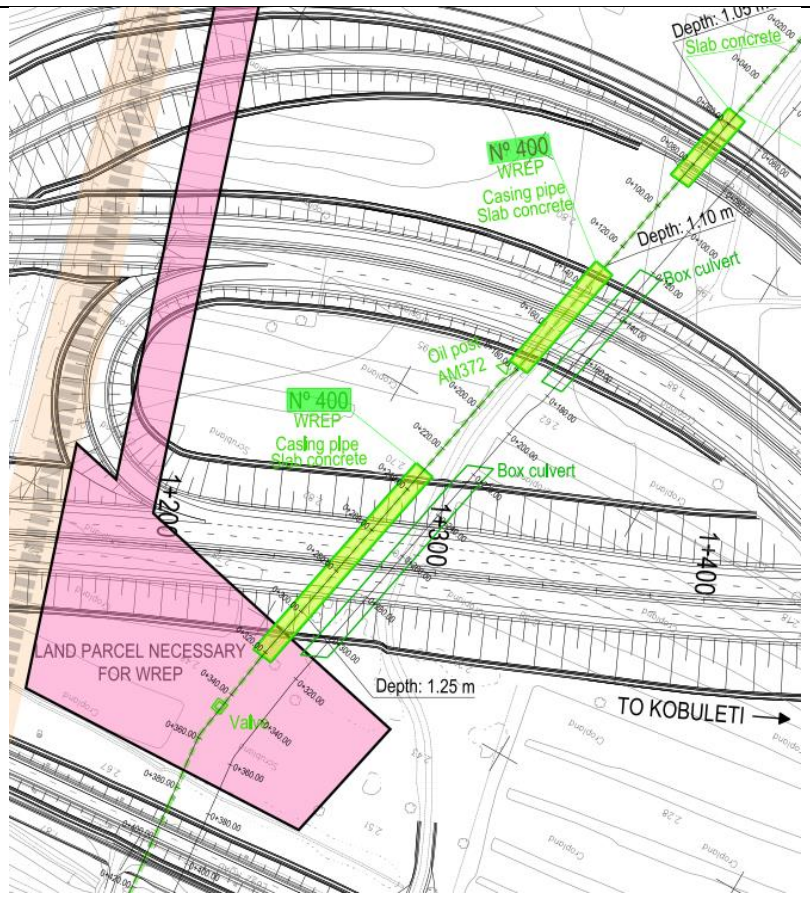


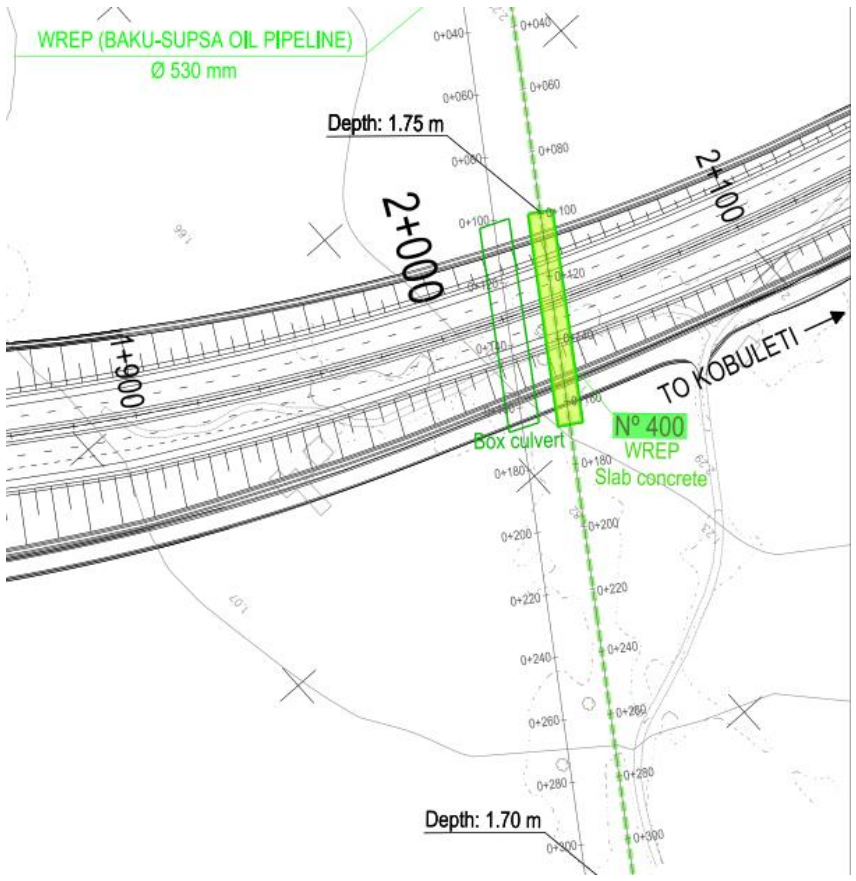
Existing layout



Relocated cable

| | |
|---|---|
| | **Western Route Export Pipeline (WREP)** |
| **Crossing #400 (Interchange 1+300 and PK 2+036)** | On Interchange pk 1+300, a highway crosses WREP three times. Coordinates of road axis to oil pipeline are WGS 84 UTM HUSO 38 232385.284E 4658567.887N, crossing angle is 54º, pipeline diameter 530mm, depth from ground surface ≈1.0 - 2.4 m and its deepening from design road surface shall be 6.0-12.0 m.<br><br>On PK 2+036, WREP crossing coordinates of road axis to oil pipeline are WGS 84 UTM HUSO 38 231837.506E 4658058.970N, crossing angle is 78º, pipeline diameter – 530mm, depth from ground surface ≈1.70 - 1.75 m, and its deepening from design road surface shall be 5.0 - 7.0 m.<br><br>In order to defend existing pipeline, along with arrangement of new road, reinforced- concrete slabs are to be installed on top of it and additional measurements are carrying out for this purpose, namely:<br>• Removal of topsoil layer by hand and stockpiling.<br>• Soil excavation by hand.<br>• Installation of R/C protection slabs on the top of pipeline (Above 30cm).<br>• Reinforced-concrete slabs shall be laid on sand layer of 30cm thickness.<br>• Installation of warning tapes.<br>• Soil backfill by hand.<br>• Installation of pipeline warning signs.<br>• Removal of excess soil and area re-cultivation of territory.<br><br>Besides, in parallel to existing pipeline 15m away of it, reinforced-concrete case (box culvert) with section 1.0x1.0 (h) m is to be installed. Its installation is necessary for performing maintenance activities on pipeline in a way not to damage motorway earth bed and thus, traffic delay. In this unavoidable case, substitute pipe shall be laid in case. The ends of case shall be shut to avoid soil penetration in it. The case is designed in a way that, soil thickness on its top shall be no less 0.5 m.<br>For installation of reinforcement concrete case, the following activities shall be taken:<br>• Removal of topsoil layer and stockpiling;<br>• Soil excavation;<br>• Installation of sandy/gravel pad of 10cm thickness;<br>• Installation of concrete foundation for case;<br>• Installation of body for reinforced-concrete case;<br>• Shutting of case ends by metal plates;<br>• Installation of lubricant waterproofing on internal and external surfaces of case;<br>• Soil backfill;<br>• Installation of pipeline warning signs;<br>• Removal of excess soil and area re-cultivation of territory.<br><br>Special Conditions<br>Aforesaid protective measurements must be performed prior to commencement of road upgrading construction works to avoid pipeline damage by machinery, using in construction. The commencement of pipeline shall be agreed with oil pipeline owner company (BP). Execution of any works at oil pipeline Right of Way (ROW) zone (25 m to each side), without owner Company's (BP) permission, is unacceptable.<br>Close to 3 m. of pipeline, all excavation works shall be handmade, herewith, the use of electric tools is not acceptable. All underground communications shall be identified and fixed prior to commencement of works. The presence of owner Company's (BP) representatives during the works on pipeline ROW is necessary. Also, all requirements set in Conditions and Restrictions for third party work activities within protection zones of the export pipelines (BTC, SCP and WREO) must be fulfilled. |

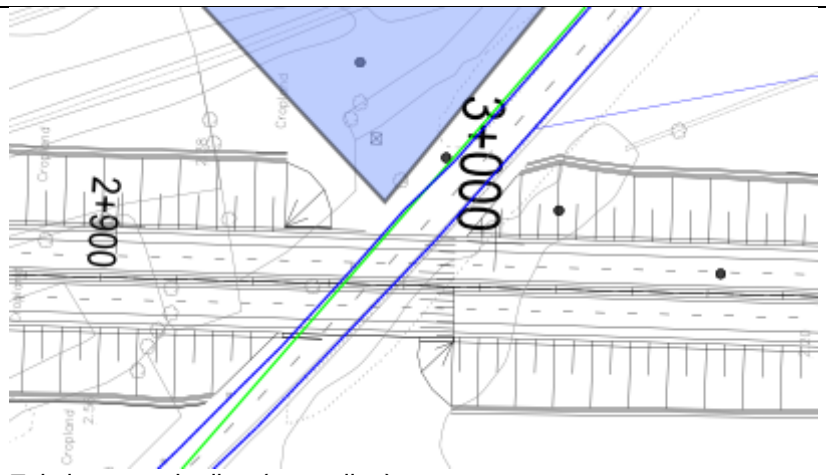


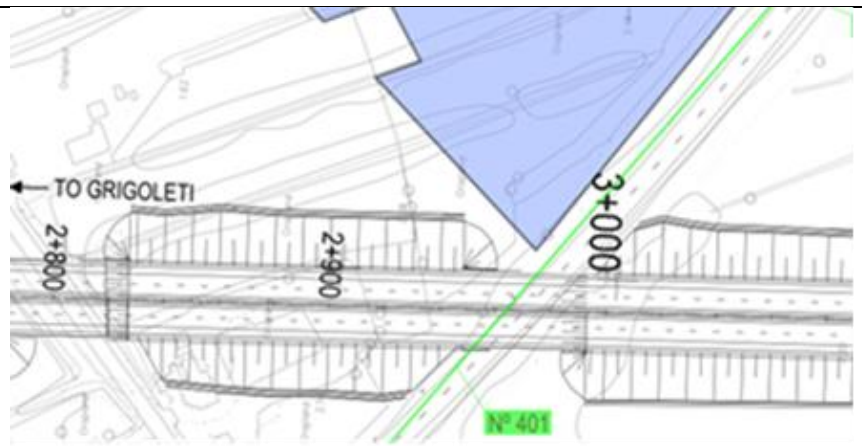

**Gas pipelines**

**Crossing #401 (KP -3+00)**

Route of the new road crosses existing low pressure underground gas pipeline. The pipeline should be relocated along the new road, protection for crossing - arranged.



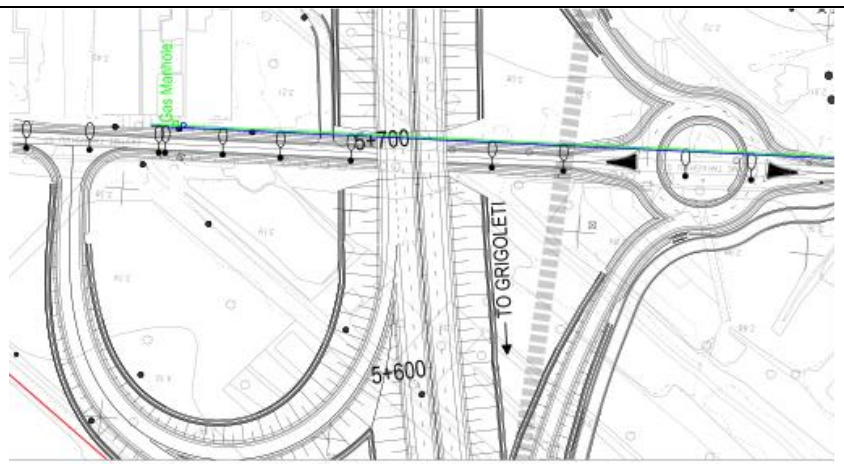

Existing gas pipeline (green line)



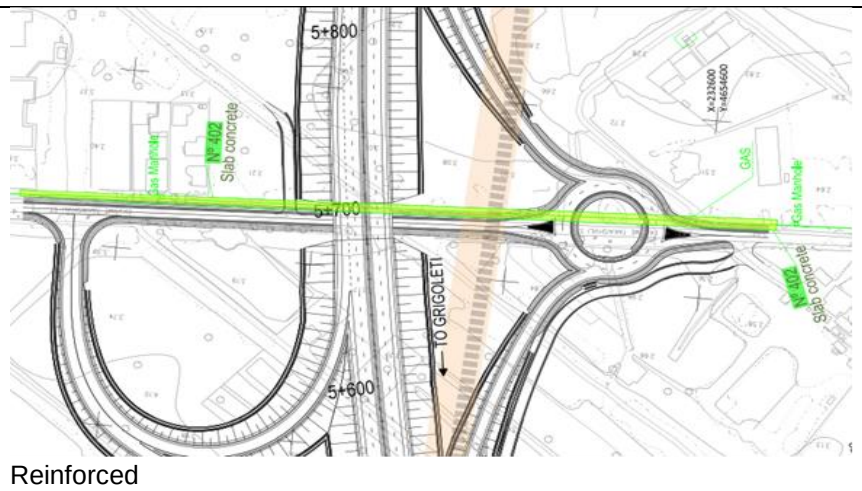

Reinforced

**Crossing #402 (KP -5+700)**

Route of the new road crosses existing low pressure gas pipeline. New gas pipeline should be relocated, protection for crossing – arranged



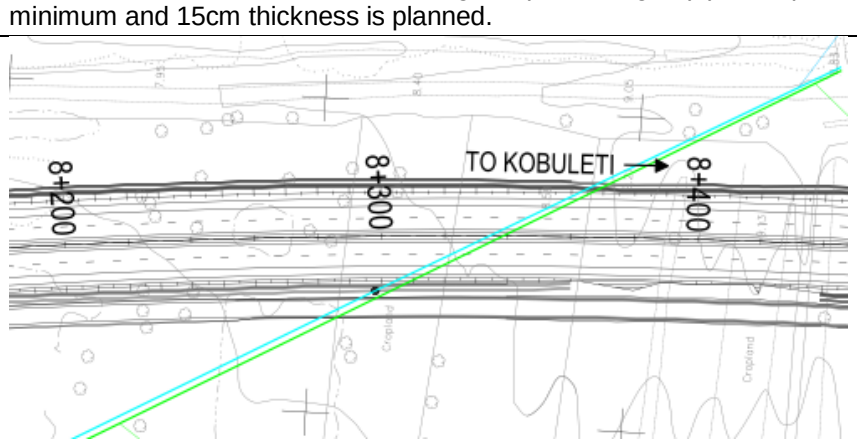

Existing gas pipeline (green line)



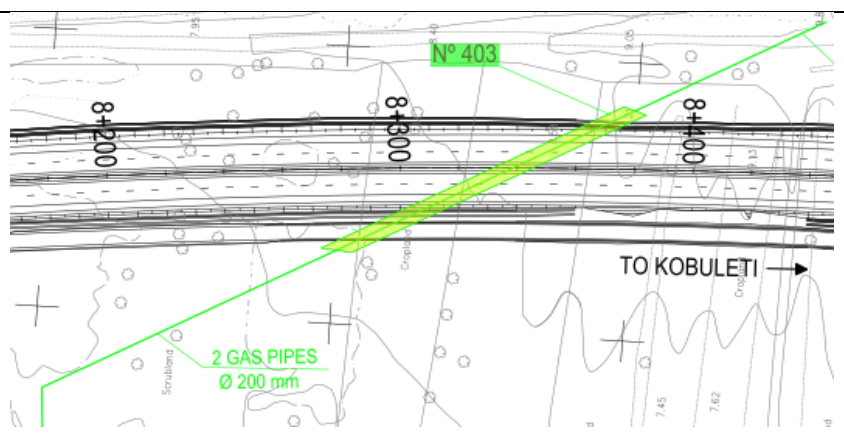

Reinforced

**Crossing #403 (KP -8+300)**

Route of the new road crosses existing low pressure gas pipeline (200mm). Reinforcement with concrete slab along the new road with a width of 1,5 m minimum and 15cm thickness is planned.



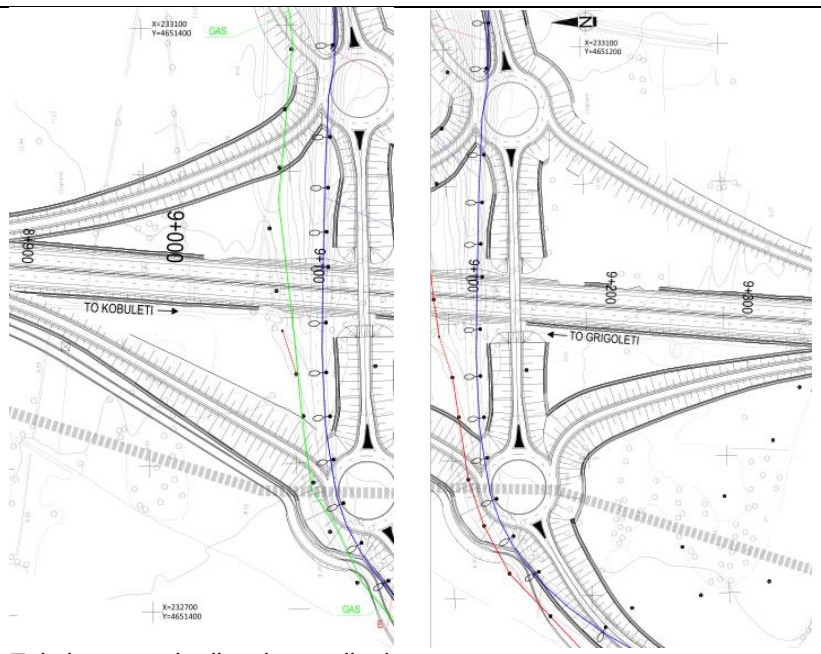

Existing gas pipeline (green line)



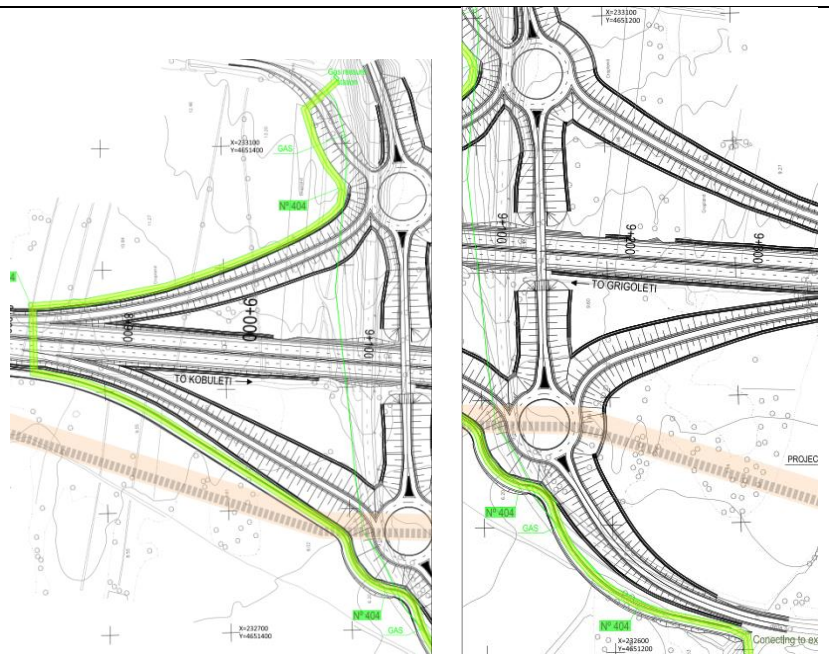

Reinforced

**Crossing #404 (Overpass IC-3 KP -9+120)**

Route of the new road crosses the existing low pressure gas pipeline. The pipes should be relocated along the new road with iron protection cased pipeline. Cathodic protection for crossing will be provided



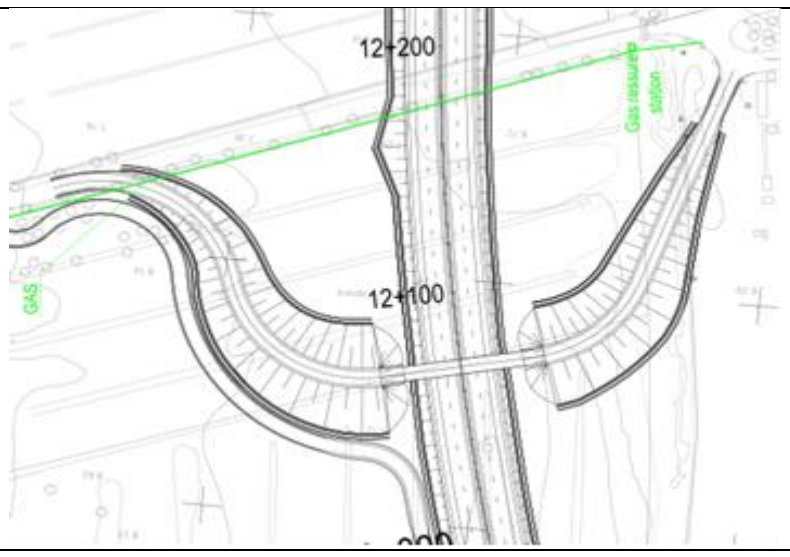

Existing gas pipeline (green line)




Relocated

**Crossing #405 (KP -12+200)**

Route of the new road crosses the existing low pressure gas pipelines. Reinforcement - concrete slab along the new road with a width of 1,5 m minimum and 15cm thickness will be used to protect the pipeline

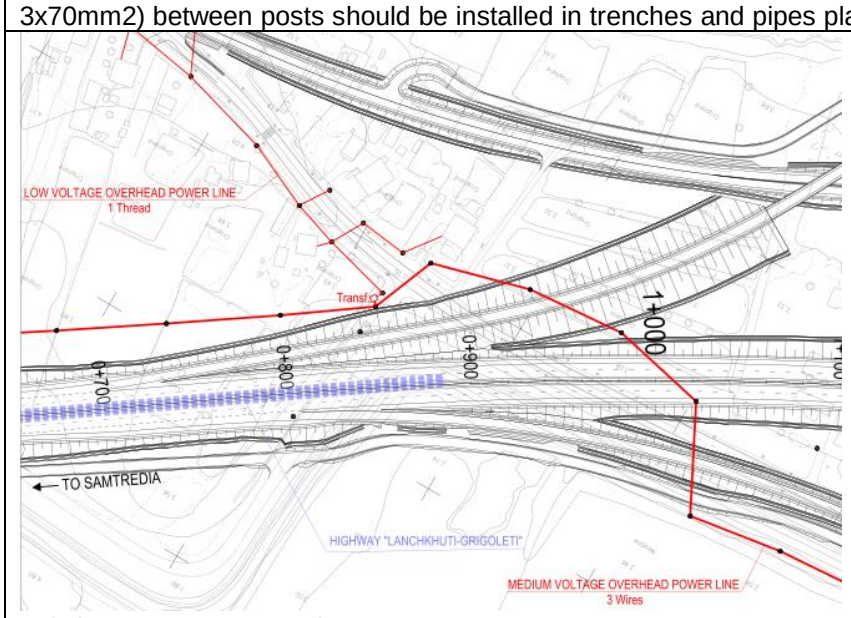




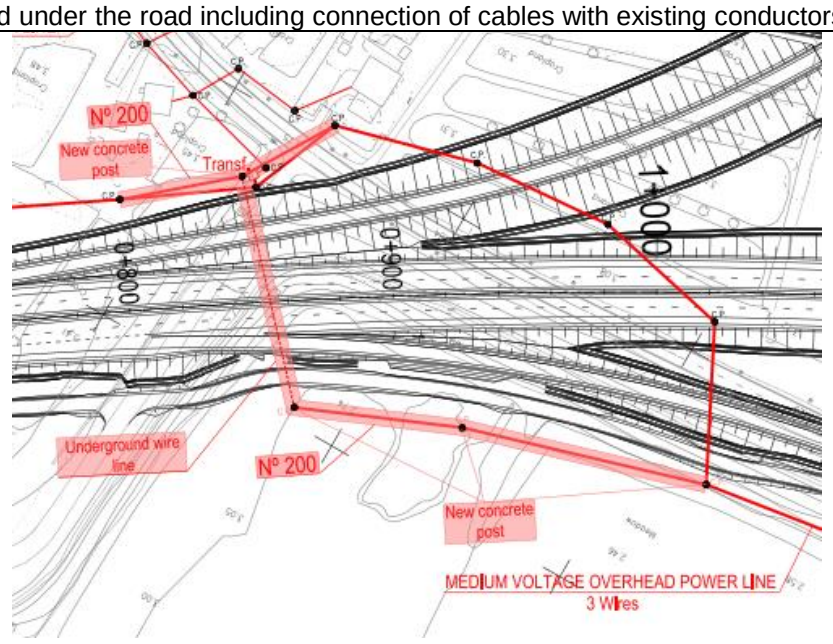
**Electricity high, medium and low overhead Power line**

**Crossing #200 (KP 0+840)**

**10kV line -** Replacement of 3 concrete poles with 4 similar ones. Section of 10 kV overhead line will be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use) and 'new' copper cable line (cross section 3x70mm2) between posts should be installed in trenches and pipes placed under the road including connection of cables with existing conductors.



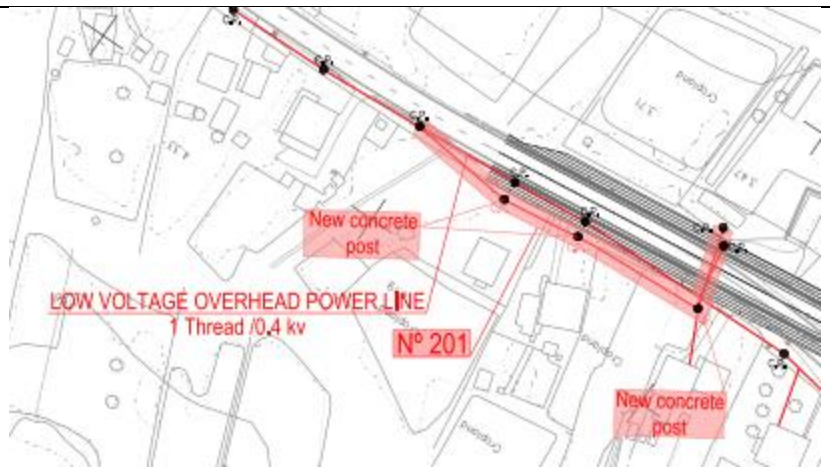

Existing OTL vs new road




Relocated

**Crossing #201 (KP 0+700)**

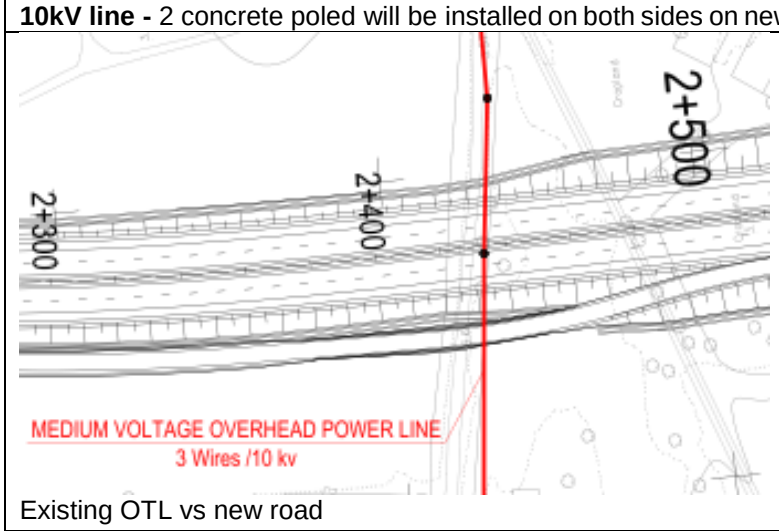
**0.4kV line -** 5 poles to be replaced with 5 similar ones outside the RoW, overhead connection of cables with existing conductors will be provided.



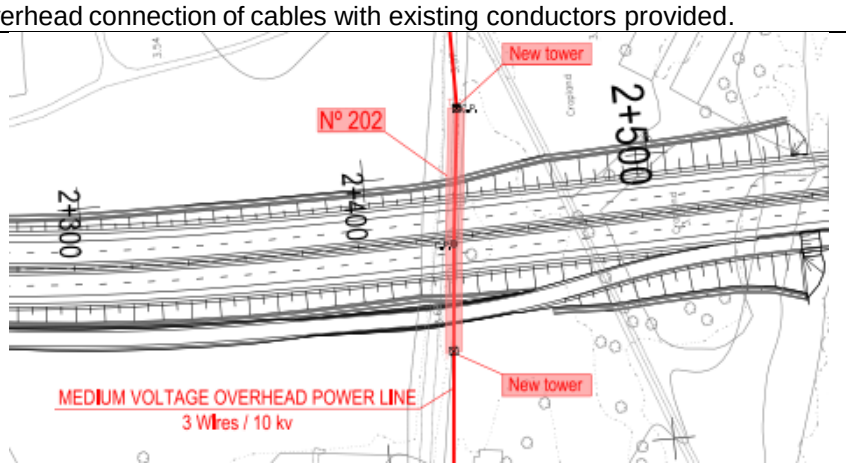

Relocated

**Crossing #202 (KP 2+400)**

**10kV line -** 2 concrete poled will be installed on both sides on new road, overhead connection of cables with existing conductors provided.




Existing OTL vs new road




Relocated

**Crossing #203 -(KP 2+700); Crossing #204 (KP 2+720) Crossing #205 (KP 0+700)**

**Crossing #203**

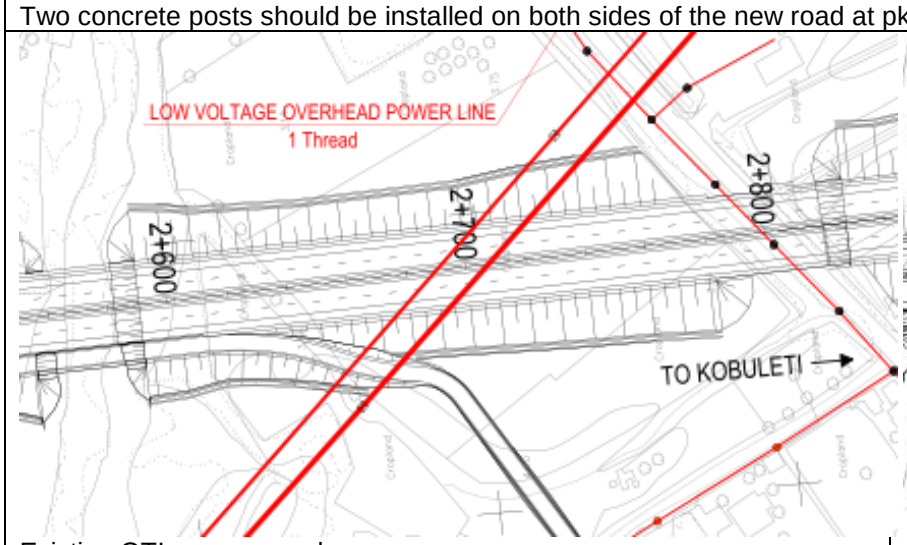
**30-35 kV** overhead - Height of 2 existing towers will not conform with requirements Rules for Electrical Installations. Two tower should be installed on both sides on new road .

**Crossing #204**

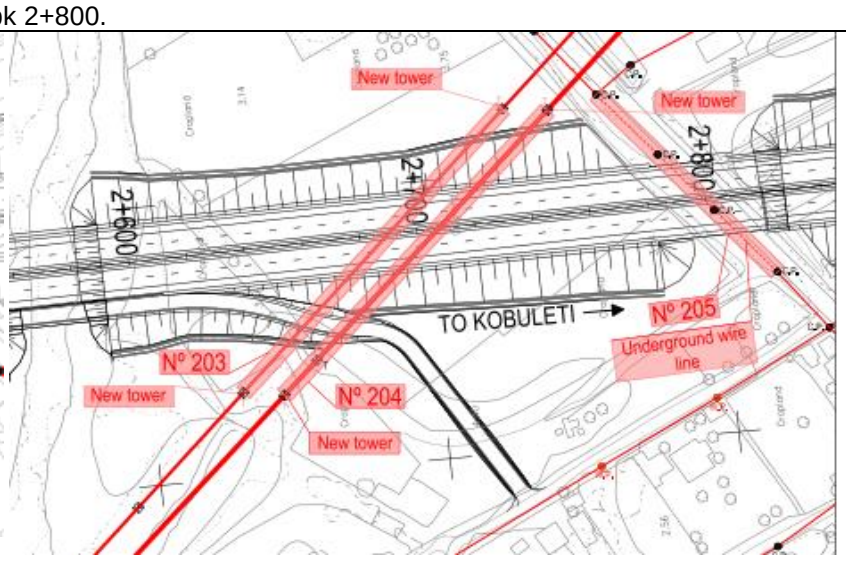
**110kV line** - Two towers will be installed on both sides of span where 110kV overhead line crosses new road.

**Crossing #205**

**0.4 kV line -** Concrete poles should be relocated. Underground cable line installed in pipes and trenches under the proposed road will be arranged. Two concrete posts should be installed on both sides of the new road at pk 2+800.



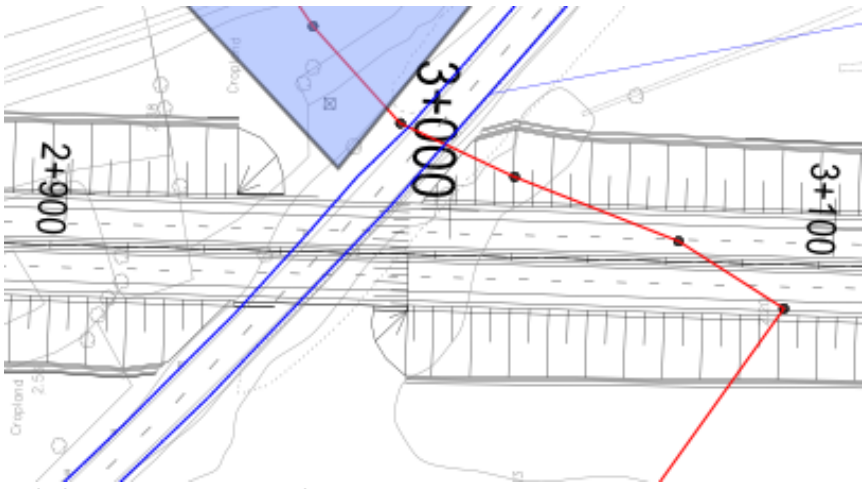

Existing OTL vs new road



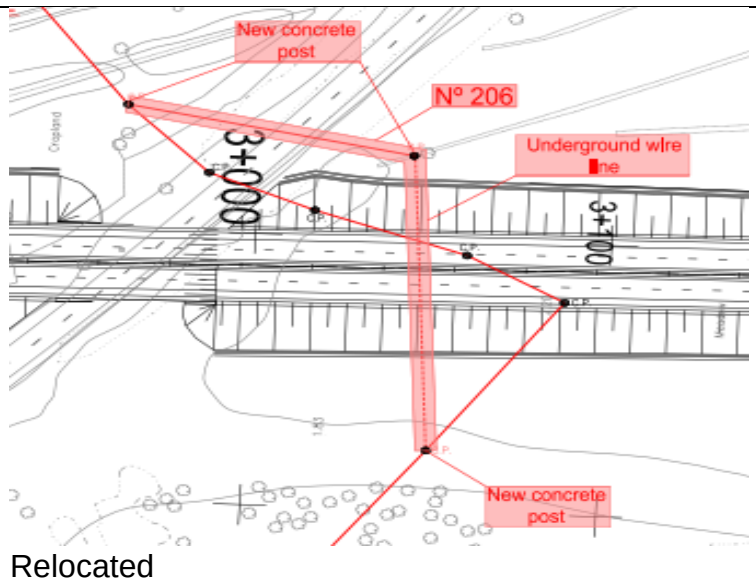

Relocated

**Crossing #206 (KP 3+040)**

**0.4kV line -** Three concrete poles should be removed. Section of the OTL should be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use). New copper cable line (cross section 3x6mm2) between posts should be installed in trenches and pipes placed under the road.



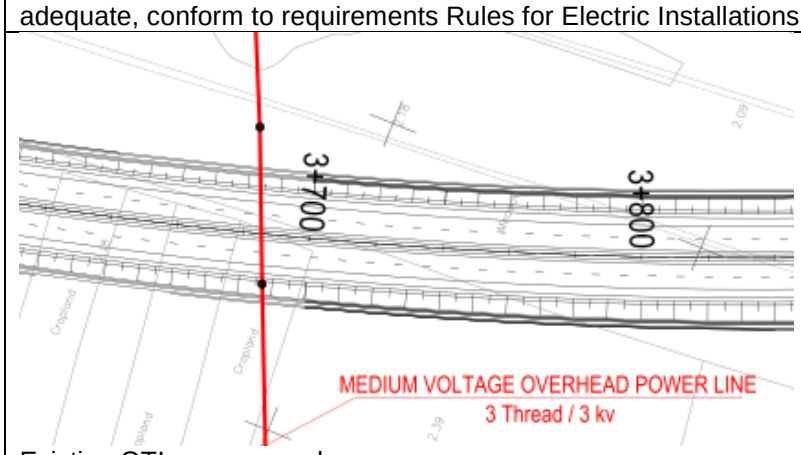

Existing OTL vs new road



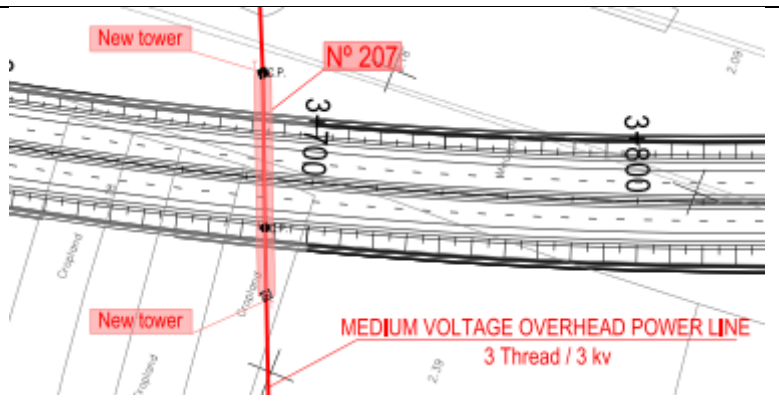

Relocated

## Crossing #207 (KP 3+680)

**3kV line -** One concrete pole is located within the area of road construction. Two towers should be installed on both sides on new road with height adequate, conform to requirements Rules for Electric Installations.



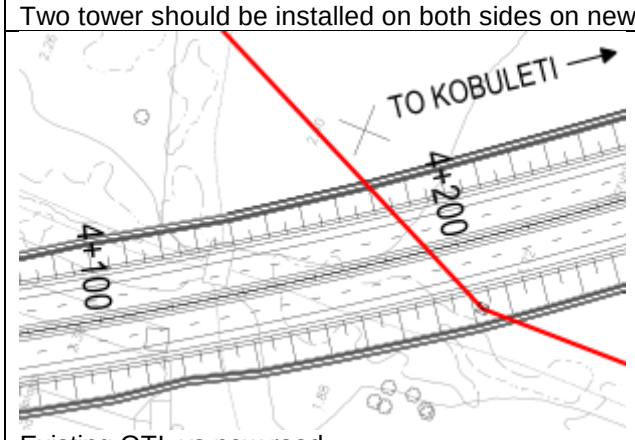

Existing OTL vs new road



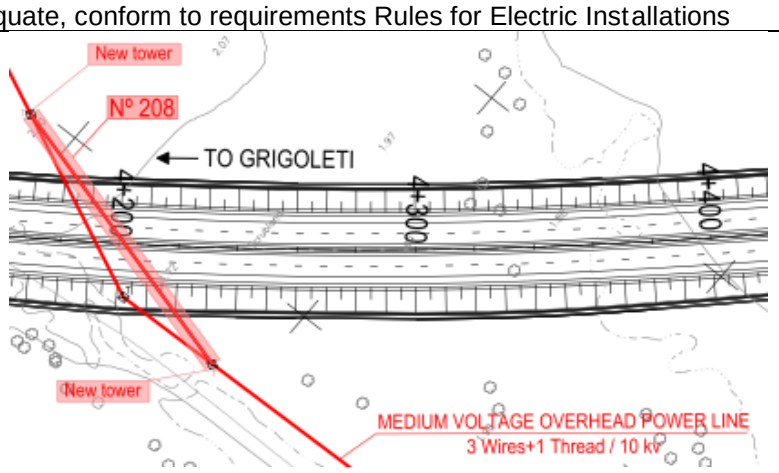

Relocated

## Crossing #208 (KP 4+200)

**10kV line -** One tower (concrete pole) is located within the area of road construction so it is necessary to relocate.
Two tower should be installed on both sides on new road with height adequate, conform to requirements Rules for Electric Installations




Existing OTL vs new road




Relocated

## Crossing #209 (KP 5+800); Crossing #210 (KP5+600); Crossing #211 (KP 5+600-6+360); Crossing #700(KP5+600)

**Crossing #209**

**Two 0.4kV lines -** Two concrete posts are located within the area of road construction so it is necessary to relocate.
Height of another OTL installed on concrete posts do not conform with requirements Rules for Electrical Installations, so it is necessary to relocate.
Two underpasses ((Underpass 5+600) and (Road 5+900)) should be arranged. OTL should be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use). New copper cable line (cross section 3x6mm2) between concrete posts should be installed in trenches and pipes placed under the road. .

**Crossing #210**

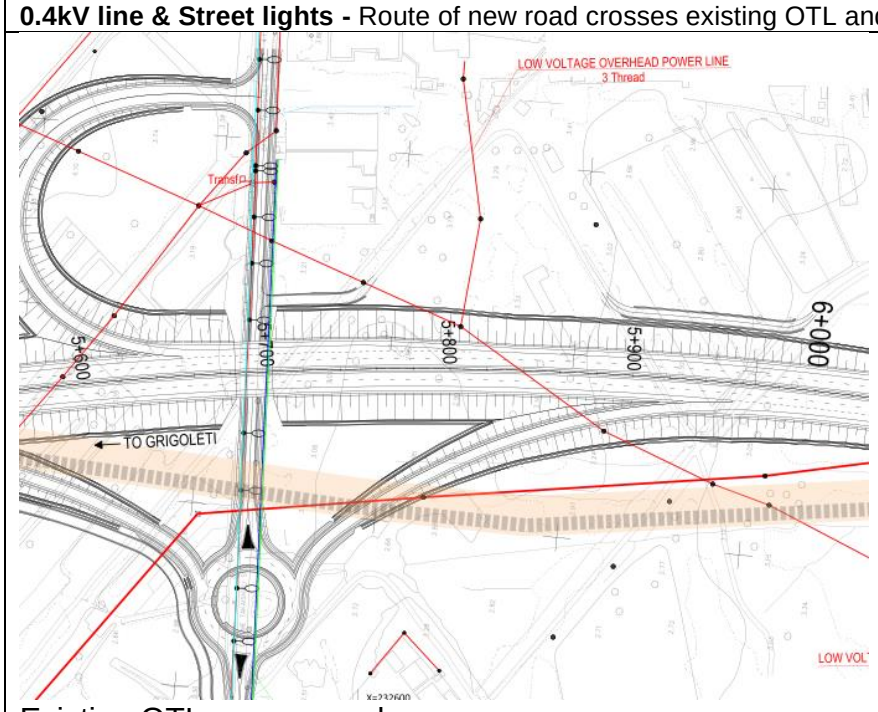
**0.4kV line -** Route of the new road crosses existing 0.4 kV OTL installed on concrete posts for one house, this line it's not necessary to relocate because the house will be demolished.

**Crossing #211**

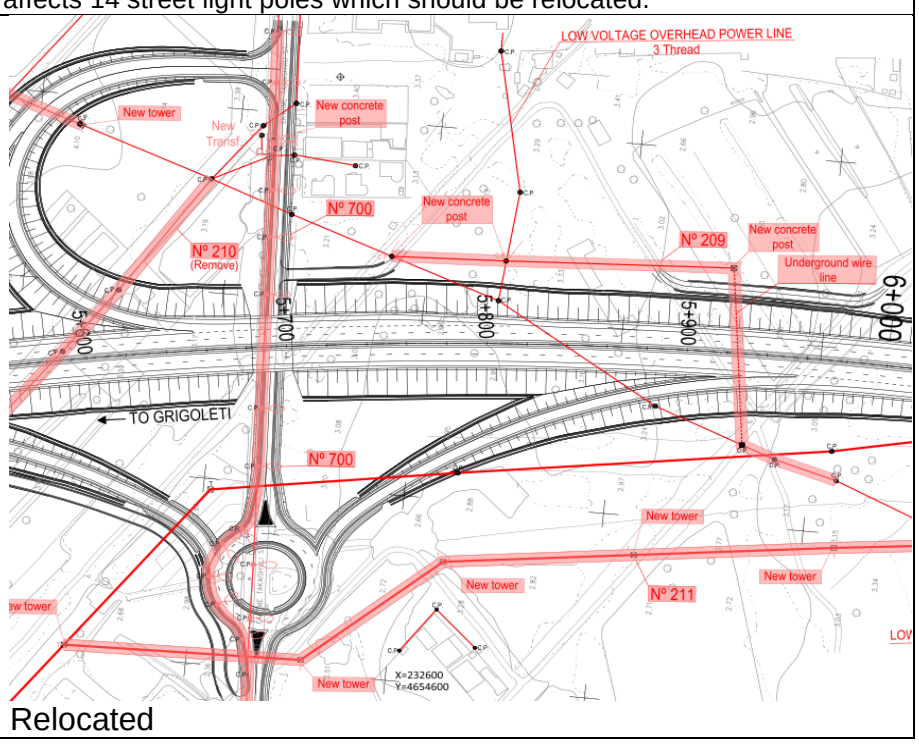
**10KV line -** Route of new road crosses the existing OTL installed on concrete posts. 4 concrete posts and 1 tower are located within the area of road construction so it is necessary to relocate.
8 tower should be installed in total and 2 on both sides on new road with height adequate, conform to requirements Rules for Electric Installations.

**Crossing #700**

**0.4kV line & Street lights -** Route of new road crosses existing OTL and affects 14 street light poles which should be relocated.




Existing OTL vs new road




Relocated

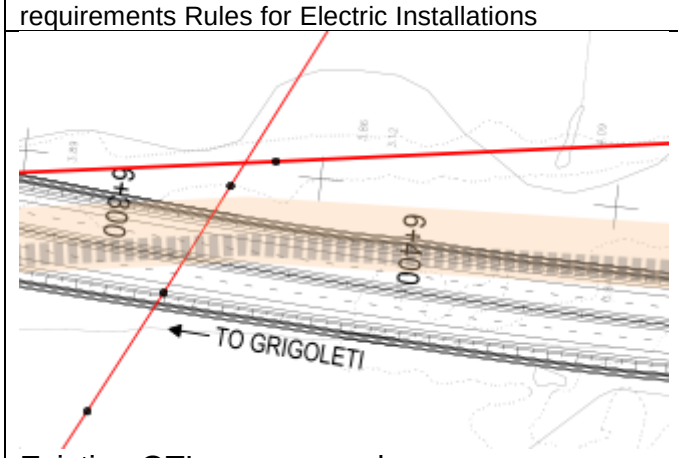
## Crossing #211 (KP 5+600-6+360) ; Crossing #212 (KP -6+320)

**Crossing #211**

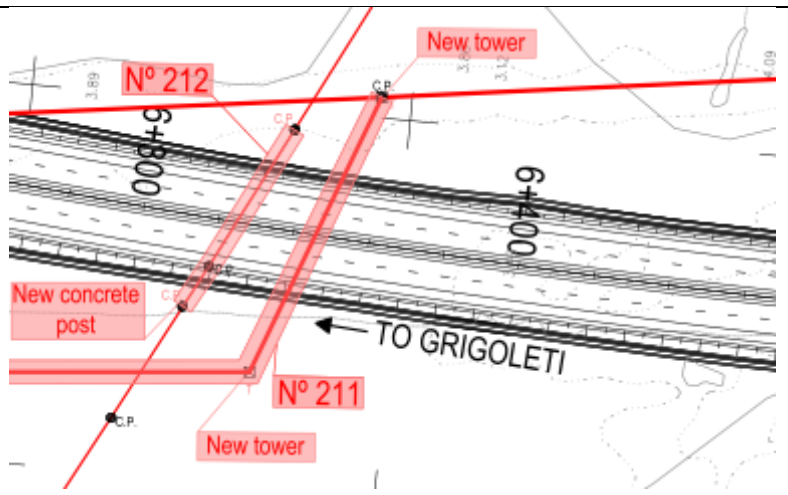
**10KV line -** Route of new road crosses the existing OTL installed on concrete posts. 4 concrete posts and 1 tower are located within the area of road construction so it is necessary to relocate.
8 tower should be installed in total and 2 on both sides on new road with height adequate, conform to requirements Rules for Electric Installations

**Crossing #212**

**0.4kV line -** Route of new road crosses the existing OTL installed on concrete posts. The height do not conform with requirements Rules for Electrical Installations, so it is necessary to relocate. 2 concrete post should be installed on both sides on new road with height conforming with requirements Rules for Electric Installations




Existing OTL vs new road

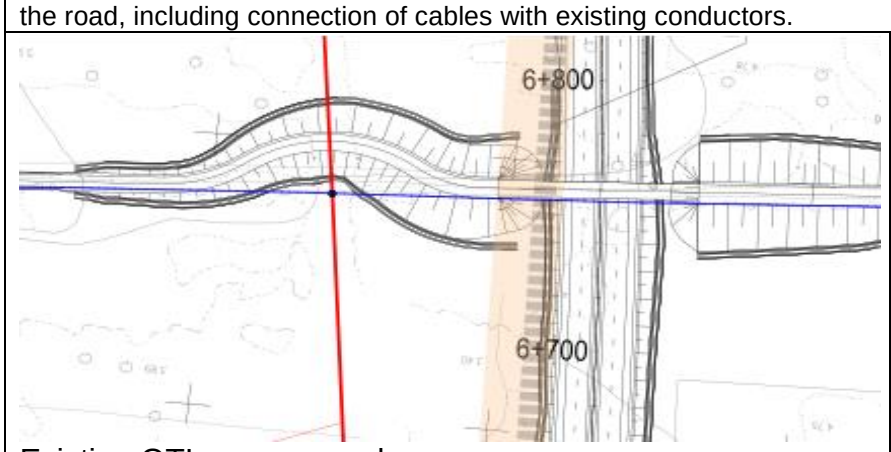



Relocated

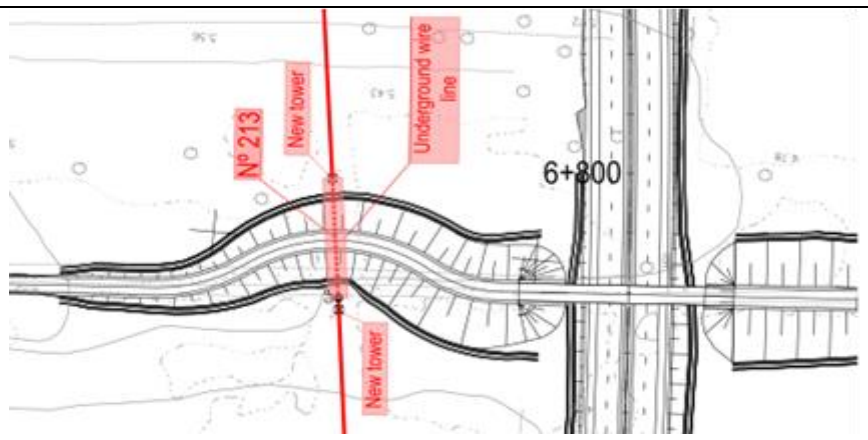
## Crossing #213 (Overpass KP -6+720)

**10 kV line**

Route of new road crosses existing OTL installed on concrete posts, the height do not conform with requirements Rules for Electrical Installations. In this section the OTL should be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use). New copper cable line (cross section 3x70mm2) between posts should be installed in trenches and pipes placed under the road, including connection of cables with existing conductors.



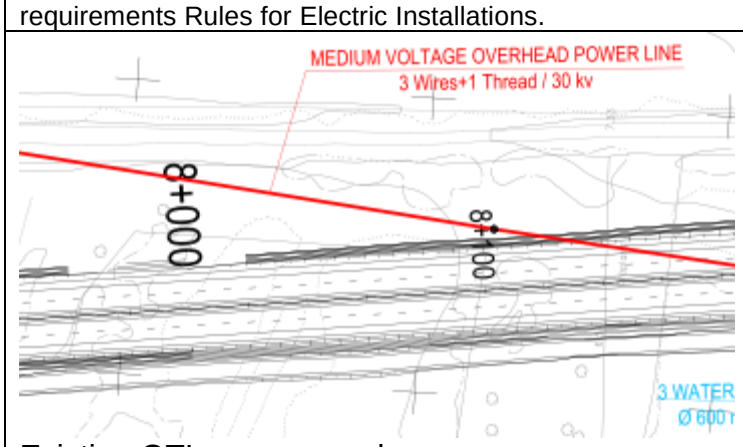

Existing OTL vs new road



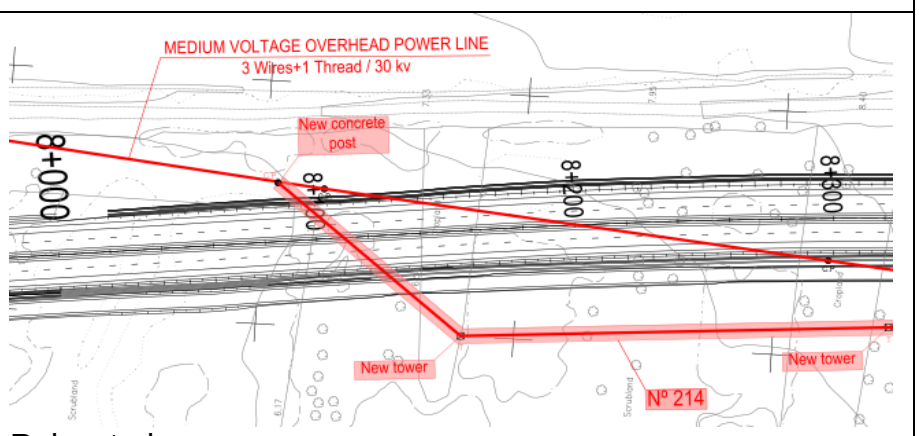

Relocated

## Crossing #214 (KP -8+100-9+500)

**10kV line -** Route of new road crosses the existing OTL installed on concrete posts. 5 concrete poles and 2 towers are located within the area of road construction.
10 towers should be installed in total and 2 on both sides on new road (KP 8+100 and Overpass IC-3) with height adequate, conform with requirements Rules for Electric Installations.




Existing OTL vs new road




Relocated

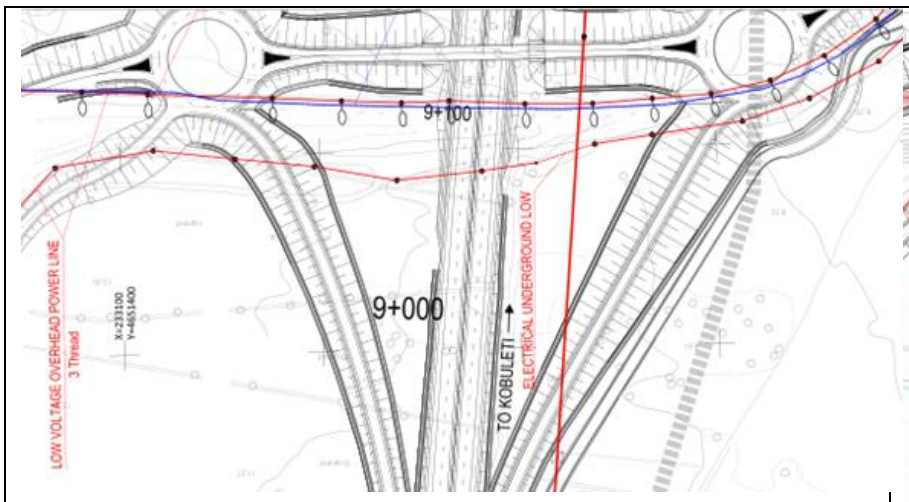
## Crossing #215 (Overpass IC-3 KP -9+120 KP 9+400)

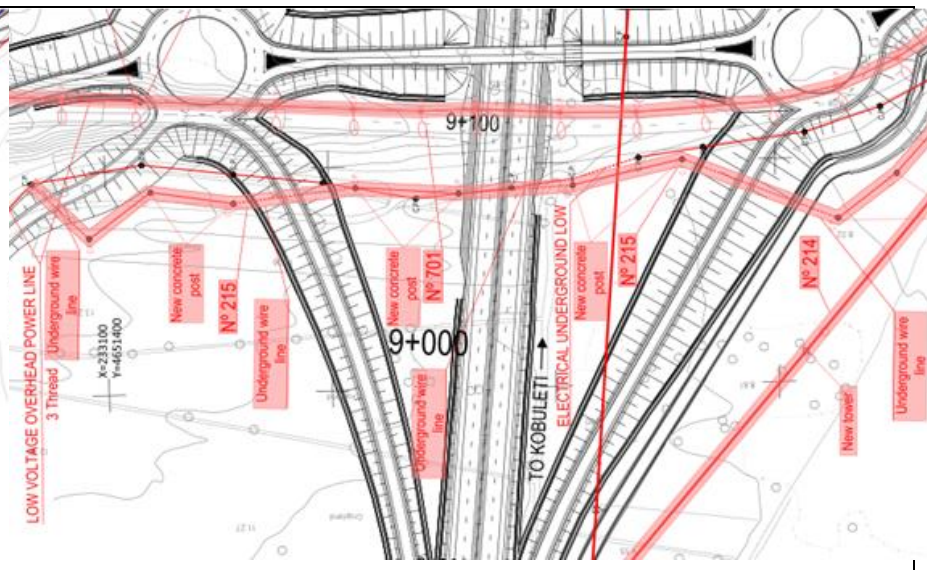
**0.4kV line -** (Overpass IC-3 KP) Route of the new road crosses existing OTL installed on concrete posts. 13 concrete posts are located within the area of road construction, so it is necessary to relocate.

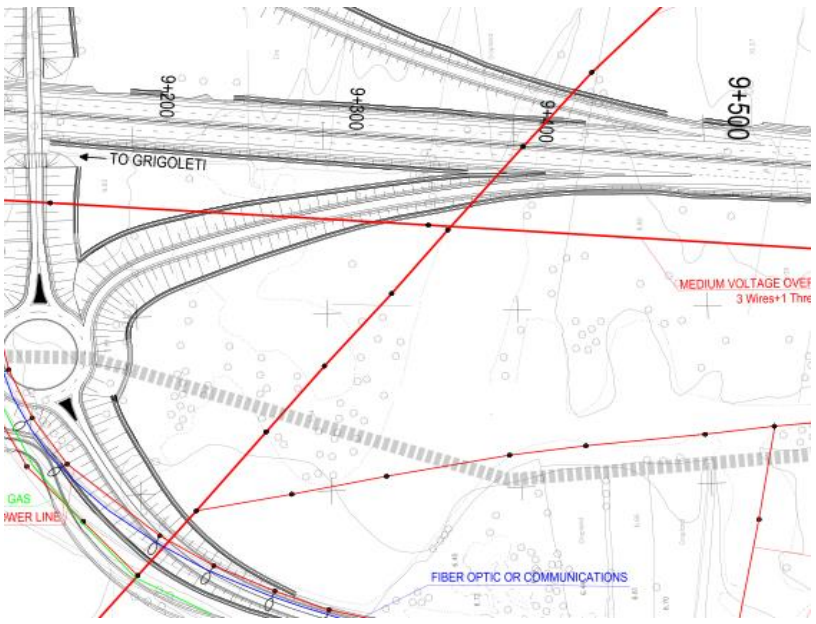
**10kV line -** (KP 9+400) Route of the new road crosses existing OTL installed on concrete posts. The height do not conform with requirements Rules for Electrical Installations, so it is necessary to relocate.

Relocation:
Underpass 9+080 (in three different places) 0.4kV OTL should be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use). New copper cable line (cross section 3x6mm2) between concrete posts should be installed in trenches and pipes placed under the road.

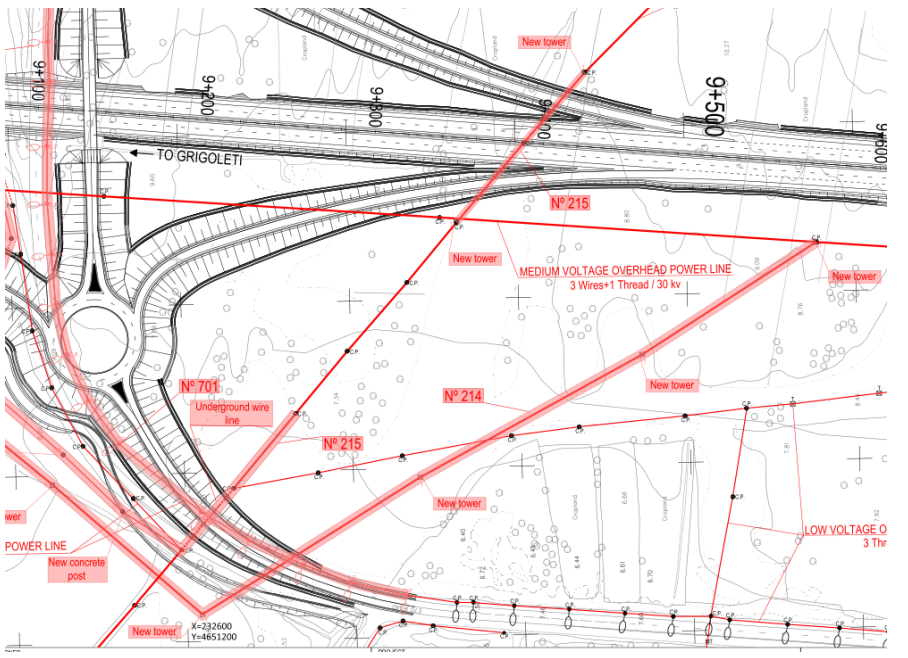
Section of 10 kV overhead line should be replaced with underground cable line installed in pipes laid under the new road (one pipe for current cable and one spare pipe for future use). New copper cable line (cross section 3x70mm2) between posts should be installed in trenches and pipes placed under the road. Two new towers on both sides of the new road (KP 8+100 and Overpass IC-3) with height adequate, conform with requirements Rules for Electric Installations required



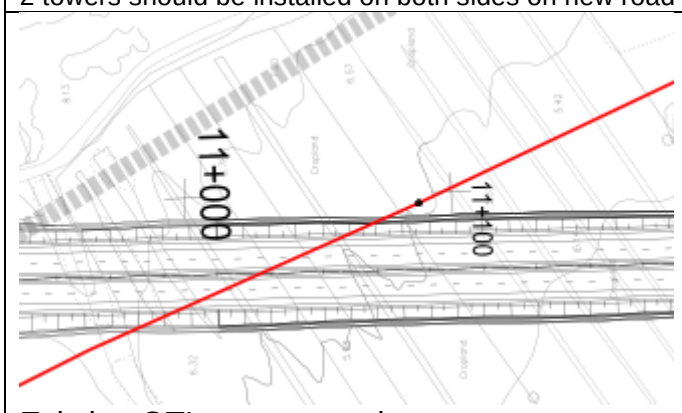

Existing OTL vs new road



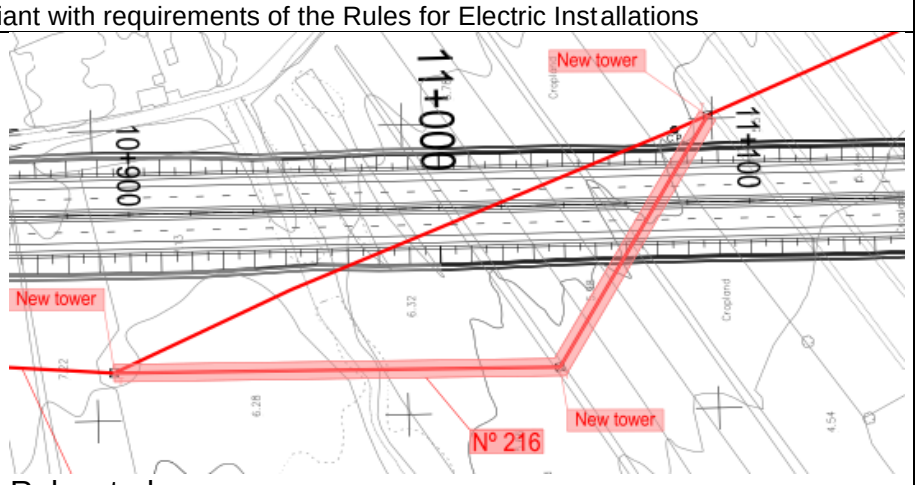

Relocated

## Crossing #216 (KP -11+000)

**30kV line -** Route of new road crosses the existing OTL installed on concrete posts. The height do not conform with requirements Rules for Electrical Installations, so it is necessary to relocate.
2 towers should be installed on both sides on new road with height compliant with requirements of the Rules for Electric Installations



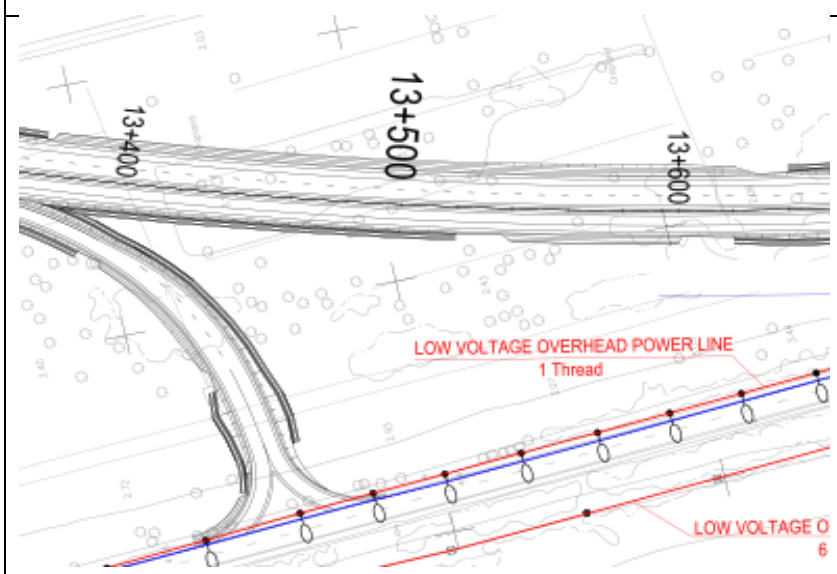

Existing OTL vs new road



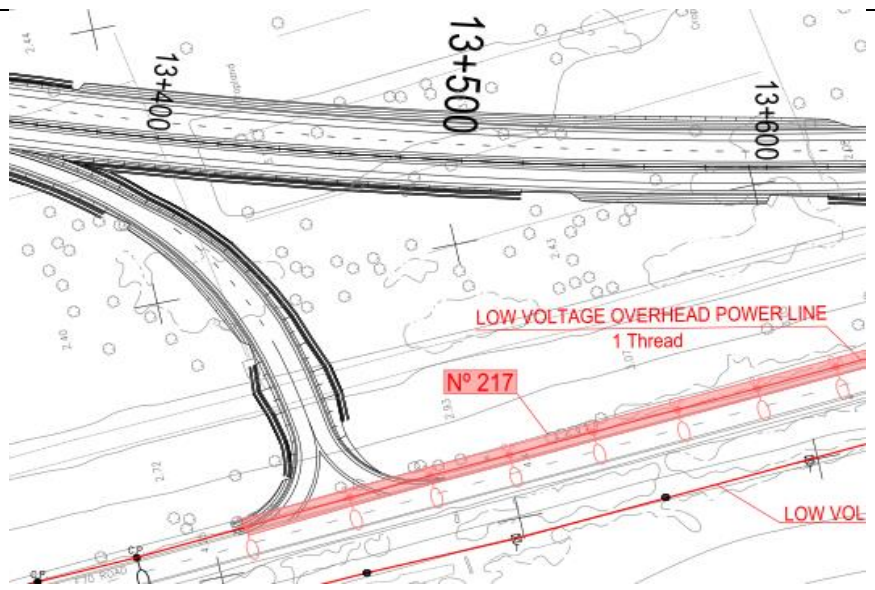

Relocated

## Crossing #217 (KP -13+500-14+400)

**0.4kV line**
Route of the new road crosses existing OTL installed in Street light on existing road. 38 Street light are located within the area of road construction so it is necessary to relocate.




Existing OTL vs new road




Relocated

***Figure 45. Infrastructure in the project area***

### 5.3.12. ENERGY

Supply of the natural gas for Ozurgeti and Lanchkhuti residents is undertaken by private companies Sokar and Itera. By 2013 almost 98% of the city along with villages Likhauri, Shemoqmedi, Chanieti, Ozurgeti, Gurianta, Naruja and Laituri were connected to service network.

Every family has electrical energy. Extensive work program is carried out by private company Energo-pro Georgia for installing the individual electricity meters.

Only 6 households in the area directly affected by the project iare using gas for heating, the use wood.

### 5.3.13. WATER AND SEWAGE

Centralized water supply and sewerage systems are available in towns. 57% of interviewed households in the project impact zone do not have a centralized water supply. Majority (80% of interviewed households) is using use latrines.

### 5.3.14. WASTE

There are landfills available in Ozurgeti, Lanchkhuti and Chokatauri: Ureki with total area of 13,305m$^2$, Ozurgeti (vil.Meria) – 39,699m$^2$, Chokhatauri 11,970m$^2$ and Lanchkhuti 45,001m$^2$. Volume of annual waste generation is 36,000m$^3$. Management of landfills is responsibility of Solid Waste Management Company of Georgia.

Waste collection companies operate in municipalities. The services fully cover administrative centres, Ureki and Shekvetili, and partially other 12 territorial units of the district. In 2016,with financial aid from EBRD car park (dump trucks) and other equipment (containers) have been upgraded.

### 5.3.15. MEDIA

Along with the national coverage media, there are local TV broadcasting company Guria TV, two companies in Poti area (9th channel and cable television), cable TV Madi; one local radio station (Harmony) and a range of newspapers - Guria News,

Guria Moambe and Alioni. Guria News and Guria Moambe are weekly editions with regional coverage.

### 5.3.16. NON-GOVERNMENTAL ORGANISATIONS

There are several NGOs in Guria region mainly involved in human rights protection, information availability, youth issues. The list includes:

- Union of Young Teachers (Ozurgeti),
- Youth centre Progress (Chokhatauri),
- Mediators association of Guria (Ozurgeti),
- Women for Development (Ozurgeti),
- Consumers Society of Ozurgeti,
- Farmers Union of the Guria Region (Ozurgeti),
- Foundation for Protection of Mothers and Children (Chokhatauri),
- Union of Hunters and Fisherman (Ozurgeti),
- Lanchkhuti Information Centre,
- Georgian Young Lawyers' Association – Ozurgeti branch;.
- Youth Resource Centre of Guria;
- Student-youth consultative organisation.

# 6. EXPECTED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

## 6.1. INTRODUCTION

Environmental impacts of the Grigoleti-Kobuleti bypass section of the design highway have been identified and evaluated for pre-construction, construction and operation stages of the project. On each stage both negative and positive impact on environment along the new alignment and next to it will occur. The list of expected impact by the stage of the project is given in ***Table 47***.

***Table 47. Planned operations and related impacts***

| Planned Operations | Environmental Impact |
|---|---|
| **Pre-construction:**<br>• Obtaining all clearance and permits related to the project;<br>• Development and approval of plans (such as waste management, traffic management, erosion management);<br>• Identification of sources /suppliers of materials identified;<br>• Selection of sites for temporary camps, material, topsoil, spoil and waste with consideration of environmental and safety requirements. | These activities are not related to impact on environment |
| • Preparation of worksites, sites for vehicles and construction machinery, arrangement of temporary facilities and camp site (in case arrangement of construction camp is considered by contractor advisable) – this includes removql of vegetation (whether absolutely necessary), stripping and removal of topsoil to temporary storage, grading of the work areas;<br>• Clearing the RoW strip - removal of vegetation, stripping and removal of topsoil to temporary storage area;<br>• Onsite and offsite works. | • Air emission of inorganic dust and combustion products;<br>• Propagation of noise and vibration;<br>• Generation of waste, littering;<br>• Accidental oil spills - risk of soil and water pollution;<br>• Soil erosion, ramming;<br>• Impact on flora and fauna;<br>• Visual impact;<br>• Increase of traffic;<br>• Impact on infrastructure – potential temporary disruption of services provided to population;<br>• Resettlement/land acquisition of permanenent use agreement needs;<br>• Safety – community, workforce;<br>• Temporary employment (Note: positive impact). |
| **Construction works:**<br>• Importation of inert material for arrangement of embankment;<br>• Storage of material in specially allocated area (if deemed advisable);<br>• Arrangement of embankment – forming | • Air emission – dust, exhaust emissions and welding aerosols;<br>• Propagation of noise and vibration;<br>• Deterioration of water quality – pollution with oil products and increased turbidity |

| | |
|---|---|
| embankment, ramming;<br>• Arranging drainage system;<br>• Installation of sheet piles in water crossing bridge construction area (Supsa river crossing);<br>• Bridge construction - arrangement of foundation; pile cap; bridge column, bearing, bridge deck – works include excavation, concrete works, assembling pre-cast elements on the site;<br>• Paving of the deck and the carriageway, including shoulders;<br>• Road marking and installation of road signs;<br>• Onsite and offsite traffic. | during works close/in the riverbed;<br>• Risk of flow blockage;<br>• Accidental oil spills – soil pollution;<br>• Soil erosion, ramming;<br>• Waste generation, littering;<br>• Impact on terrestrial fauna;<br>• Impact on aquatic fauna (in river crossings);<br>• Risk of impact on vegetation;<br>• Increase of traffic;<br>• Impact on road infrastructure;<br>• Risk of accidental undeliberate impact on private properties;<br>• Temporary employment in construction (Note: positive impact);<br>• Safety – community, workforce;<br>• Promotion of satellite businesses (positive impact). |
| **Demobilisation**<br>• Dismounting of temporary structures;<br>• Removal of machinery and waste from the area;<br>• Recultivation of site disturbed during construction (based on recultivation plan, tailored to the site). | • Air emission – dust, exhaust emissions;<br>• Propagation of noise and vibration;<br>• Waste generation, littering;<br>• Risk of soil and water pollution;<br>• Impact on baseline traffic;<br>• Safety – community, workforce. |
| **Operation:**<br>• Traffic along the new alignment;<br>• Maintenance of roads and bridges. | • Air emissions (dust, combustion emissions);<br>• Noise and vibration;<br>• Safety risks;<br>• Impacts during maintenance - similar to those expected during construction, but with lower magnitude, local. |
| **Decommissioning;**<br>Must be considered separately (whether required). | Will depend on planned works. |

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

Note: *On feasibility stage Zero alternative was excluded for consideration as non appropriate. Existing horizontal alignment is not suitable for the required design speed (120km/h). The road is two lane and will not be able to serve increasing traffic flows in the future. Bringing existing road into compliance with requirements set for 120km/h highways will require upgrading of 5 sections. Upgrading of these as well as widening of the other sections of alignment will affect existing properties and create problems with utilities which will have to be relocated. Besides, presence of multiple accesses from existing road to the properties is fully against the modern safety standards for more than 80km/h highways. In addition, complete rehabilitation of pavement and drainage conditions will be required. Alternative was considered as not appropriate and has been excluded from evaluation*.

## 6.2. IMPACT ON AIR QUALITY

### 6.2.1. ASSESSMENT OF IMPACT - PRE-CONSTRUCTION AND CONSTRUCTION STAGES

Deterioration of air quality pre-construction and construction works can be due to the following:

- Dust emissions during earthwork and stockpiles;
- Dust from loading, transportation and unloading of soil and friable materials;
- Emissions from operation of construction machinery, asphalt/concrete plant;
- Dust and emissions from onsite and offsite traffic, vehicles moving across unpaved or dusty surfaces;

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. Amounts of vehicle-emitted pollutants will mainly depend on 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. Keeping that in mind attention should be paid to the age and status of technical maintenance of vehicles/machinery used during construction.

Alignment alternatives in some sections run close to the residential area. The sites suggested for stationing of machinery and storage of materials (including topsoil) are at some distance from the settlements, in the design interchange areas (***Figure 46***),

Dust and emissions during operation of machinery along alignments is inevitable. With consideration of prevailing wind direction higher risk of impact will be in areas located east and west to construction site (depending on the season). The impact can be managed to some extend though implementation of mitigation measures and good organisation of works.

The lengths of alternative alignment is 1 and 2 are almost similar. Alternatives 3 is the shortest. This enables to assume that because of the shorter duration of works the sources of dust and emissions in case of Alternative 3 will be of lower duration.

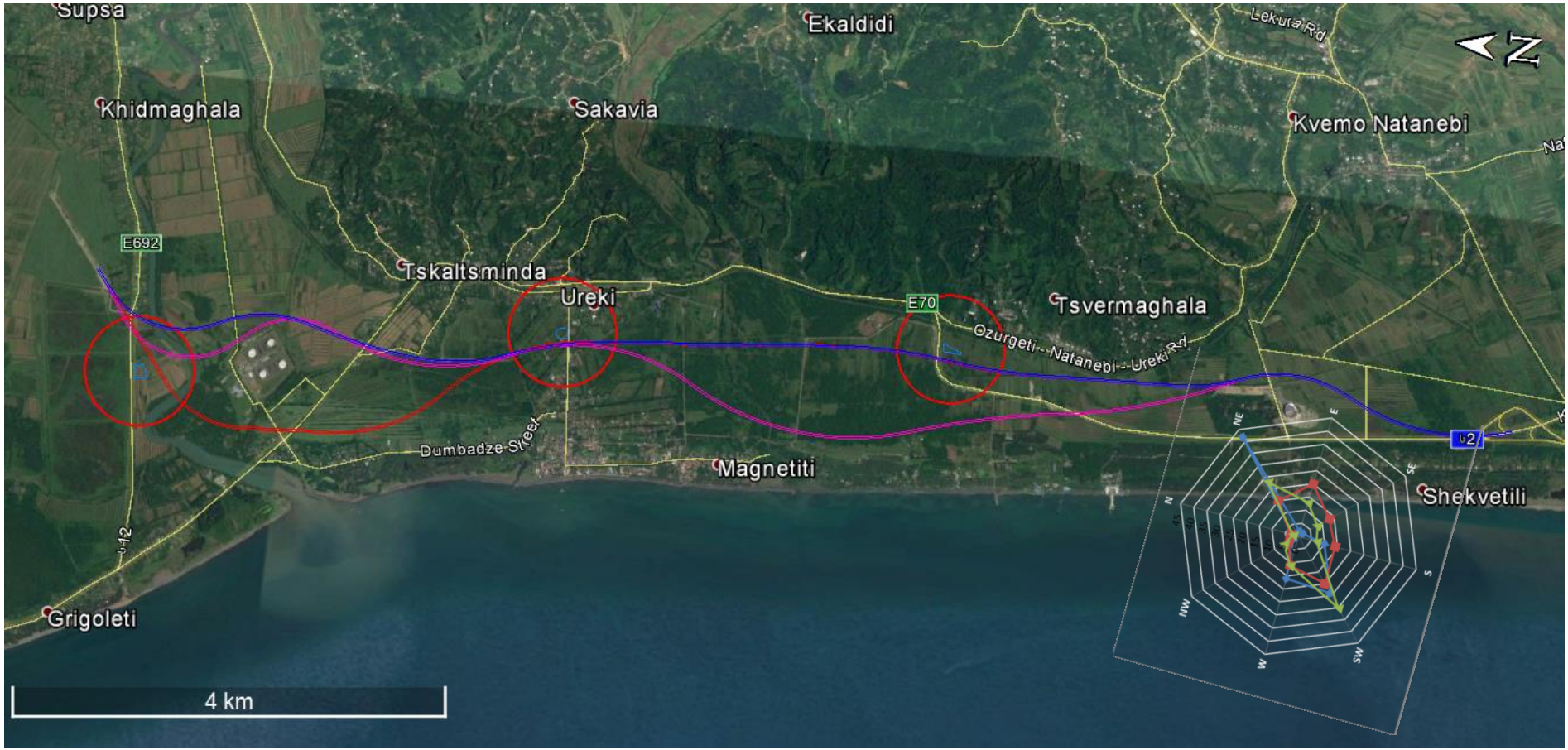



***Figure 46. Worksites with indication of 500m impact zone and windrose for the project area***

*(wind rose key: blue line –Supsa, Red line – Ureki, green line – Kobuleti)*

On the other hand, the difference is not expected to be significant. Dust and exhaust emissions for all alternatives will be of the same range.

The ranking of project impact on air quality for considered alternatives is as follows:

- Likelihood of impact – medium to high, depending on location
- Magnitude of impact – medium to high, depending on location.

### 6.2.2. ASSESSMENT OF IMPACT - ROAD OPERATION STAGE

Impact during operation will be related to dust and exhaust emissions from the vehicles using the highway. Amounts of vehicle-emitted pollutants mainly depend on technical condition of the vehicles, fuel quality and speed. As already mentioned above, 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 construction of the new highway the speed limit will be set to 120 km/h (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. Traffic emissions will mostly depend on speed, technical condition of the vehicles and percentage of Heavy Goods Vehicles (HGV) in the traffic flow.

Assessment of impact on air quality during operation of the highway was carried out using software referred to in the text below. Traffic data provided by design team were used as a basis for calculation.

Modelling of air emissions was done with consideration of 11,186 cars per day, including 9,508 light (85%) and 1,679 (15%) heavy good vehicles. These values correspond to traffic flows predicted for the opening year (2020). Hourly flows recalculated using transition coefficient 6.13% total 583 and 103 light and heavy good vehicles respectively. For input into the software the flow per 20 minutes was identified (195 LV, 35 HGV). Qualitative and quantitative characteristics of emissions were calculated using the software ‘Магистраль-город’, версия 3.0, Copyright ©1997-2013 ФИРМА «ИНТЕГРАЛ»’.

Results of calculation are given below. (***Table 48***- ***Table 50***).

***Table 48. Emissions from highway***

| Substance | Code | Emission, g/sec | Emission, t/year |
|---|---|---|---|
| Nitrogen dioxide | 0301 | 0.139000 | 1.876500 |
| Nitrogen oxide | 0304 | 0.022587 | 0.304931 |
| Soot | 0328 | 0.003201 | 0.043214 |
| Sulphur dioxide ($SO_2$) | 0330 | 0.000981 | 0.013247 |
| Carbon oxide (CO) | 0337 | 0.191771 | 2.588906 |
| Benzo(a)pyrene | 0703 | 2.750000e-8 | 3.712500e-7 |
| Formaldehyde | 1325 | 0.000290 | 0.003921 |
| Hydrocarbons, petrol | 2704 | 0.032500 | 0.438750 |
| Hydrocarbons, kerosene fraction | 2732 | 0.037917 | 0.511875 |

**Dispersion of harmful emissions**

Dispersion was calculated using software 'Ecolog-3'. for the section where alignment runs closest to the residential area (Ureki settlement). Conventional centre of coordinate system was set in the start point of the modelled section.

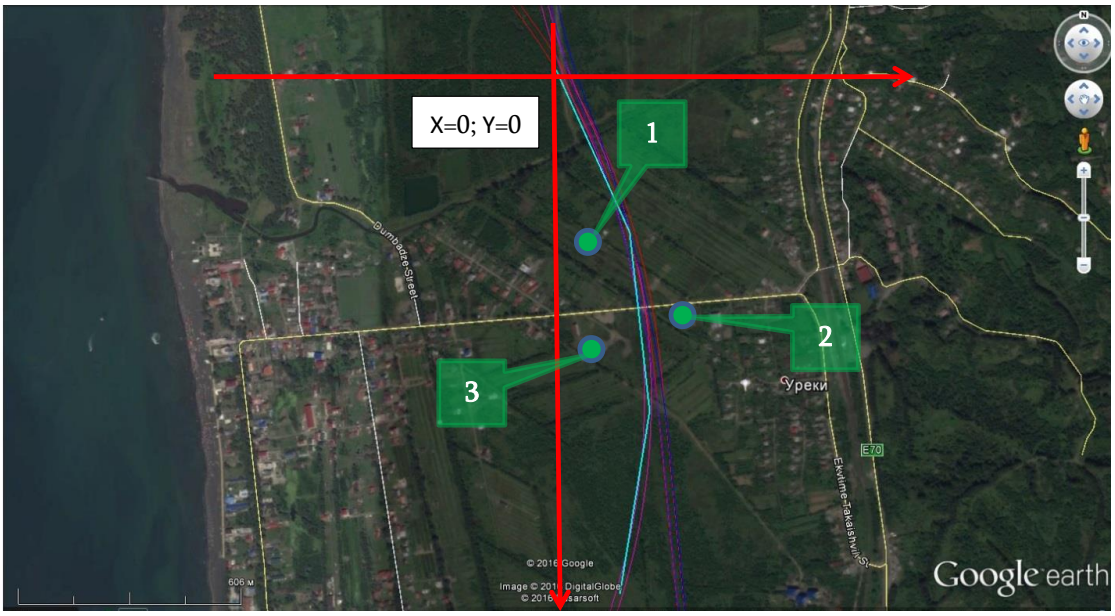



***Figure 47. Location of recipients selected for calculation***

Three locations at 110, 120 and 140m distance from alignment have been set as recipients. Additional 4 control points (within 1200m x 3000m rectangle, step 50m) were included in calculation.

Results in graphical representation of results (***Figure 48***- ***Figure 57***) are given below.

***Table 49. Calculation points***

| # | Coordinates of the points (m) | | Height (m) | Description of the point | Comment |
|---|---|---|---|---|---|
| | X | Y | | | |
| 4 | -69,00 | 488,00 | 2 | 500 m zone boundary | North |
| 5 | 756,00 | -560,00 | 2 | 500 m zone boundary | East |
| 6 | 193,00 | -1938,00 | 2 | 500 m zone boundary | South |
| 7 | -276,00 | -708,00 | 2 | 500 m zone boundary | West |
| 1 | 86,00 | -475,00 | 2 | Point at the boundary of residential zone | |
| 2 | 363,00 | -676,00 | 2 | Point at the boundary of residential zone | |
| 3 | 139,00 | -736,00 | 2 | Point at the boundary of residential zone | |

Calculation and graphical analysis shows that maximum concentration of all substances are below allowable limit. (Emissions and dispersion calculation printouts are given in Annex 3)

***Table 50. Values of parameters as MPC shares***

| Parameter | Share of MPC |
|---|---|
| Nitrogen dioxide | 0.45 |
| Nitrogen oxide | 0.04 |
| Soot | 0.02 |
| Sulphur dioxide | 0.0012 |
| Carbon oxide | 0.03 |
| Benzo(a)pyrene | 0.0019 |
| Formaldehyde | 0.0055 |
| Hydrocarbons, petrol fraction | 0.0042 |
| Hydrocarbons kerosene fraction | 0.02 |
| Summary impact group 6009 (301+ 330) | 0.28 |

Transport is considered as the major GHG emitter in Georgia. The main emissions from the sector include carbon monoxide (CO), hydrocarbons (volatile organic compounds and methane), nitrogen oxides (NO), sulphur dioxide (SO2), soot, benzapirene and carbon dioxide (CO2). Growth of emissions from the sector is determined by the following several factors:

- Annual growth of the car fleet,
- Large share of the used vehicles in the fleet,
- Poor vehicle monitoring and restrictions on local or global pollutants (standards),
- High traffic of transit vehicles, in particular HGV,

- Fuel quality.

Traffic accounts for over 60 % of $CO_2$ emissions in Georgia. Passenger transport contributes to 60.8% of total energy consumption in road transport, while trucks contribute to 26.5%, the rest belongs to other types of road transport (ariculture machine, firefighting cars etc.). Among the transport related greenhouse emissions carbon dioxide dominates with 99.3%.

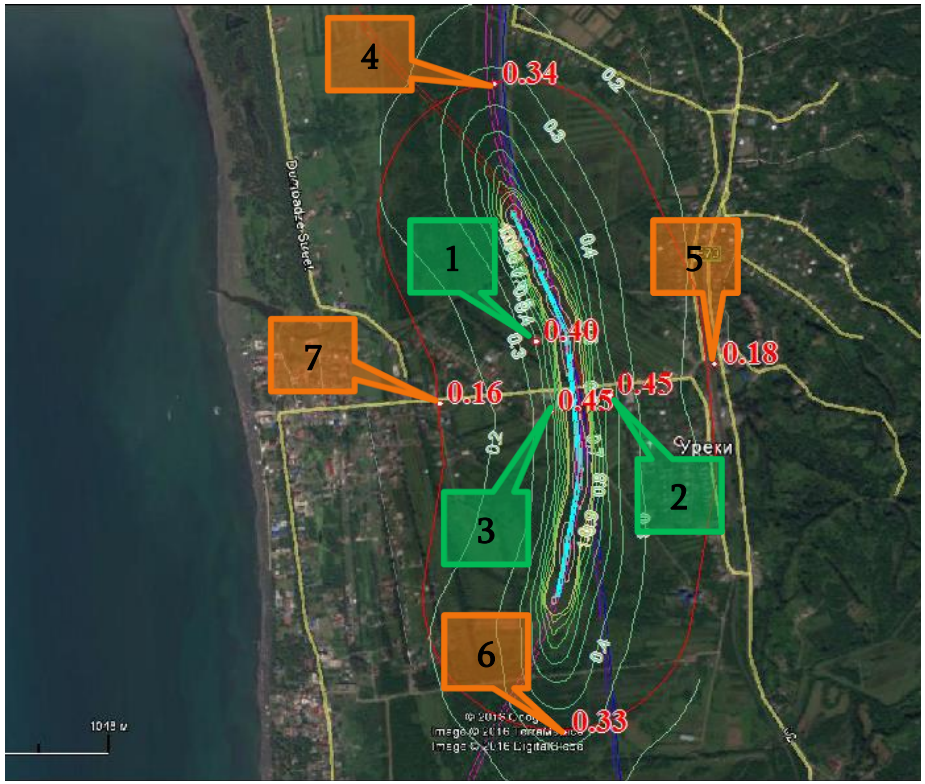



*Figure 48. Nitrogen dioxide (Code 301) – maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

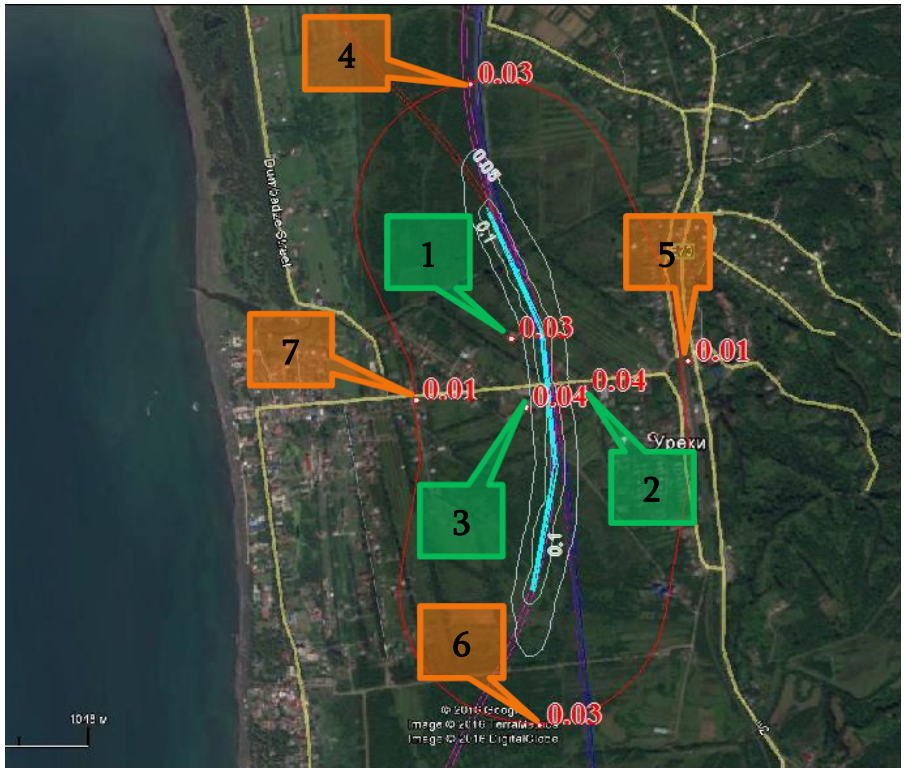



*Figure 49. Nitrogen oxide (Code 304) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

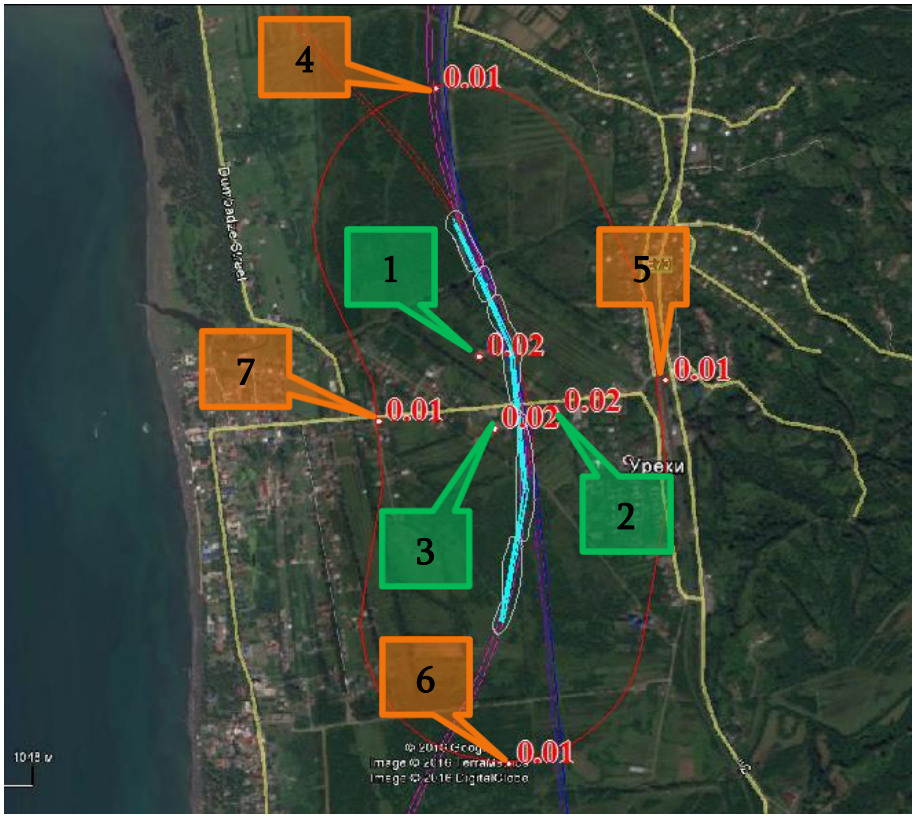



*Figure 50. Soot (Code 328) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

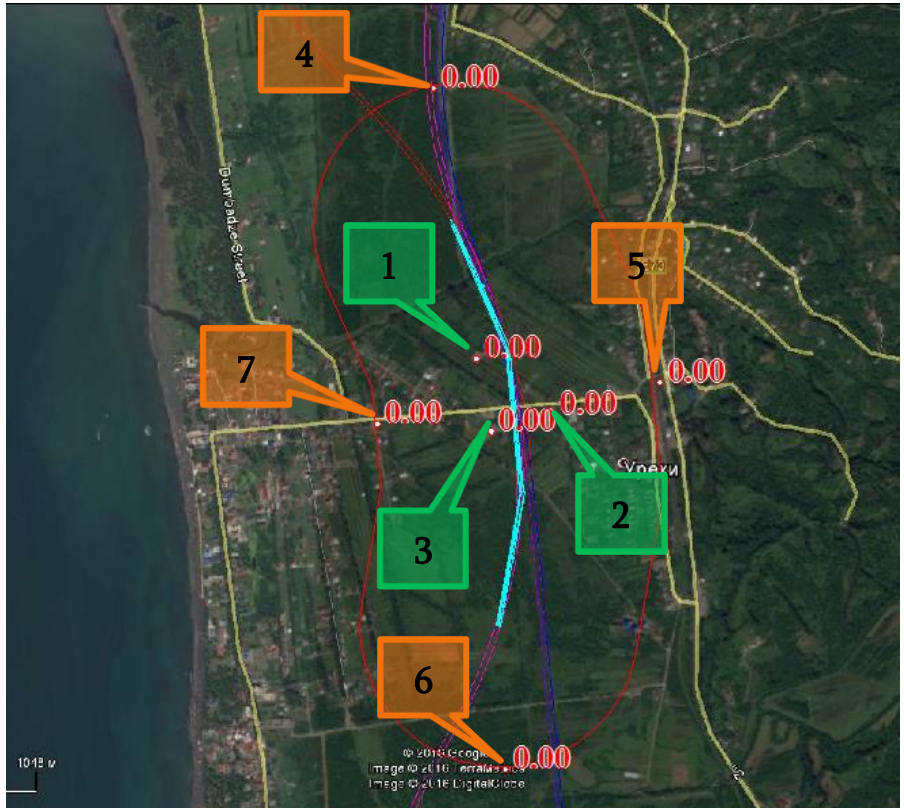



*Figure 51. Sulphur dioxide (Code 330) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

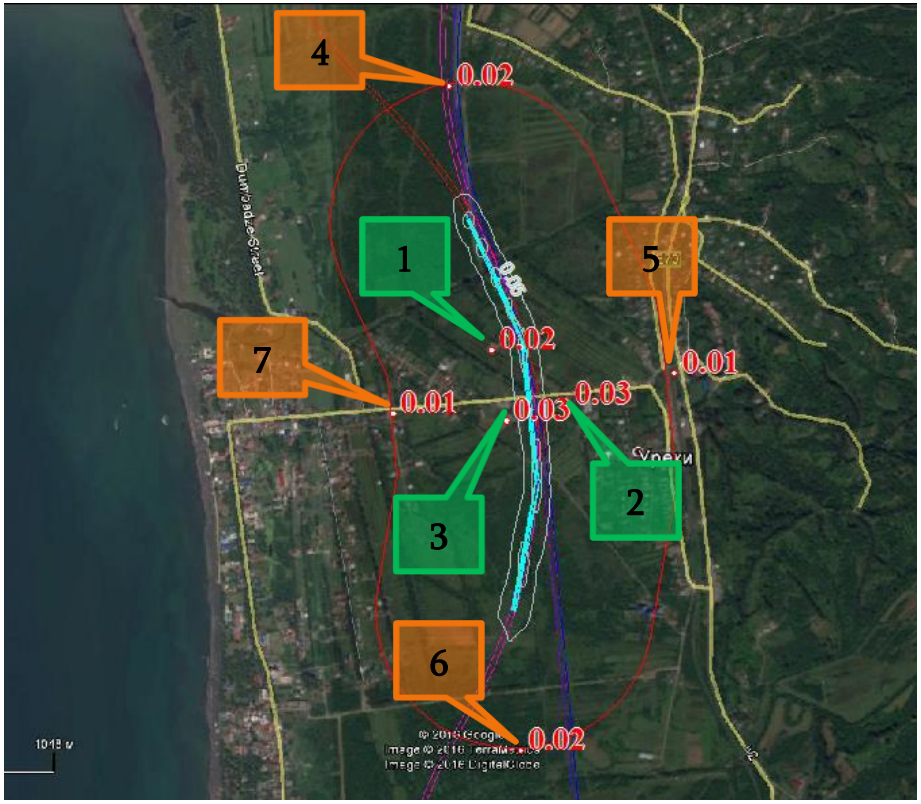



*Figure 52. Carbon oxide (Code 337) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

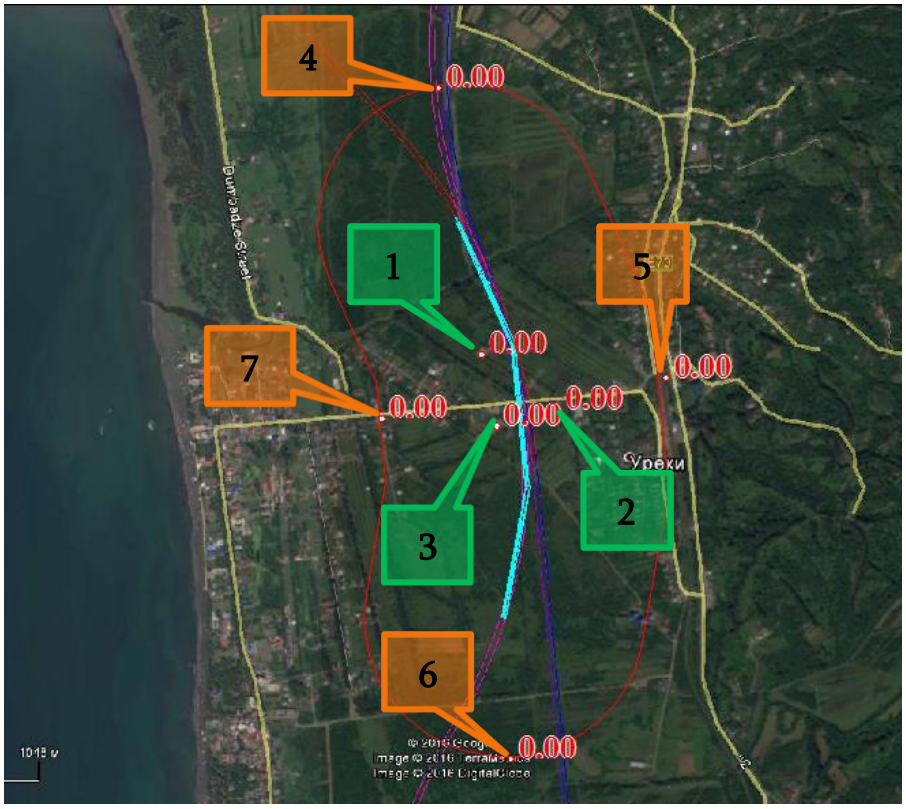



*Figure 53. Benzo(a)pyrene (Code 703) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

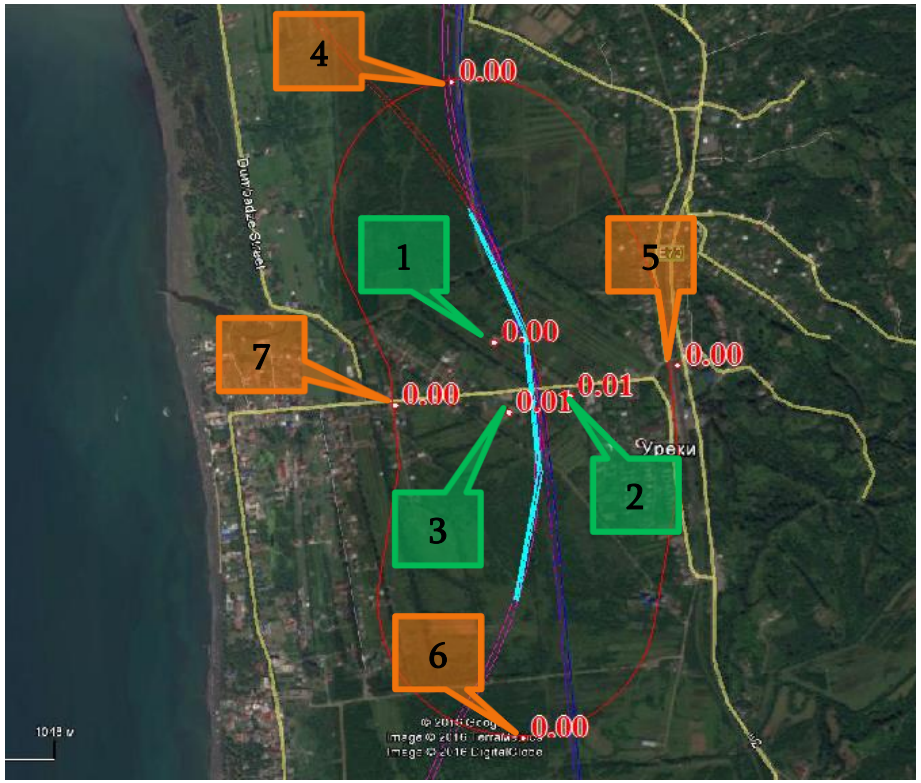



*Figure 54. Formaldehyde (Code 1325) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

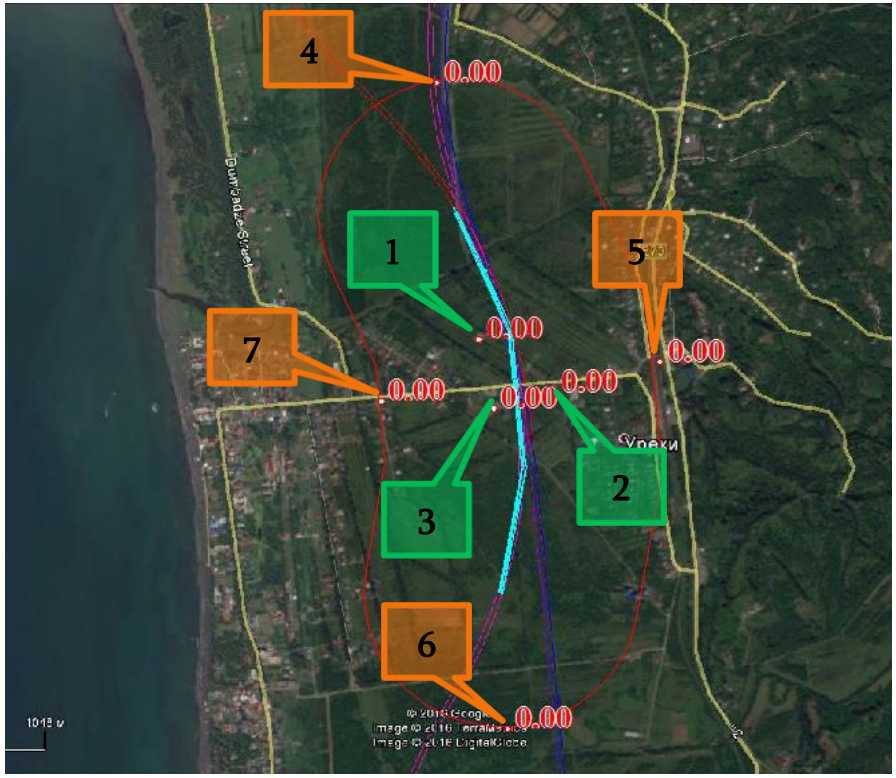



*Figure 55. Hydrocarbons, petrol fraction (Code 2704) - maximum concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

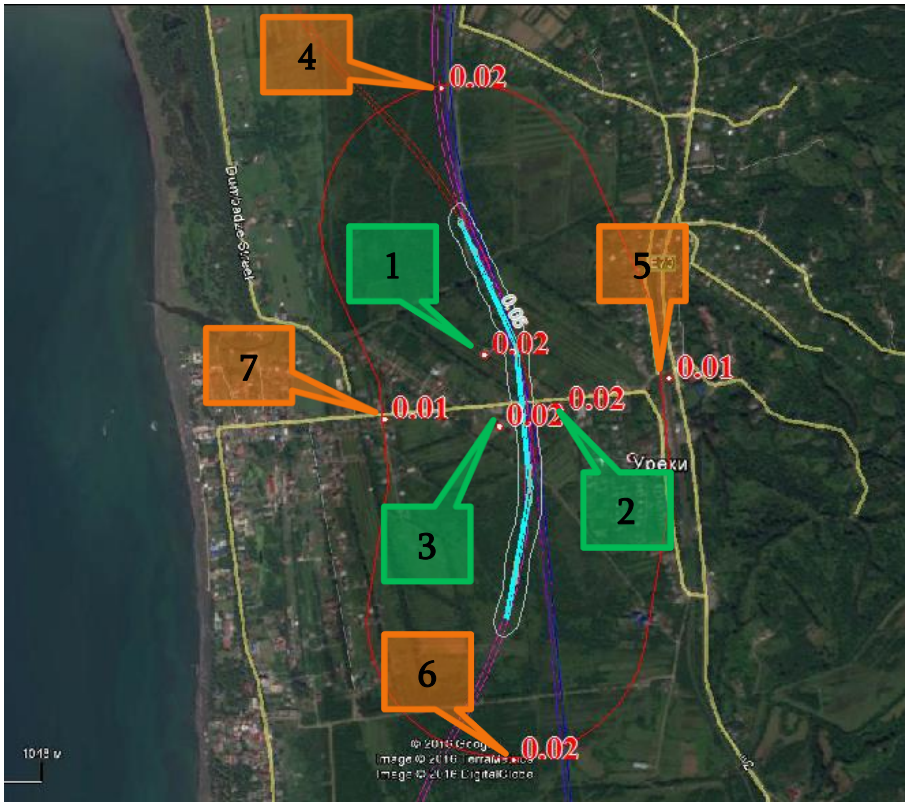



*Figure 56. Hydrocarbons, kerosene fraction (Code 2732) – max. concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

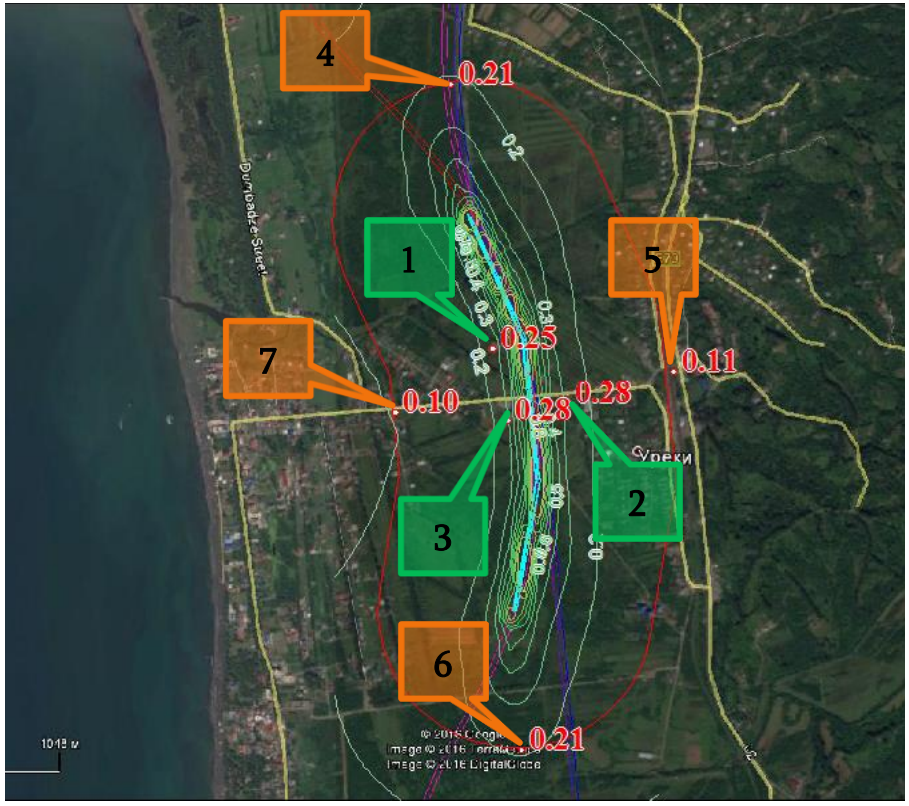



*Figure 57. Incomplete total impact group 6009 (Codes 301 + 330) – max.concentrations in control points (#1-3 residential sites, #4-7 boundary of 500m zone)*

Georgia has one of the fastest growing economies in the region, and favourable geographical position. It is expected to have continual increase in goods transit and upgraded roads should serve for this purpose. Increased traffic flows will inevitably result in bigger $CO_2$ emissions.

Very low average speeds generally represent stop-and-go driving, and vehicles do not travel far. Therefore, the emission rates per kilometre are quite high (when a car's engine is running but it is not moving, its emission rate per distance unit reaches the maximum). Conversely, when vehicles travel at much higher speeds, they demand very high engine loads, which require more fuel, and therefore lead to high $CO_2$ emission rates. Low emission rates are obtained at moderate speeds of about 65 - 95 km/h.

For design speed of the project is 120 km/h. Increased speed along the route would result in larger amounts of emitted $CO_2$ gases, but on the other hand would help to avoid emissions due to vehicles travelling at very low speed or queuing. One of the measures for $CO_2$ emissions reduction is proper management of vehicle speed. To reduce $CO_2$ emissions from the transportation sector, attention should be given to more efficient vehicles, alternative fuels. In terms of the perspective of the new road section upgrading, all factors influencing $CO_2$ emissions are hard to foresee. For example, it is possible that in 2050 the consumption of low-carbon fuel (such as biofuel and synthetic fuel) will considerably increase resulting in lower emissions than predicted. However, consistent policy on the topic should be obtained considering all the influencing factors and development of the state.

Despite of a certain growth in the traffic flow in 2020-2050 period, 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 stiffen and control over the quality of fuel will enhance, leading to the decrease of impact from the movement of vehicles.

Project impact on air quality for all considered alternatives will be in the similar range. The ranking of project impact on air quality for considered alternatives is as follows:

- Likelihood of impact – high,
- Magnitude of impact - medium to low, depending on location.

### 6.2.3. MITIGATION MEASURES

*Pre-construction and construction stages.*

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

- Spraying all unpaved roads and significant areas of uncovered soil with water every four hours (or more frequently, depending on the needs) on working days, during dry and/or windy weather;
- Covering all loose material with tarpaulins when transported off-site on trucks;
- Good selection of layout of the stockpiles to avoid aeolean erosion;
- Ensuring proper maintenance of vehicles and machinery;
- Setting optimum speed while moving through the residential area to reduce dust emissions;
- Prohibition of idling with switched gear;
- Prohibition of dumping of material from high to avoid dust related nuisance;
- Keeping at least 300 m distance from residences windward to reinforced concrete production plants (if planned to run);
- Obtaining environmental impact permit for asphalt plant (if planned to run own facility);
- Training staff in construction best practice.

Note: *Aeolean dust generally depends on location of the linear dust source. With wind perpendicular to the source dust is deposited in a broad strip, the thickness of deposited dust decreasing gradually with the distance from the source. When winds blow at oblique angle – the belt of dust deposition is narrower, the thickness decreases more rapidly in direction perpendicular to the source. In case of variable winds, the result is a broad strip with a zone of high thickness adjacent to the source. (see* ***Figure 58***).

Under condition that mitigation measures are implemented the magnitude of residual impact will be medium to low, depending on location.

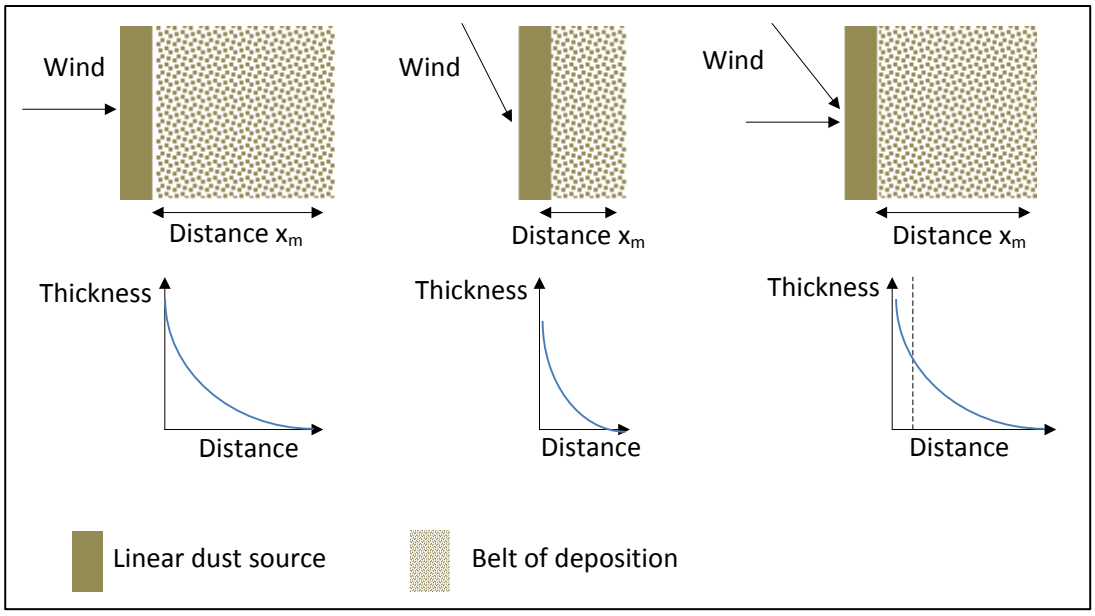



***Figure 58. Schematic diagram showing dust dispersion from liner sources under different wind conditions***

*Operation stage*

The only measure for reduction of emissions related nuisance during operation is arrangement and maintenance of vegetation barrier along the road (in particular in the sensitive areas such as settlements).

Mitigation measures suggested for construction stage should apply to road maintenance works (the measures should be relevant to the type of activity and the scale of impact).

Under condition that mitigation measures are implemented the magnitude of residual impact will be medium to low, depending on location.

## 6.3. IMPACT ON BACKGROUND NOISE LEVEL

### 6.3.1. ASSESSMENT IMPACT ON BACKGROUND NOISE AND VIBRATION: PRE-CONSTRUCTION AND CONSTRUCTION STAGES

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. Noise and vibrations will be inevitable from such activities as digging trenches, soil compaction, and other.

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 – if required). Noise levels during the construction will vary depending on the construction activity and schedule.

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 in this phase. For heavy industry (with no demand for oral communication) limit equivalent noise level is set to 85 dBA; maximum – 110 dBA.

Noise levels induced by the main road construction equipment are presented in *Table 51*. (Note: the values indicated in the table may differ depending on the brand of machinery provided/used by construction company).

***Table 51. Construction equipment noise emission levels***

| Equipment | Typical noise level (dBA), in appr. 15 m from source |
|---|---|
| Backhoe | 80 |
| Compactor | 80 |
| Roller | 85 |
| Concrete mixer truck | 85 |
| Concrete pump truck | 82 |
| Bulldozers | 85 |
| Front loader | 80 |
| Grader | 85 |
| Paver | 85 |
| Dump Truck | 84 |
| Clamshell | 93 |
| Angle dozers | 85 |
| Front loader | 85 |
| Shovel loaders | 85 |
| Excavators | 85 |
| Drilling Machines | 85 |
| Ditcher/Trencher | 85 |
| Scrapers | 85 |

| Equipment | Typical noise level (dBA), in appr. 15 m from source |
|---|---|
| Tractor | 84 |

Noise impact assessment was performed identifying sensitive receptors (settlements, dwellings) within minimum distances from alignment boundaries.

Noise level for the worst possible scenario – all machinery operating simultaneously- was assessed. Octave levels of the sound pressure in the reference point are calculated using the following equation:

$$L = L_p - 15\lg r + 10\lg \Phi - \frac{\beta_a r}{1000} - 10\lg \Omega$$

Where,

$L_p$ – Octave level of the noise source capacity;

$\Phi$ – noise source direction factor, non-dimensional, is determined through trial and changes from 1 to 8 and depends on spatial angle of sound radiation;

$r$ – Distance from the source of the noise to the reference point;

$\Omega$ – Spatial angle of sound radiation, which will be: $\Omega = 4\pi$- when located in the space; $\Omega = 2\pi$- when located on the surface of the area; $\Omega = \pi$ - double ribbed angle; $\Omega = \pi/2$ – triple ribbed angle;

$\beta_a$ – Sound damping in the air (dBA/km) tabular description.

***Table 52. Average geometric frequencies of octave band***

| Average geometric frequencies of the octave band, Hz | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
|---|---|---|---|---|---|---|---|---|
| $\beta_a$ dBA/km | 0 | 0.3 | 1.1 | 2.8 | 5.2 | 9.6 | 25 | 83 |

Summary noise level on the site is calculated according as:

$$L_p = 10\lg \sum_{i=1}^{n} 10^{0,1Lpi}$$

Where,

$L_{pi}$ –is i-type source noise capacity.

For simplicity, calculations are performed for the sound equivalent levels (dBA) and average value of its octave indicator is taken as sound reduction coefficient $\beta_{ave}$=10.5 dBA/km;

The summary noise level generated during simultaneous operation of all machinery from the source of noise propagation:

$$10\lg\sum_{i=1}^{n}10^{0,1Lpi} = 10\lg\ (3*10^{0,1x80}+ 12*10^{0,1x85}+2*10^{0,1x84} +2*10^{0,1x93}+10^{0,1x82})= 99.4\ \text{dBA}$$

The maximum noise level at recipient located in 80m from the source will be as follows:

$$L = L_p - 15\lg r + 10\lg\Phi - \frac{\beta_a r}{1000} - 10\lg\Omega = 99.4 - 15\lg 80 + 10\lg 2 - 10.5*80/1000 - 10\lg 2 =$$

=59.3dBA

Calculation results are given in ***Table 53***.

**Table 53.** ***Noise propagation calculation results with indication of allowable limits***

| Noise equiv. level at source, | Distance to nearest receptor | Noise equivalent level at the closest receptor | Norm[5] | | | |
|---|---|---|---|---|---|---|
| | | | Georgian | | Good international practice and standards (European) | |
| | | | Day hours | Night hours | Day hours | Night hours |
| 99.4 dBA | 80 m | 59.3 dBA | 55 dBA | 45 dBA | 65 dBA | 55 dBA |

Results of calculation show that the noise level in case of simultaneously operation all types of machinery is slightly above the day-time limit (Georgian regulations). Keeping in mind that this is the worst case scenario which is not likely to happen we can assume that acceptable noise level will not be exceeded. Construction during night hours is not planned.

Increased HGV movement along the route during the construction will be low as compared to the existing traffic flows and will not cause noise-related disturbance.

Settlement patterns along the road section imply that only few people would be exposed to elevated noise levels during the road construction. Besides, construction noise impact will be temporary and of medium significance, if environmental and safety requirements are followed.

[5] Sanitary norms “the noise on the workplaces, residential, in public building housing and on the residential development territory”.

According to acceptable practice, minimum distances for various construction related activities from sensitive recipients, to protect human health from the impacts of emissions, noise and vibration should be kept:

- Borrow pits > 100 m;
- Asphalt plants > 500 m;
- Reinforced concrete production > 300 m;

The mentioned requirements will be observed.

Vibration impacts are expected to be felt only locally near construction sites and should not have any negative impacts on residents. However, prior to construction the status of the nearest buildings will be checked to avoid unjustified complains of community regarding damages caused by construction related vibration. Mitigation measured allowing control of vibration will be kept to.

Noise and vibration levels generated during pre-construction and construction will be similar for all alternatives. As for related impact on recipients (wildlife, community and workers), it will depend on the distance from the source. More details are given in Sections 6.5 and 6.10.

The ranking of project impact for considered alternatives is as follows:

- Likelihood of impact – medium to high, depending on location;
- Magnitude of impact – medium to high. depending on location;

Under condition that mitigation measures are implemented the magnitude of residual impact will be medium to low.

### 6.3.2. ASSESSMENT OF IMPACT ON BACKGROUND NOISE AND VIBRATION: ROAD OPERATION (MODELLING OF LONG-TERM NOISE LEVELS)

There are two types of road-related noise:

- noise generated by vehicle engines and
- noise generated by tyre-road friction.

Noise levels increases with the speed. It should be taken into account that use of asphalt pavement is planned, in similar conditions, this, compared to concrete paving may result in noise level lower by approximately 3 dBA.

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.

As a part of this ESIA, noise modelling software CadnaA (Computer Aided Noise Abatement) was used for outdoor noise level assessment. The model allows calculation and evaluation of different scenarios by choosing and managing different types of noise sources (mobile sources – roads, railways, aircraft; point sources – industrial enterprises etc.).

According to good international practice and standards commonly used in European Union countries, the maximum noise level for residential areas, mainly influenced by traffic noise, is 65 dBA during the day and 55 dBA at night. National regulations (Noise at workplaces, in rooms of residential and public buildings, and on a territory of residential área, Approved by Order 297/n of the Minister of Labour, Health and Social Affairs, dated 16.07.2001) set maximum indoor day-time and night-time noise limits as 55 dBA and 45 dBA respectively. On the other hand, for the areas adjacent to residential houses, outpatient buildings, dispensaries, rest houses, elderly and disabled living facilities, preschool, school and other education facilities, library buildings, sanatoria and hotels, the mentioned regulation allows +10 dBA amendement to noise levels generated by road and railway traffic for the areas in 2 metres from the first row of buildings (outer building envelope) facing the main road. For the needs of this ESIA the Georgian limits with this last remark, which comply with the standards accepted in EU states, have been used.

Modelling the terrain in 2D, followed by detailed modelling work in 3D, focussed in possible affected areas detected in the previous appraisal has been carried out.

The noise level calculation was done for road operation using the forecasted traffic flow data for 2020 year. Traffic was considered as a main source of noise.

**Table 54.** ***Initial modelling road traffic data***

| Traffic type | Type of vehicle | Traffic flow, vehicles/period | Speed, km/h |
|---|---|---|---|
| Motor vehicle (Road to Lanchkhuti-Magnetiti) | Heavy motor vehicle | 1935 vehicles/24 h | 80 |
| | Light motor vehicle | 9840 vehicles/24 h | 120 |
| Motor vehicle (Magnetiti – Ozurtegui Coast) | Heavy motor vehicle | 1838 vehicles/24 h | 80 |
| | Light motor vehicle | 9348 vehicles/24 h | 120 |
| Motor vehicle (Ozurtegui Coast – Kobuleti Bypass) | Heavy motor vehicle | 1687 vehicles/24 h | 80 |
| | Light motor vehicle | 9494 vehicles/24 h | 120 |

Noise from railway traffic (the railway line is situated at the distance of more than 350 m eastern from planned road) has been taken into account.

**Table 55.** ***Initial modelling train traffic data***

| Type of train | Traffic flow, vehicles/period | Speed, km/h |
|---|---|---|
| Fast passenger train (direction Tbilisi-Batumi) | 2 trains/day<br>2 trains/evening<br>2 trains/night | 100 |
| Commuter electric train (direction Batumi-Ozurgeti) | 1 train/day<br>1 train/evening | 80 |
| Freight train (direction Tbilisi-Batumi) | 11 trains daily | 60 |

The speed limit for trains in particular railway sections is unknown, but evaluation of the slowdown (from limit speed to 0 km/h) near the stations would be appropriate. On the other hand, the slowdown and acceleration of train leads to noise. Compensating the braking and accelerating noise, the speed limit was used as the actual speed for all railway in the model.

Configuration of calculation settings for the first appraisal was done as follows:

1. order of reflection – 2;
2. grid height: 1.5 m (as average hearing height at the outdoor areas);
3. receiver point spacing – 10 m;
4. evaluation parameters: Leq,D, Leq,N;
5. usage of map of ground absorption;
6. in noise maps one colour covers 5 dBA noise level and is divided by isolines at every 1 dBA.

Calculated Leq,D, Leq,N values for built-up areas are provided in ***Table 56***, noise maps - included in Annex 4.

**Table 56.** ***The Leq,D, Leq,E, Leq,N near the facades and indoor of the residential buildings during operation***

| Receiver | Equivalent noise level, dB(A) | |
|---|---|---|
| Site | Daytime $L_{eq,D}$, dB(A) | Night time $L_{eq,N}$, dB(A) |
| | 55dB(A)* | 45 dB(A) * |
| 0 | 55 | 46 |
| A | 62 | 51 |
| B | 51 | 40 |
| C | 47 | 46 |
| D | 58 | 50 |
| E | 57 | 52 |
| F | 54 | 48 |

| Receiver | Equivalent noise level, dB(A) | |
|---|---|---|
| G (territory of Black Sea Arena) | 55 | 45 |
| H | 54 | 47 |

***** *Noise limit level (maximum noise level limits for Georgia)*

Predicted equivalent noise level from operation of Grigoleti – Kobuleti bypass road will exceed the nominated guideline goals at some of the receivers. In these locations mitigation measures should apply.

The results arisen from the first appraisal show the following areas as affected by noise at least during night period:

- Residential areas: A1, A2, B, D1, E, F
- Hotel: D1

Location of the sites is shown in

The modelling was done without consideration of attenuation due to foliage and the fact that increase of noise level by 3dBA is barely perceptible to the human ear..Additional modelling was performed with consideration of verified data on distances and topography. Modelling showed the need of barriers in some sections of the road (see Section 6.3.3.)

The ranking of project impact for considered alternatives differs by location. Expected impacts can be described as follows:

- Likelihood of impact – medium to high, depending on location;
- Magnitude of impact – medium-high to medium, depending on location.

### 6.3.3. MITIGATION MEASURES

*Pre-construction and construction stages*

- Maintain the distance to the nearest residence building or inhabited area;

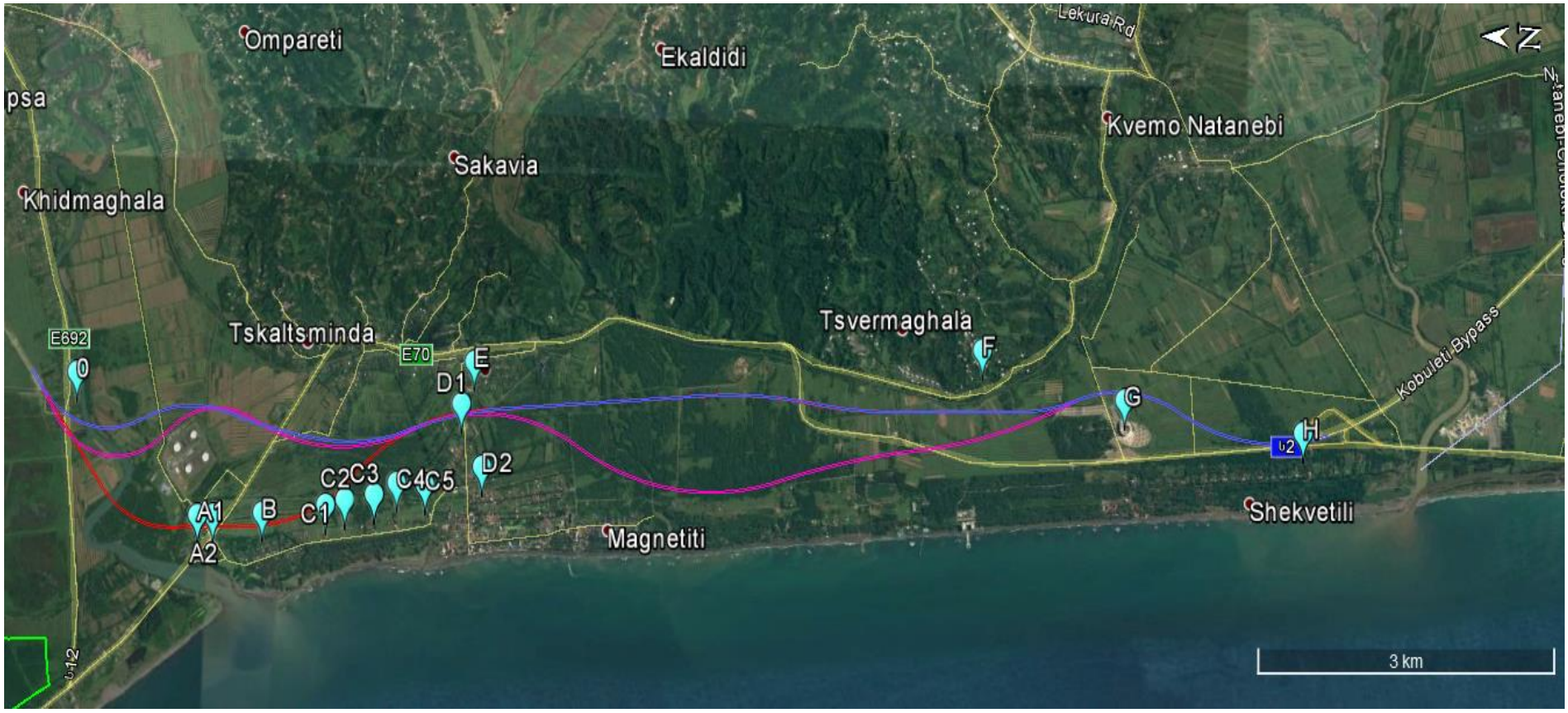



***Figure 59.. Noise recepients in the project corridor***

- Keep restrictions on working hours on week days, weekends or public holidays, no night-time working;
- Ensure proper state of maintenance of machinery and vehicles;
- Develop and keep to the traffic schedule;
- Set optimum travel speed during offsite travel;
- Install temporary noise barriers whether appropriate;
- Preserve vegetation that can act as a natural noise barrier;
- Prohibit idling with switched gear;
- Design and construction of noise barrier - a wall, an earthen berm, or a combination of wall and berm, use of green barrier (tree planting);
- Adherence to no horn policy;
- Train staff in construction best practice.

Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

Responsibility for implementation of mitigation measures rests with construction company.

*Operation stage*

Installation of noise barriers and vegetation barriers can be used to reduce the noise impact. The artificial barrier can achieve a 10dBA noise level reduction, when it is tall enough to break the line-of-sight from the highway to the house or receiver, approximately 1.5 decibels of additional noise level reduction for each meter of barrier height. To effectively reduce the noise coming around its ends, a barrier should be at least eight times as long as the distance from the receiver to the barrier. This is just a simple orientative rule.

According to the preliminary modelling data (done assuming flat terrain and absence of structures/vegetation acting as barriers between the source and recipient), in some of the built up areas noise reduction measures are required. In those locations, where the night time noise is expected to slightly exceed allowable limit, (A1, A2, B, D1, E, F), noise barriers and speed reduction are recommended. In other areas (C, G) noise barriers are not needed. In Black Sea Arena section the modelled noise value were also found to be in allowable limit.

It needs to be stated that the whole area between Grigoleti and Kobuleti is in process of urbanistic development, addressed to touristic sector. This fact means that in the

near future (short or medium term), seasonal housing, hotels and resorts may appear in the neighbourhood, more or less close to the new road. So that, it may be foreseen that the number of affected locations will increase and more barriers may be needed to mitigate the effects of noise caused by the road.

Following to additional modelling was carried out In the second stage of the study, dimensions of the walls were calculated with consideration of the distances and topography of the area. Lower, but longer barriers have been suggested to reduce visual effect of the structure. For all barriers height equal to 2.1m was chosen. Lengths of the barriers per site are as follows:

- Areas A1 + A2: length = 990 meters;
- Area B: length = 340 meters;
- Area D1: length = 630 meters;
- Area E: length = 420 meters;
- Area F: length = 2,910 meters.

Additional measures may be required later during operation in case monitoring reveals expedience of the limit or complaints from the resident received.

The proposed noise barriers are “metallic sandwich type”. It consists of a double metal sheet (aluminium or steel) and a rock wool sheet inside both. (see ***Figure 60***).

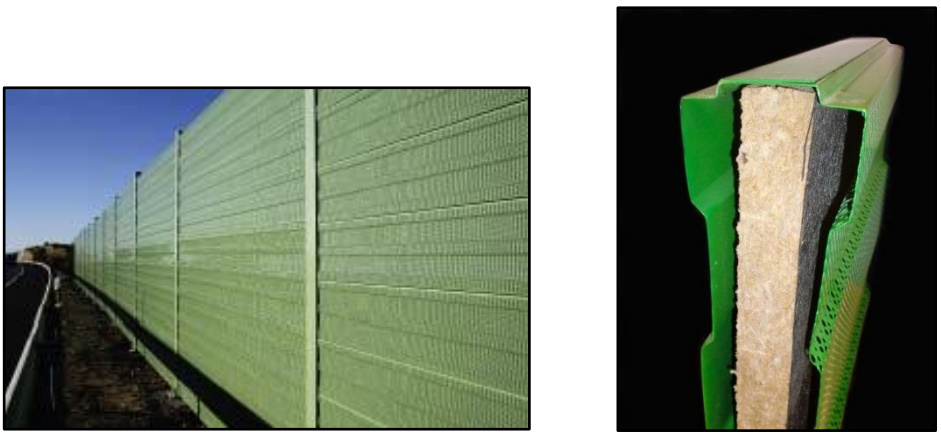


***Figure 60. Noise barrier: metallic sandwich type***

Under condition that mitigation measures are implemented the magnitude of residual impact will be low/medium, although depending on location.

## 6.4. IMPACT ON WATER RESOURCES

### 6.4.1. ASSESSMENT OF IMPACT - PRE-CONSTRUCTION AND CONSTRUCTION STAGES

Preparation works and works during construction of the road, bridges and overpasses and underpasses may have impacts on water environment. These are:

- Potential contamination of surface and ground waters, which can be caused by:
  - Accidental leakages of fuel/oil/ lubricants from cars and machinery (including emergency situations);
  - Pollution caused by improper management of construction materials and waste;
  - Increase of turbidity caused by earthworks and construction activities near and/or in the riverbed;
  - Possible pollution with runoff from contaminated areas;
  - Contamination of ground waters by infiltrated contaminated surface water.
  - Possible pollution of ground water (shallow horisons) during earthworks and construction activities;
- Blockage of the stream during construction near/in the waterbed;
- Littering.

According to the engineering geological survey, the ground water level in the project area varies from 0.3-2m. 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 Supsa, Sepa and Tskhaltminda streams. During construction, qualitative parameters of these surface water bodies may be affected by accidentally spilled fuel/oil or contaminated surface runoff. Increase of turbidity caused by the lack of erosion control, and pollution with poorly managed solid construction waste may also occur.

Direct discharge of potentially contaminated waste water into the river is not planned. Construction company selected through bidding will specify location of construction camp (if deemed advisable). With consideration of vicinity of worksites to the residential areas contractor may decide to use existing facilities (hire accommodation

in the nearest village) rather than run his own camp. This will allow to resolve (avoid) the issue of domestic waste water and alleviate the impact on environment. On worksite portable toilets will be installed[6].

Machinery stationing and material/topsoil storage sites are located away from the watercourses/canals. Impact on surface water from these areas will not happen.

Use of commercial car service facilities will be encouraged. Along with reduction of the risk of spills and pollution of water with spilled/washed off lubricants/fuel, impacts related to presence and management of fuel stock on site will be avoided.

All new alternatives have similar number of river crossings. Because the crossing over the most of the streams except for the Supsa River, does not require construction of piers in the riverbed, direct impact generally related to works in water for Sepa and small streams will be avoided.

During construction of the Supsa crossing sheet piles with be used to avoid operation in water. Use of machinery in the riverbed will be prohibited. Works will be implemented in 'dry' environment.

In the Supsa river crossing piers in the riverbed will be arranged in two sections of the stream – in case of alignment Alternatives 1 and 3, and three section – in case of alignment Alternative 2. Keeping the mentioned above in mind, impact on the surface water quality in river crossings for Alternatives 1 and 3 is assumed to be similar and lower compared to Alternative 2.

The risk of littering and blockage of the stream for all alternatives is similar.

With consideration of the main types of water pollution (mainly increase of water turbidity) deterioration of ground water because of the project is not expected.

The ranking of project impact on water flow and quality for considered alternatives is as follows:

[6] According to the experience 1 toilet per 10 individuals is required. Capacity of a standard toilet tank is 225-227 litres. Capacity of water reservoir is 19 litres. The tank should be cleaned maximum once in 4 weeks. Odour problem can be avoided through use of deodorants.

- Sensitivity of receptor – high,
- Likelihood of impact – medium to high, with consideration of location,
- Magnitude of impact - low to medium (Alternatives 1 and 3) to medium (Alternative 2).

### 6.4.2. ASSESSMENT OF IMPACT: ROAD OPERATION STAGE

Major possible impacts on water during operation of the highway will be:

- Sedimentation and pollution of waters with heavy metals and petroleum hydrocarbons (runoff, emergency);
- Pollution with waste;
- Cross contamination of ground water in case of surface water pollution;
- Increase of ground water level caused by the load of the road structure;
- Pollution during winter maintenance (application of salt, sand and other products posing water quality under threat);
- Pollution of water during maintenance works.

Surface and ground water pollution during operation of the 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 brought to the possible minimum by application of road safety measures.

The World Bank-financed program of assistance to RD delivered though several on-going projects includes technical assistance with the implementation of Road Safety Action Plan 2016-2021, which will enhance safety of operation of the newly reconstructed highways as well.

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.

Finally, pollution of surface and ground water may occur from regular operation of the highway through direct release of drainage carrying heavy metals, oil products from the road surface. The list of typical pollutants washed off from the road surface/bridge deck is given in ***Table 57***.

***Table 57. Typical pollutants in the runoff***

| Pollutant | Source |
|---|---|
| Particulate matter | Pavement wear, vehicles, ‘natural’ dust, maintenance activities |

| Pollutant | Source |
|---|---|
| Rubber | Tire wear |
| Asbestos | Clutch and brake lining wear |
| Nitrogen and phosphorus | Air, roadside fertilizer application and sediments |
| Lead | Leaded gasoline from auto exhaust, tire wear, lubricating oil and grease, bearing wear and atmospheric fallout |
| Zinc | Tire wear, motor oil and grease |
| Iron | Auto body rust, steel highway structures such as bridges and guardrails and moving engine parts |
| Copper | Metal plating, bearing wear, moving engine parts, brake lining wear |
| Cadmium | Tire wear |
| Chromium | Metal plating, moving engine parts and brake lining wear |
| Nickel | Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear and asphalt paving |
| Manganese | Moving engine parts |
| Sulphur | Roadway beds, fuel |
| Bromide | Exhaust |
| Petroleum | Spills, leaks, antifreeze and hydraulic fluids, asphalt surface leachate and blow-by motor lubricants |
| PCB | PCB catalyst in synthetic tires |
| Pathogen bacteria | Soil litter, bird droppings and trucks hauling livestock/stockyard waste |

Source: USEPA. Guidance Specifying Management Measurements for Sources of Non Point Pollution in Coastal Waters, Washington, D.C.: Office of Water 1997 and Federal Highway Administration. Sources and Mitigation of Highway Runoff Pollutants, Washington, D.C.: Federal Highway Administration, 1984

Concentration of the mentioned components in the runoff varies. Since specific quality data for runoff is not available, typical values for highways with more and less than 30,000 vehicles per day is used for illustrative purposes. (see ***Table 58***).

***Table 58. Concentration of pollutants in highway runoff***

| Pollutant | Mean concentration (mg/l) for highways with | |
|---|---|---|
| | **<30000 vehicles/day** | **>30000 vehicles/day** |
| Total suspended solids | 41 | 142 |
| Volatile suspended solids | 12 | 39 |
| Total organic carbon | 8 | 25 |
| Chemical oxygen demand | 49 | 114 |
| Nitrite and nitrate | 0.46 | 0.76 |
| Total Kjeldal nitrogen | 0.87 | 1.83 |
| Phosphate phosphorus | 0.16 | 0.4 |
| Copper | 0.022 | 0.054 |

| Pollutant | Mean concentration (mg/l) for highways with | |
|---|---|---|
| | <30000 vehicles/day | >30000 vehicles/day |
| Lead | 0.08 | 0.4 |
| Zinc | 0.08 | 0.329 |

Source: Driscoll, E., Shelley, P., and Strecker, E. Pollutant Loadings and Impacts from Highway Stormwater Runoff, Volume I. Washington, D.C.: Federal Highway Administration, 1990

The ***Table 58*** shows that the lower is the traffic flow the lower are concentrations of main pollutants in the runoff.

Concentration of contaminants in the runoff cannot be reduced on source and depend on the status of technical maintenance of cars, traffic speed, quality of petrol, etc. Curbs and gutters can trap particulate matter on the highway. Impact caused by the runoff on surface water can be somehow reduced by vegetation along the highway, availability of infiltration trenches, general roadway maintenance and clean-up activities. The baseline quality of water, size and characteristics of receiving stream, potential for dilution, ability of self-cleaning are the critical factors in determining the magnitude of highway runoff on surface water

For bridges, according to general practice, spill and/or runoff direct discharge prevention measures are taken for recipient water bodies of zero tolerance (drinking water reservoir, protected area, etc.). To avoid pollution of water a system that collects water from the centre of the bridge to one of its sides, where some holes are available in the deck. In case of this scheme, water gets into a pipe (attached to the down side of the slab. The pipe spills off when the bridge ends (abutment) into a ditch. This ditch drains in a pool where the polluting spill gets stuck, while the clean water is allowed to flow through. Road design was developed so to minimize rapid direct discharge of drained 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 stiffen and control over the quality of fuel will enhance, leading to the decrease of impact from the movement of vehicles.

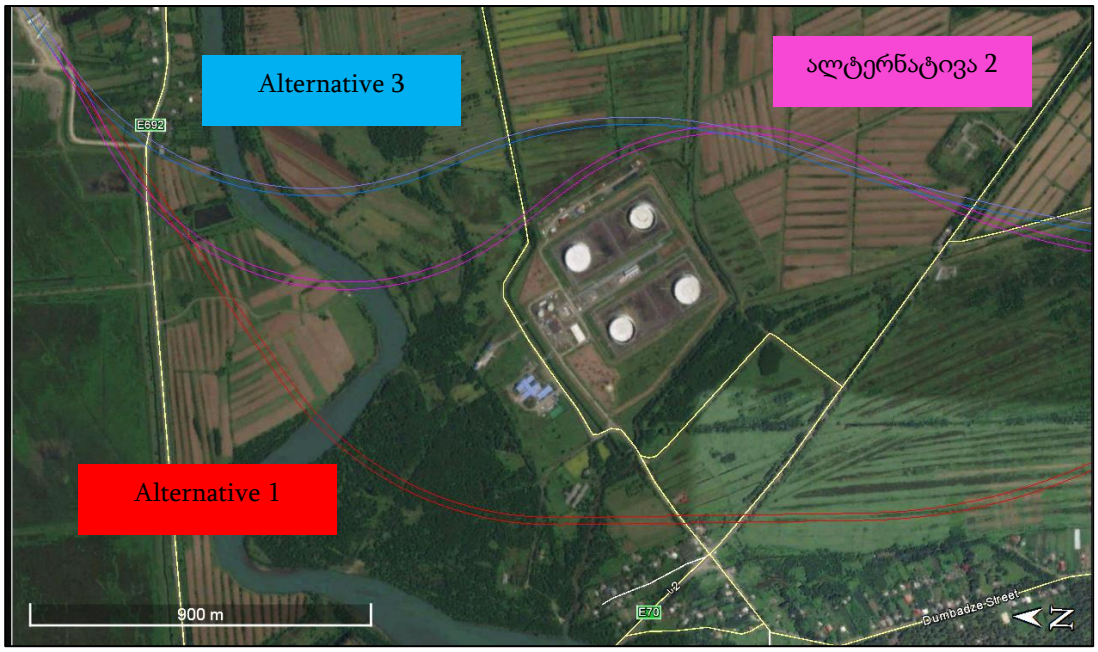



***Figure 61. Supsa river crossing***

*(Alternative 1 – red line, Alternative 2 – purple line, Alternative 3 – blue line)*

It should be mentioned that use of road salt or sand for improvement of traffic safety in winter might affect the quality of water. The road salt (sodium chloride), is composed of 40% of sodium ions (Na+) and 60% of chloride ions (Cl-). Other components and impurities account for 5% of the total weight. The salt components make their way into environment through the runoff (rain, melting snow and ice), as well as through splash and spray by vehicles and/or by wind causing impact on environment. Chloride ion is completely soluble and very mobile, toxic to aquatic life and capable to impacts vegetation and wildlife. There is no natural process by which chlorides are broken down, metabolized, taken up, or removed from the environment. The transport of sodium (Na+) in environment is less prominent due to ion exchange. With consideration of the climate excessive use of ice breakers in the project area is not required.

The piers in Supsa river crossing may affect hydrology in the section of direct impact. The riverbed in the river crossing of Alternative 1, upstream and downstream of the new bridge is straight. Local change of the flow speed in the pier area will not result in significant bank scouring. Whereas Alternatives 2 and 3 are located in the sites where impact on riverbed is higher. The higher impact in this context means higher risk of turbidity increase in the Supsa river due to the washing away of the riverbanks downstream the ‘obstacle’. As mentioned earlier, in other river crossings there are no piers in the active riverbed.

According to the design team the 'load' of the new infrastructure of the ground will not result in change of the ground water level. Drainage system along embankment and a range of culverts are planned.

By impact on surface water quality and risk of littering all alternatives are similar.

Cross contamination of ground water is not expected.

The ranking of project impact on water flow and quality for considered alternatives is as follows:

- Sensitivity of receptor – high,
- Likelihood of impact – medium to high,
- Magnitude of impact - low to medium.

### 6.4.3. MITIGATION MEASURES

*Pre-construction and construction stages.*

In order to avoid or mitigate impact 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 localized 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 with secondary containment for possible spills for on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels and 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.
- 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.
- 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.
- In disturbed soil areas silt fence, fibber rolls, gravel bags, or other approved sediment control must be ensured. At a minimum, bare soil (whether it is 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;
- Due to the design solution direct discharge of the runoff in surface water is reduced to minimum;
- Management of material and waste will be carried out in compliance with the plan (waste management plan) developed by contractor;
- The area will be cleaned regularlu.

Responsibility for mitigation measures rests with the contractor.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low to negligible.

*Operation stage*

Most mitigation measures suggested for construction phase shall be applied to maintenance works. The measures required for each specific site will be specified with consideration of the scope/scale and type of maintenance and location of the site. 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

- Risk of emergency situations will be reduced tominimum through implementation of safety measures [World Bank funded project one of the component of which is technical assistance in development of road safety action plan 2016-2021];

- 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;
- Risk of pollution with poorly managed waste and material will be avoided by implementation ofmitigation measures defined for construction stage;
- Regulat cleaning of the road and roadside area will be ensured.

As mentioned above, in the long term propspective stricter regulations on age of vehicles and quality of fuel will be introduced. Consequently the level of pollution of the road runoff and respectively, the impact on environment will reduce.

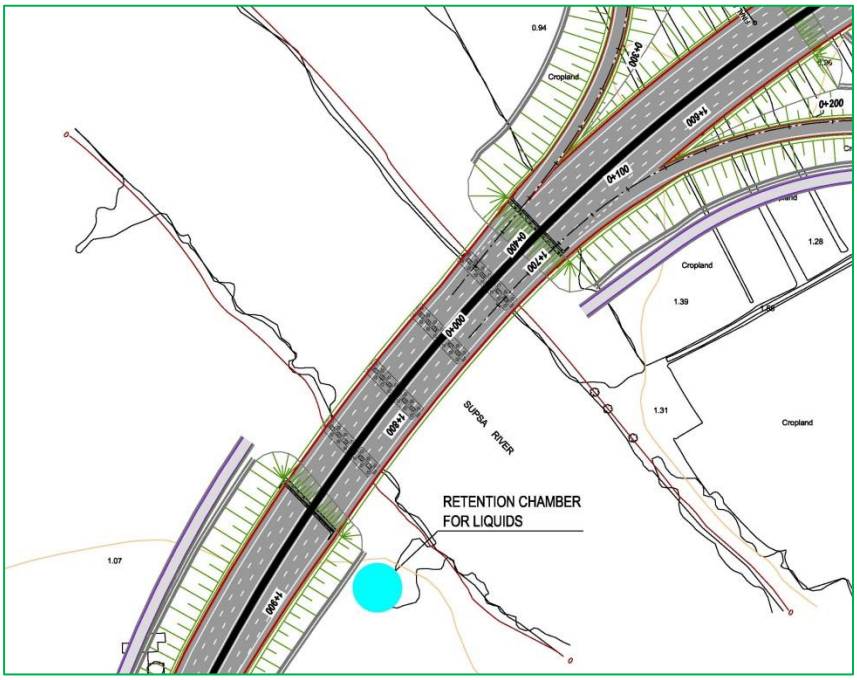



***Figure 62. Location of the retention chamber at Supra river bridge***

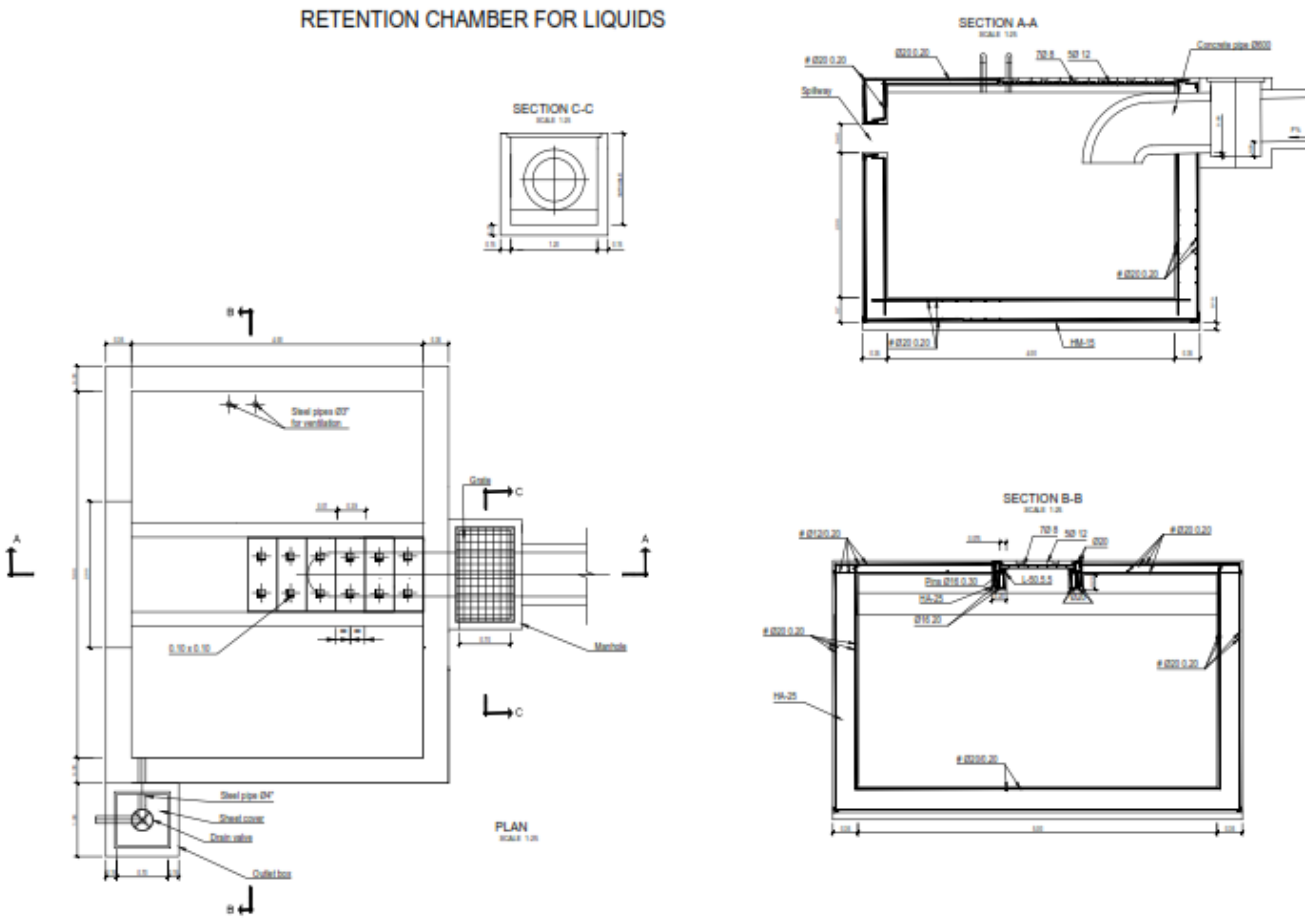



***Figure 63. Retention chamber: plant layout and section***

Prevention of pollution with spillage in case of a road accident. To protect water quality in case of accident and the subsequent possibility of spillage of hazardous substances, protection measures are considered.

Runoff waters and waters conducted by drainage will be collected and retained before discharge into the river/down the slope. Based on topography and relief, to assure the flow of waters from both sides of the structure, the area on the left side of the second abutment of the Supsa bridge (see ***Figure 62***) was selected for arrangement of retention chamber. The drainage system will collect runoff from the bridge diverting it to the chamber. The chamber (***Figure 63***)**)** is designed with consideration of capacity of a medium truck to cover average common situations.

The mentioned scheme will allow basic treatment of the runoff and enable retention and removal of spillage caused by a traffic accident.

Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

## 6.5. IMPACT ON FLORA AND FAUNA

### 6.5.1. ASSESSMENT OF IMPACT - PRE-CONSTRUCTION AND ROAD CONSTRUCTION STAGES

**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;
- Introduct of invasive species;
- Soil erosion triggered by removal of vegetation in road cuts that may lead to additional impact/loss of vegetation in adjacent to the cut areas;
- Sealing of soil surface reducing ‘availability’ of land for vegetation.

The project will affect farmlands and vegetation in the RoW.

Alignment alternatives cross forested areas, meadows and cultivated land. All alternative alignments are almost similar with the view of their impact on

vegetation/flora. Botanical survey has not revealed any protected tree species in the forested and other areas under the direct impact zone of considered alternative alignments. However, it should be mentioned that Alternative 1 in the section near the Supsa River (left bank of the river, near Supsa Terminal) runs close to the waterlogged area near the river delta. In existing river crossing, on the left bank of the Supsa river, and in the waterlogged areas in Shekvetili - Spring snowflake (*Leucojum vernum*) has been registered (see ***Figure 64***). The plant is not protected, but has decorative value and used to be harvested and sold, providing minor, but still, a certain source of income for local residents. The plant is found in damp woodlands, scrub, hedges and meadows over a range of altitudes. It is often found in hilly areas on calcareous soils.

Another plant worth to mention in this section and other areas cut up with the drainage canals is rare (IUCN_Critically Endangered category) freshwater species with fragmented population - Colchis Water-Chestnut (*Trapa colchica*). This species is endemic to the Kolkheti lowland and is mainly found in the Abkhazeti, Guria, Adjara and Samegrelo floristic regions. These two species are considered as requiring particular attention on pre-construction and construction stages.

In the forest areas species registered in the direct impact are represented mainly by Alder (*Alnus barbata*), lianas such as Perfoliate honeysuckle (*Lonicera caprifolium*), and Common ivy (*Hedera helix*), Silkvine (*Periploca graeca*) and Blackberry (*Rubus fruticosus*) bushes.

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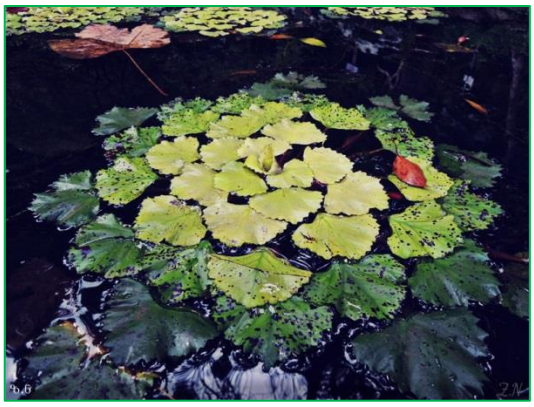
***Figure 64. Sensitive areas within the project region***



Water-Chestnut (*Trapa colchica*)

Spring snowflake (*Leucojum vernum*)

(Source of the photos – web)

Rough comparison of alternatives shows that the length of the forested area under the impact varies by alignment. The main difference between alternatives in observed in the starting section of alignment.

In this area impact of Alternative 1 on forested zone is higher. After Ureki towards the end of the road Alternatives 1 and 3 coincide having similar, lower impact on trees/bushes compared to Alternatives 2 which has higher impact, even though affected vegetation in mostly secondary, represented by alder trees and bushes. All alternatives have similar scale impact on Colchis Water-Chestnut.

**The project Alignment 1 will affect 14ha of the forested area.** The species composition of affected strip will be as follows:

**In the lowest sited humid section on the project corridor within the boundaries of alder dominating forest area (4 ha) mature and older than mature groves will be affected**. Maximum height of the alder trees reaches 15m, diameter at the chest level is up to 0.5-1m. Density of the forest massive low (0.3-0.4), degree of sheltering 31-40%, timber category - firewood. **During construction in this section 1000 Alder tree will be cut. Along with trees shrubs and hydrophilic grasses will be affected.**

**In 10 ha affected will be young alder boskets. Maximum height of the alder sprouts in this section is around 5m, stem width 3-5cm**. In the mentioned section of alignment natural forestation is in process.

Most of these areas used to be used for agricultural purposes. The mentioned neglected sections are being overgrown by fast and easily growing plants, in

particular – alder, blackberry, rush, greenbrier. Density of the forest in these areas is low (0.1-0.2), degree of sheltering 10-20%, timber category – firewood.

The areas free of vegetation are pastures, seldom plough lands.

In forest areas individual Manchurian walnut (*Juglans mandshurica*) trees (young) have been registered. Along the drainage canals along with trees hydroplylic grasses are found.

**In total, the new alignment will have impact on:**

- **60000 young alder trees,**
- **blackberry, rush, greenbrier and other water loving plants/grasses (affected area 2.5ha).**
- **pastures and plough land (affected area 3 ha).**

Tree felling in the project area is not expected to cause functional damage of ecosystem. Along with monetary compensation of loss, required under the national legislation, it is advisable to mitigate the impact by planting of the saplings of native species (see mitigation measures). However, first and foremost, unnecessary damage and removal of trees will be avoided to the extent possible. Access roads, the equipment/machinery stationing yard, and the camp (if any) must be established with maximum caution so as to preserve the vegetation/trees.

Compensatory tree planting 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.

The ranking of project impact on vegetation for considered alternatives is as follows:

- Sensitivity of receptor – high (in the area on the left bank of Supsa River marked as vulnerable (Alternative 1),

  - medium waterlogged areas where Water chestnut and Spring snowflake (Alternatives 1, 2 and 3) are found. Note: it is to mentioned that despite the overall sensitivity of the area on the left bank of the Supsa ranked as high (see above), within the RoW strip of Alignment 1 in the mentioned area no protected plant species have been registered),
- Likelihood of impact –high,
- Magnitude of impact – high (Alternatives 2) to medium (Alternative 1, 3).

**Fauna**

Construction and operation of highway in those sections which pass through transformed landscapes and cultivated lands will not cause significant impacts on animal life, as such areas do not support important animal species due to human presence and consequent significant permanent disturbance.

Hence, impacts on fauna are expected rather in the construction stage and will be considerably lesser in the operation stage. Expected impacts from the construction 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;
- Risk of injuries that may occur at night because of open trenches;
- Higher levels of disturbance and stress, including that related to noise;
- Barrier effect - reduced connectivity;
- Indirect impact from exhaust emissions and dust,
- Light pollution,
- Impact of on aquatic life because increased water turbidity (river crossings)
- Impact due to soil and/or water pollution with spilled fuel/oil, poorly managed waste.

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

The roads and excavated sites are considered as a barrier for mammals, reptiles and amphibians that might occur in the project area, both during pre-construction, construction and operation.

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 and construction sites. This is particularly important issue as the area is located within migration way of avian species.

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 cause siltation and increase water turbidity, which in its turn may lead to impact on macroinvertebrates and fish, result in siltation of the riverbed affecting quality of habitat and availability of food base for ichthyofauna. Heavy metals, oils, other toxic substances, spilles and debris from project related traffic can be absorbed by soil at the project sites and carried by runoff to the river.

All considered alignment alternatives cross Supsa, Sepa and Tskhaltsminda streams. The widest is the Supsa river crossing, where, depending on alignment arrangement of three (Alternative 2) or two (Alternative 1 and 3) rows of piers in the riverbed is planned.

Prior to commencement of works in the riverbed, the sheet piles will be installed to allow dewatering of the pier construction grounds. In this process works will inevitably result in temporary increase of water turbidity. Respectively impact on fish will occur. Since construction works will be carried out in dry environment impact on fish will be minimal. The flow in the riverbed will not be blocked. Fish migration/movement will not be hindered.

The scale of impact during construction will depend of the level of observance and implementation of water impact related mitigation measures and schedule of works. The risk of impact is assumed higher for Alternative 2 where three rows of piers are required, i.e. duration of works and risk of related impact on water environment is more likely.

With consideration of the presence ofprotected fish species in the river (see Section 5.2.2.2.) partuculat attention will be paid to water quality protection and planning works for period less sensitive for aquatic life.

All alternative alignments are almost similar with the view of their impact on terrestrial fauna. Marsh turtle (Emnus orbicularis, IUCN_NT) is widely met in waterlogged areas and ponds within the limits of the project area. Since similar habitats are present next to the project corridor the species,when encountered, must be relocated to safe areas outside the boundaries of the project impact zone.

Impact caused by poaching is ranked as low to negligible.

Pre construction and construction works are expected to have certain impact on birds. As mentioned above disturbance will be mainly due to noise, presence of people and machinery on the sites.

The survey has not revealed any protected species (aquatic, terrestrial) in the direct impact zone of the project alignment. During the walkover, no bat roosting places or bird nests have been registered within the direct impact zone of the project. In the project area predator birds chasing prey can be registered. The project area is not attractive for migrant birds.

The ranking of project impact on fauna in the project area for considered alternatives is as follows:

For aquatic fauna

- Sensitivity of receptor – medium (Alternative 1, 3) to high (Alternative 2),
- Likelihood of impact –medium to high (depending on location),
- Magnitude of impact - medium.

For terrestrial fauna

- Sensitivity of receptor – medium,
- Likelihood of impact –medium to high, depending of the section
- Magnitude of impact – medium to low, depending of the section.

### 6.5.2. ASSESSMENT OF IMPACT - ROAD OPERATION STAGE

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 ice-breaking salt and/or sand on vegetation and fauna, including aquatic, is not assumed to be high.

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.

Arrangement of passages for animals is envisaged. The structures include:

- Rectangle pipes 4m x 3m – for small and medium size animals and cattle;.
- Underpasses – for small amd medium size animals;
- Brisges over rivers, strems and local roads (can be used by animals of any size).

With consideration of structures arranged in every 1000, the road will not restrict free movement of small and medium size animals. Exceptions are two sections where connectivity betrween the sides is breached:

- Section between pk2+630 and pk 5+180 where connectivity is low
- Section between pedestrian crossing at pk +890 and rectabgle culvert (drainage pipe) at pk13+690 where connection is not available

The ranking of project impact on vegetation for considered alternatives is as follows:

For water fayna

- Sensitivity of receptor – high,
- Likelihood of impact– medium,
- Magnitude of impact – mesium.

Foe terrestrial fauna:

- Sensitivity of receptor– medium,
- Likelihood of impact– medium,
- Magnitude of impact - medium to low, depending of the section.

### 6.5.3. MITIGATION MEASURES

*Pre-construction and construction stages*

On pre-construction and construction stages the following measures for impact mitigation on the vegetation/flora are suggested:

- Strict keeping to the boundaries of RoW and operation area,
- Prohibition of shortcuts to avoid impact on the adjacent vegetation;
- Preservation of vegetation as much as feasible;
- Replacing Colchis Water-Chestnut (*Trapa colchica*) and Spring snowflake (*Leucojum vernum*) to similar area out of the project impact zone (see ***Figure 64***). Relevant plan and schedule must be developed and kept to;
- "Replacing' lost vegetation by triple amount of the same species replanted in the area (whether deemed advisable), maintenance of vegetation for 2 years minimum;
- Fencing critical root zone of the trees at the boundary with the project area;

- Waste management –regular clean up, management of waste with consideration of type and class of material
- Recultivation of disturbed sites after completion of works;
- Implementation of dust, water, soil, waste-related impact mitigation measures;
- Training staff in construction best practice.

Note: while planting 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.

Measures for mitigation of impact on fauna include:

- Preservation of vefetation as far as feasible;
- Adherence to no horn policy to avois disturbance of wildlife;
- Scheduling works to the season less sensitive for fauna. 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;
- Avoidance of construction in/near the riverbed in the fish spawning season (June-September);
- Monitoring of aquatic and water related species will be carried out. However, it is believed that though planning and proper management of works impact will be low and short term. Compensation measures will not be required, In river crossing sections and direct impact zone of the project burrows of water dependent specied have not been found;
- Implementation of measures set for mitigation of impact related to noise, air, water, soil, vegetation/flora and waste generation;
- 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.
- Marsh turtles registered in the project corridor should be relocated to similar area (pond, waterlogges area) otside the boundaries of the impact zine;
- Prohibition of poaching;
- Training staff in construction best practice.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low to medium, depending on location.

*Operation stage*

Impacts on flora and fauna during operation are reduced by

- Arrangement of barriers preventing cattle and animals from death caused by road mortality.
- Monitoring of road mortality in order to identify additional protection measures;
- Arrangement of passages to improve connectivity;
- Prohibition of direct discharge of untreated runoff into the river;
- Roadside waste collection and regular clean up (sweeping) of the road;
- Preservation of roadside vegetation.

Barrier effect will be avoided by mitigation measures considered in design – the passages (box culverts 4mx3m and 2mx2m) allowing connectivity/link between the area bordering to the both sides of the carriageway. (see Table below showing the general overview of the permeability of the new road).

As well, some recommendations are given in the table, when convinient, regarding the possibilities to adequate the entrances of the structures to facilitate the permeability and to implement landscaping works under bridges.

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

Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

| ELEMENT | | | | | | DISTANCE | | | | RATES | | REMARKS / RECOMMENDATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | N° | TYPE | SIZE | LENG. (m) | Total | Signif. | Partial | Signif. | Section | Aperture ratio (AR) | |
| Start | 0+000 | | | | | | | | | | | |
| Drain | 0+425 | 1 | B-C | ( 3,0 x 2,0 ) m | 50 | 425 | | | | 6,00 | 0,120 | Landscaping |
| Drain | 0+465 | 1 | B-C | ( 3,0 x 2,0 ) m | 50 | 40 | | | | 6,00 | 0,120 | Landscaping |
| Drain | 1+125 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 660 | x | | | 4,00 | 0,080 | |
| BR | 1+680 / 1+845 | | | Bridge | 165 | 555 | x | 1.680 | x | | >1 | restoration under viaduct deck |
| BR | 2+540 / 2+630 | | | Bridge | 90 | 695 | x | 695 | | | >1 | restoration under viaduct deck |
| UP | 2+800 | | | Bridge | 50 | 170 | | 170 | | | >1 | restoration under viaduct deck |
| UP | 2+960 | | | Bridge | 50 | 160 | | 160 | | | >1 | restoration under viaduct deck |
| Drain | 4+150 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 1.190 | xx | | | 4,00 | 0,080 | |
| UP | 4+180 | 1 | B-C | ( 4,0 x 2,5 ) m | 40 | 30 | | | | 10,00 | 0,250 | landscaping at entrances |
| BR | 5+180 / 5+200 | | | Bridge | 20 | 1.000 | xx | 2.220 | xx | | >1 | restoration under viaduct deck |
| UP | 5+700 | | | Bridge | 40 | 500 | x | 500 | | | >1 | restoration under viaduct deck |
| Drain | 5+732 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 32 | | | | 4,00 | 0,080 | |
| Drain | 5+934 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 202 | | | | 4,00 | 0,080 | |
| Drain | 6+545 | 1 | B-C | ( 1,5 x 1,0 ) m | 50 | 611 | x | | | 1,50 | 0,030 | |
| Drain | 7+000 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 455 | | | | 4,00 | 0,080 | |
| BR | 7+080 / 7+120 | | | Bridge | 40 | 80 | | 1.380 | x | | >1 | restoration under viaduct deck |
| BR | 7+645 / 7+685 | | | Bridge | 40 | 525 | x | 525 | | | >1 | restoration under viaduct deck |
| UP | 7+890 | 1 | B-C | ( 4,0 x 2,5 ) m | 40 | 205 | | | | 10,00 | 0,250 | landscaping at entrances |
| Drain | 7+935 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 45 | | | | 4,00 | 0,080 | |
| Drain | 8+850 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 915 | x | | | 4,00 | 0,080 | |
| Drain | 9+055 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 205 | | | | 4,00 | 0,080 | |
| Drain | 9+290 | 1 | B-C | ( 1,5 x 1,5 ) m | 50 | 235 | | | | 2,25 | 0,045 | |
| Drain | 10+125 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 835 | x | | | 4,00 | 0,080 | |
| Drain | 10+410 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 285 | | | | 4,00 | 0,080 | |
| Drain | 10+945 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 535 | x | | | 4,00 | 0,080 | |
| Drain | 11+795 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 850 | x | | | 4,00 | 0,080 | |
| Drain | 12+450 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 655 | x | | | 4,00 | 0,080 | |
| Drain | 12+850 | 1 | B-C | ( 2,0 x 2,0 ) m | 50 | 400 | | | | 4,00 | 0,080 | |
| Drain | 13+155 | 1 | B-C | ( 1,5 x 1,5 ) m | 50 | 305 | | | | 2,25 | 0,045 | |
| Drain | 13+690 | 1 | B-C | ( 4,0 x 3,0 ) m | 50 | 535 | x | | | 12,00 | 0,240 | landscaping at entrances |
| End | 14+470 | | | | | 780 | x | 6.785 | xx | | | |

B-C: Box-Culvert
BR: Bridge
UP: Underpass

Key: Lenth. For box-culverts and underpasses, means the transverse lenth; for bridges means the lenth between abutments; Total Distance. One “x” points out a range of distance between 500 and 1.000 meters; two “xx” remarks a range from 1.000 to 2.000 meters; Partial Distance. One “x” points out a range of distance between 1.000 and 2.000 meters; two “xx” remarks a range over 2.000 meters.

## 6.6. ASSESSMENT OF IMPACT ON PROTECTED TERRITORIES AND CRITICAL HABITATS

There are no protected areas and/or critical habitats in the direct impact zone of the Grigoleti-Kobuleti alignment. The string section of alignment is located at around 2 km distance from the boundary of protected area (Kolkheti National Park=Ramsar site=Emeralf network candidate site).

The area is developed (see Figure below) and differs from the habitats in the limits of protected and can not e considered as  valuable for any species met in protecet area

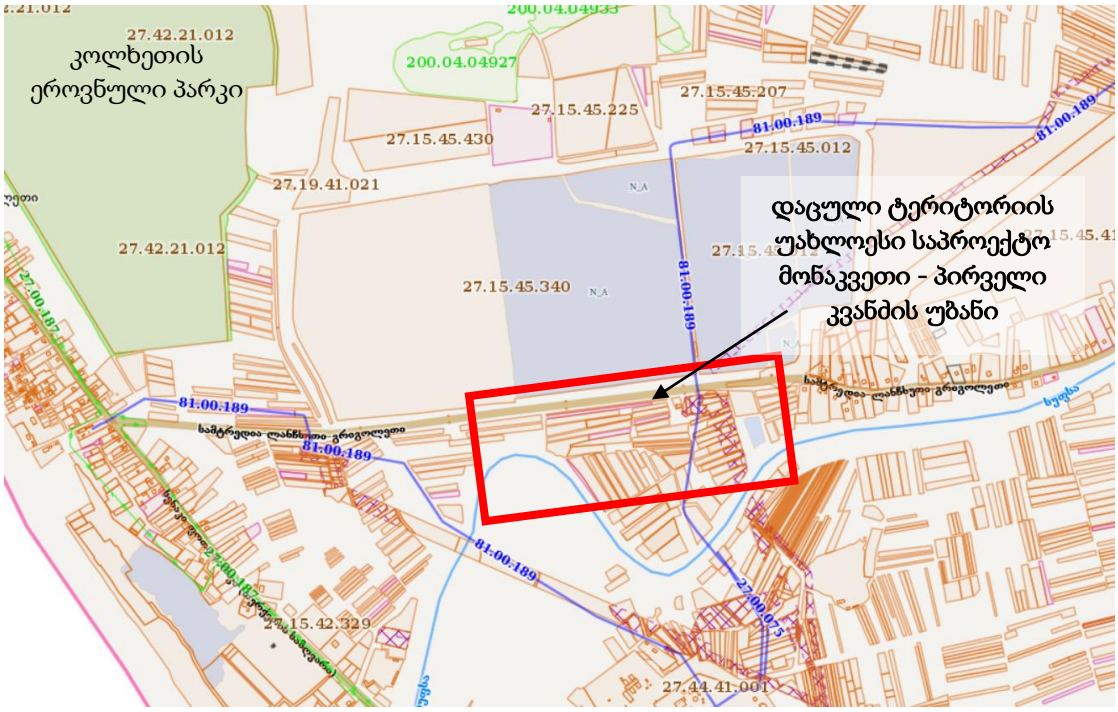



***Figure 65. Project area (first interchange) closest to Kolkheti National Part***

## 6.7. IMPACT ON SOILS/LAND

### 6.7.1. ASSESSMENT OF IMPACT - PRE-CONSTRUCTION AND CONSTRUCTION STAGES

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; 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.

The topsoil can be lost/degraded if not stripped prior to the construction, or if mixed with subsoil. Impact on soil productivity outside the RoW may result from excessive ramming. (According to the engineering survey in the area the topsoil depth is around 30cm). The impact on soil is commensurate to the length of alignment. Total volume of topsoil removed from the project area for Alternative 1 will be around 4233m3. For Alternatives 2 and 3 the volume will be less.

Site for temporary storage of the topsoil must be selected with due regard to environmental morms and conditions on the sites. The area must be flat, located away from any surface water body, must be protected from runoff and aeolean erosion. Potential sites are indicated on the map.The areas are located in the boundaried of the buffer zone and are sufficient for this purpose, Location of topsoil storage sited will be specified by construction company.

With consideration of the floor space of the sites suggested for stationing of machinery and topsoil/material storage the areas are sufficient for accommodation of the topsoil stripped from the area. All three sites are easily accessible from existing road. This allows avoiding unnecessary additional impact related to construction of any temporary access.

Other sources of impact on soil quality are poorly managed waste (both solid and liquid), spilled fuel/oil.

Respectively, impact of Alternative 1 on topsoil will be slightly higher compared to Alternative 2, while for Alternative 3 it will be the lowest. However, the impact is conventional as the topsoil removed from the RoW will be reintroduced to remediate effect of temporary works after completion of construction activities.

Despite of the lowest length of Alternative 3 the risk of impact on soil for this alignment is expected to be higher. In the section after Ureki, from the E-70 crossing towards the end of alignment Alternative 3 runs through the area dissected by drainage canals. Therefore in case of accidental soil pollution the risk of spreading of the impact 'along' the canals and contamination of the clean areas exists.

The ranking of project impact on soil/land for considered alternatives, depending on the section of alignment is as follows:

- Sensitivity of receptor – medium,
- Likelihood of impact – medium,
- Magnitude of impact – low to medium, depending on the area.

### 6.7.2. ASSESSMENT OF IMPACT - ROAD OPERATION STAGE

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.

Use of ice breaking salt may lead to increase of siudiun and chlorine ions in surface runoff and, respectively, in the soils. This will affect ion exchange process, reduce water permeability and aeration ability, increase alkalinity. With consideration of climate conditions in the project area the need in use of ice-breaking materials is rather low. .

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 rising and education of the community may 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 will be avoided. Phytoremediation may be considered as a measure for reduction of soil contamination.

For the area south to the Supsa River historically terrain uplift trend is observed. Minor impact of Supsa river level increase is sometimes registered in the river delta area. No flooding related impact on alignments under consideration is expected.

Implementation of protection measures is not required. The drainage design implies the runoff of the future highway will improve compared to the current situation of the existing road. In addition, the material that will form the embankment will be properly selected according to international standards and consistently compacted to assure that if any possibility of flooding processes in the basement occurs, the embankment will remain unchanged and steady.

As mentioned above impact of Alternative 2 on soil quality is ranked as high with consideration of peculiarities of the area. Impact of Alternatives 1 and 3 are almost similar.

The ranking of project impact on soil/land for considered alternatives, depending on the section of alignment is as follows:

- Sensitivity of receptor – medium,
- Likelihood of impact – medium,
- Magnitude of impact – low to medium dependim .

### 6.7.3. MITIGATION MEASURES

*Pre-construction and construction stages*

In order to avoid or mitigate 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 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 must be properly designed/shaped and managed;[7], – stability of the stockpile will be achieved through preservation of 'safe' slope inclination and diversion of runoff from the area;
- Topsoil and subsoil must be stored separately until reuse;
- 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 strict keeping to temporary roads, camp/operation ground boundaries;
- Disturbed vegetation must be replanted immediately after the construction/disturbance stops;
- Any temporary fuel tank (if contractor decided to have small stock of fuel on the site) shall be placed in a covered area with berms or dikes to contain any spills. Any spill shall be immediately contained and cleaned up with absorbent material;
- 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;
- The site will be cleaned regularly, littering will be prohibited;

[7] 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. 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.

- Waste collection area will 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;
- Discharge of effluents into the water bodies 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 or waterlogging. It is advisable not to drain water to the area where crops are cultivated.
- Adequate training on environmental protection and safety shall be provided to the staff;

Under condition that mitigation measures are implemented the magnitude of residual impact will be low .

*Operation stage*

- Awareness raising and education of community on waste management (no fly tipping);
- Maintenance and clean up the drainage system to prevent impact on erosive sliding of the soil or flooding;
- Use of phytoremediation may be considered as a measure for reduction of soil contamination.

Under condition that mitigation measures are implemented the magnitude of residual impact will be low.

## 6.8. LANDSCAPE AND VISUAL IMPACT

### 6.8.1. ASSESSMENT OF IMPACT – PRE-CONSTRUCTION AND ROAD CONSTRUCTION STAGES

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’.

Landscape visual impact will also be due to topsoil/material storage areas. By the end of works it is assumed that surplus material (if any) and topsoil are fully removed from the area.

Special attention must be paid to the need for recultivation of all disturbed areas (including borrow pits/quarries in case contractor obtains a short-term licence) 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 Environment Protection Oversight of MENRP.

In the section near Supsa Terminal, visual impact of construction works for Alternative 1 will slightly exceed that of Alternative 2 and 3. In Ureki-Magnetiti section Alternative 2 runs closer to residential area, so works will be more visible for the residents and travellers. In section from Supsa till Ureki impact of Alternatives 1 and 3 will be smaller.

The impact during pre-construction and construction will be unavoidable, though short term (restricted to duration of construction), local and reversible.

The ranking of visual/landscape impact of considered alternatives is as follows:

- Sensitivity of receptor – medium,
- Likelihood of impact – medium to high,
- Magnitude of impact – low to medium, depending on location.

### 6.8.2. ASSESSMENT OF IMPACT - ROAD OPERATION STAGE

When in place, the new alignment will change the landscape substantially. In some sections of alignment the road will be completely new structure in flat landscape. So, visual impact related to it will be significant.

The main recipients of impact will be local residents, travellers, commuters using the road. 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. With time, as community gets accustomed to the new infrastructure, visual discomfort related to the change will diminish. Therefore the magnitude of will become low to negligible.

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.

Equally for all alternatives the impact will be unavoidable. Mitigation measures will reduce impact to some extent, however the impact will be significant. In the section near Supsa Terminal, visual impact of Alternative 1 will slightly exceed that of Alternative 2 and 3 in the same section. In Ureki-Magnetiti section Alternative 2 runs closer to residential area, so the new infrastructure will be more visible. In section from Supsa till Ureki impact of Alternatives 1 and 3 will be smaller.

The ranking of visual/landscape impact of considered alternatives depending on the section is as follows:

- Sensitivity of receptor – medium to low, depending on location
- Likelihood of impact –high,
- Magnitude of impact –medium (with time, as community gets accustomed to the new infrastructure, visual discomfort related to the change will diminish.)

### 6.8.3. MITIGATION MEASURES

*Pre-construction and construction stages*

- Visual impact of construction works will be mitigated by keeping to the boundaries of the worksites and traffic routes; preservation of vegetation; clean up and good management of construction sites and camp (if any); timely removal of waste from the area (according to the waste management plan);
- Using 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 recultivation plan - landscape planting.
- Preservation of vegetation from non-deliberate damage – achievable by keeping to the boundaries of the work areas and travel routes.
- Implementation of soil, vegetation impact mitigation measures;
- According to project, design and colour of noise barriers are selected so reduce visual impact.

Under condition that mitigation measures are implemented the magnitude of residual impact will be low to medium.

*Operation stage*

- Clean up of the road and adjacent area;
- Preservation/maintenance of roadside vegetation to shield the visual change in the landscape related to the new infrastructurel
- During road and infrastructure maintenance implementation of mitigation measures set for pre-construction/construction stage.

## 6.9. WASTE MANAGEMENT

### 6.9.1. WASTE: PRE-CONSTRUCTION AND ROAD CONSTRUCTION STAGES

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

Inert waste (earth, soil) do not decompose or produce leachate or other products harmful to the environment. Recyclable materials include but are not limited to cardboard, gravel, excavated soil (uncontaminated), green waste, wood/lumber, limited amount of scrap metal.

To prevent the impact of the waste generated during construction on environment it must be collected and temporarily placed in the selected area with consideration of requirements applicable to each waste stream. 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).

All 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 construction will be collected and delivered to the nearest landfill under the contract with the Solid Waste Management Company of Georgia.

Contractor will be obliges to provide waste management plan tailored to the work schedule and waste streams. The list of possible waste streams is given below:

***Table 59. Information on waste stream generated furing implementation of the project***

| Code | Waste material | Description | Approximate quantity | Characteristics of hazardous waste |
|---|---|---|---|---|
| 08 01 11* | Waste paints that may contain organic solvents or other hazardous subtances | Liquid | 1650 -2000kg | H3B – ignitable; H5 – harmful |
| 08 03 17* | Printer tonners/ink waste | solid | 3-6 kg | H5 – harmful |
| 13 02 08* | Oils and oily lubricants | Liquid | 120-150 kg | H3B – ignitable; H5 – harmful |
| 15 02 02* | Absorbents, overals and rags, contaimated with hazardous matter | solid | 50-70 kg | H3-B - ignitable H5 - harmful |
| 16 01 03 | Waste tyres | solid | 3000 -3500 kg | - |
| 16 01 07* | Oil filters | solid | 20-25kg | H5 - harmful; H15 |
| 16 01 11* | Braked that contain asbestos | solid | 50-70 kg | H7 - carcinogenous |
| 16 06 01* | Lead containing batteries | solid | 360-450 kg | H6 – toxic H15 |
| 17 04 07 | Metals (mix) | solid | 500-1000 kg | - |
| 20 03 01 | Mixed municipal waste | solid | 225 kg | - |

*Note: since there are no landfills for hazardous waste available in Georgia,waste must be handed over to authorized contractor for utilization.*
*The quantities indicated in the table will be specified bv contractor during preparation of waste management plan*

Since Georgia has no infrastructure for the final disposal of hazardous waste, such waste generated during construction works 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 inert waste materials that may be used for the project must be reused on the site, residues should be disposed at the nearest landfill. (The closest to the site municipal landfills are in Ureki, Ozurgeti and Lanchkhuti.). Material stock will be managed so to avoid accumulation of surplus on the site.

Quantity and type of waste generated during construction will be the same for all considered alternatives. The ranking of project impact related to generation of waste is as follows:

- Likelihood of impact –medium,
- Magnitude of impact - low.

### 6.9.2. WASTE: ROAD OPERATION STAGE

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.

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

The ranking of project impact related to generation of waste is as follows:

- Likelihood of impact – low to medium,
- Magnitude of impact - low to medium, depending on location.

### 6.9.3. MITIGATION MEASURES

*Pre-construction and construction stages*

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.

Until removal from the site waste will be stored with consideration of requirements listed above. The main principles can be summarized as follows:

- The site should be located not closer than at 100m distance from the surface water body
- Waste will be sorted on source to separate recyclable/reusable material;
- Household waste will be collected in containers fitted with lids to avoid attraction of scavengers, scattering around. The lid will alos protected waste from rain and snow;
- Household waste will be removed to the nearest landfill under agreement with Solid Waste Management Company of Grotgia . If instead of the camp accommodation will be hired in the nearest settlements – waste will be disposed together with municipal waste accumulated there;
- Cut wood will be managed in compliance with the law on state property. Felt trees will be places in the agreed area. Handover certificated will be prepared;
- On the site allocated for temporary, short term keeping of hazardous wats the following safety measures will be kept to:
    - Containers suitable for each tyoe of waste will be provide
    - Use of damaged containers will be prohibited. Integrity will be regularly checked.
    - Containers will be marked adequately;
    - Cnatiners/the area will have secondary containment,
    - Various waste streams will nt be mixed.
- Hazardous waste will be removed-treated by authorisd contractoe based on agreement;
- Small scale spills will be handled onsite – for clean up biodegradation/bioremediation used;
- In case of large scale spills (that is less likely to happen) the spill will be lokalised, contaminated material excavated and removed by licenced

contractor for remediation. New, clean soil will be introduced area recultivated.
- Staff will be trained in waste management issues.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low.

*Operation stage*

- 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
- Install banners with the message that littering is not acceptable action. 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.
- Provide clean up.

Under condition that mitigation measures listed above are implemented the magnitude of residual impact will be low.

## 6.10. SOCIO-ECONOMIC IMPACTS

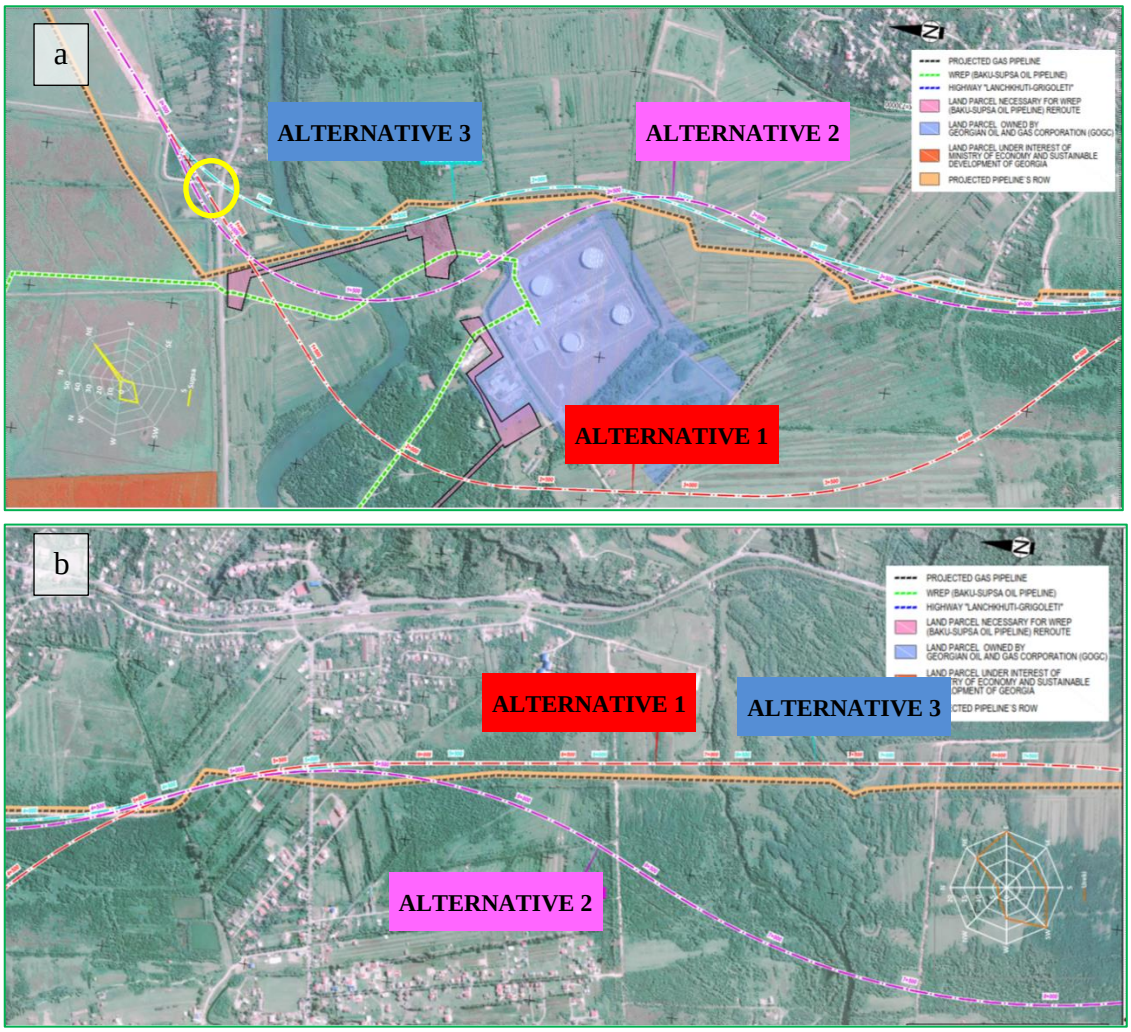
The project will have positive impact on Georgia's economy on the global scale. Modernization of the highway, as a part of the program to upgrade the major roads of the country launched by the Government of Georgia will contribute to improvement of transportation and transit of goods to surrounding countries,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

### 6.10.1. ASSESSMENT OF IMPACT – PRE-CONSTRUCTION AND CONSTRUCTION STAGES

Pre-construction and construction will have both, negative and positive impact on community. Negative impacts on community during construction will be limited to duration of construction works, mainly reversible and local. Resettlement and land acquisition issues are to be mentioned separately (see RAP report).

Certain negative impact during construction will be related to dust, noise and temporary restriction of free movement due to the project activities.

Dust, emission, noise and vibration. With consideration of prevailing direction of wind (see **Figure 66** a -d), impact on community may occur in most of the sections. In some areas alignment alternatives coincides, so distance from the axles of alternatives to the residential area is the same. In the starting section of alignments differ. Alternative 1 bypasses Supsa Terminal from the west, running close to Supsa, whereas Alternatives 2 and 3 bypasses the terminal from the east at a distance from residential area. In this section risk of noise and vibration on community will be higher, while the risk of impact of Alternatives 2 and 3 will be similar and lower. Up to Ureki all alignments coincide – impact is similar. After Ureki, Alternative 2 deviates to the west and goes closer to Magnetiti. The length of the section of Alternative 2 running close to the settlement exceeds that for Alternatives 1 and 3.



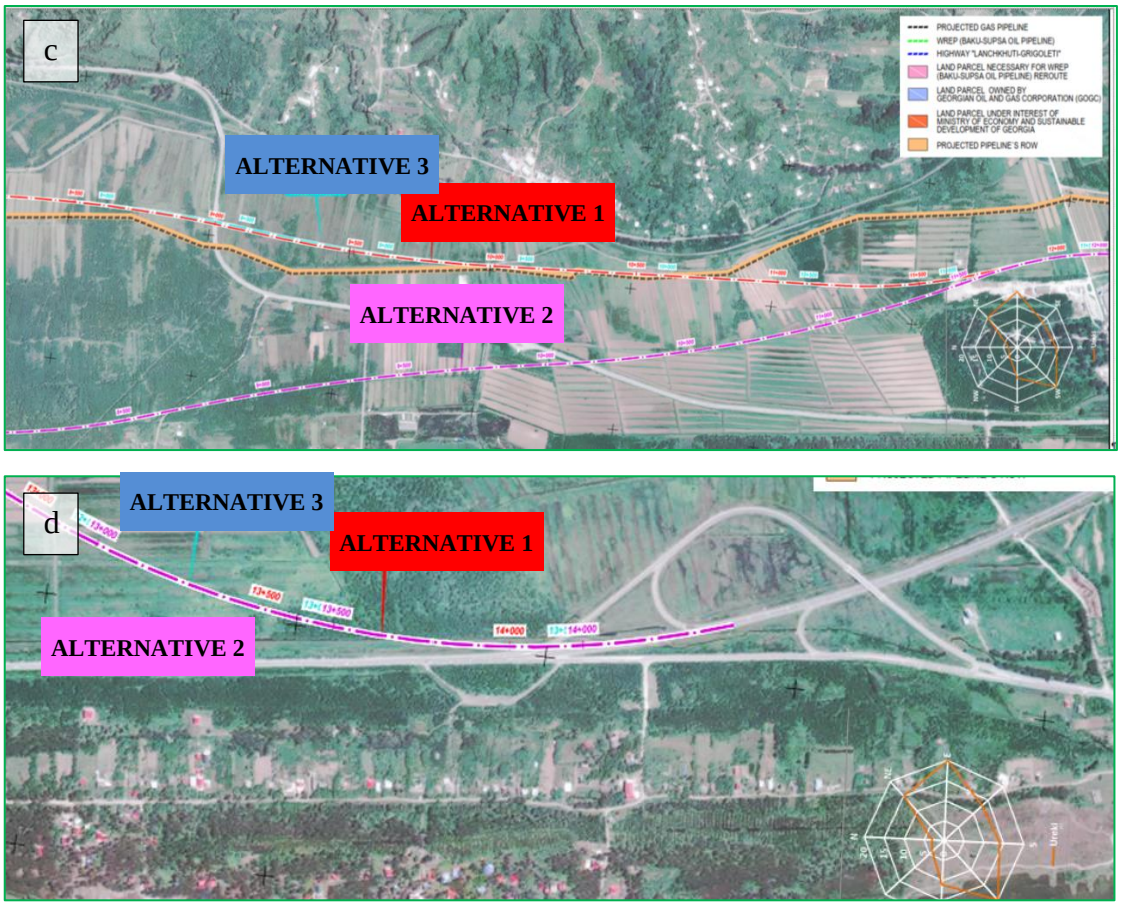



***Figure 66. Layout of alternatives with indication prevailing wind directions***

Respectively from the view of the scale of noise and vibration related impact alternatives slightly differ. Impact for all alternatives is ranked as medium, except for several sections where allowable limits will be exceeded (see Section 6.3).

Vibration impacts are expected to be felt only locally near construction sites and are not expected to have negative impacts on residents. As mentioned in Section 6.3 status of the houses near construction site will be checked to avoid unjustified claims related to damage of properties caused by the project. All legitimate claims will be satisfied.

<u>Disturbance of traffic.</u>

Disturbance of background traffic is not expected and can be avoided by implementation of traffic management plan and works schedule.

<u>Temporary employment</u>

Negative impact during construction can be due to failed expectations of employment for local resident. Contractor will be encouraged to employ local residents as far as feasible. The more so as unskilled labour force is available on site.

Gender issues

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 businesses

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.

*Cultural heritage and the sites of special importance*

There are no architectural or cultural heritage or sites of specific interest/importance sites along alternative alignments. However, it is to be mentioned that after crossing the Supda river the highway (Alternative 1) will overpass small abandoned cemetery (pk 2+560). During the field surveys the area was studied thoroughly. Each tomb within the boundaries of the mentioned abandoned cemetery was registered. According to the project none of the bridge piers are to be located in cemetery area. Construction works in this boundaries of the site are not planned. Prior to commencement of works cemetery area will be fenced to avoid any undeliberate damage. .

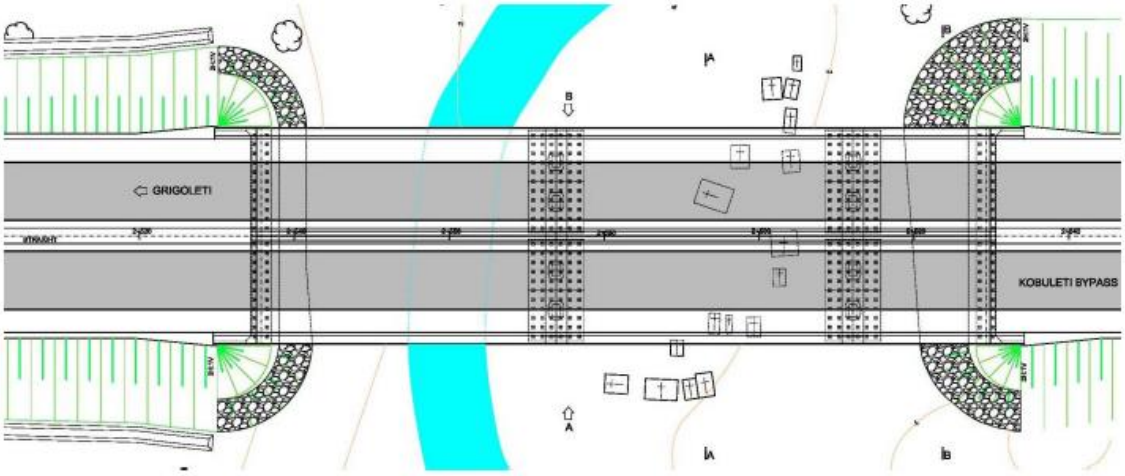



***Figure 67. Crossing over abandoned cemetery near the Supsa river***

With consideration of the fact that the region is rich in archaeological heritage, chance find procedure must be put in place. (outline of the Chance Find procedure is enclosed – see Annex vol 1, 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.

*Infrastructure*

Affected infrastructure in the RoW of the new alignment includes:

***Table 60. Infrastructure under the impact of the project***

| Description | **Qty.** |
|---|---|
| Water | 813 m |
| Transmission lines | 6,997 m |
| Streetlights | 1,042 m |
| Fibre optic communication | 3,028 m |
| Gas and oil | 1,877 m |

Relocation or reinforcement of this infrastructure is part of the project. The issue has been agreed with utility owners/operators.

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, information about any temporary disruption of services (water supply, gas, other) and duration of such inconvenience will be provided to residents in advance.

Resettlement and land acquisition

The survey revealed that from pk0+000 up to the end of alignment alternatives will affect:

***Table 61. Affected land and houses(all alternatives)***

| | **Affected land area, $m^2$** | **Number of houses, units** |
|---|---|---|
| Alternative 1* | 777,883 | 14.00 |
| Alternative 2 | 700,130.00 | 20.00 |
| Alternative 3 | 565,968.00 | 10.00 |

* value, verified based on site survey

From the view of the need of physical resettlement, related costs and amount of compensation required for impact of Alternative 2 will be the highest. Assessment of resettlement needs revealed that impact of Alternative 1 is the lowest.

Issues related to the involuntary resettlement, including land take, are covered under the RAP. Draft resettlement action plan is submitted as a separate document. Right to compensation is granted to all PAPs within the resettlement corridor, but the type of the compensation will be determined according to their legal status. Individuals, who have registered property, will receive the compensation for all types of impact. Compensation packages are shown in **Table 62**.

The ranking of impact on community for all alternatives depending on the section is as follows:

- Sensitivity of receptor – high,
- Likelihood of impact – high, medium to low, depending on location;
- Magnitude of impact
    - Noise, dust, emissions – medium (for all alternatives in the sections running near the residential areas);
    - Visual - (with time, as community gets accustomed to the new infrastructure, visual discomfort related to the change will diminish.);
    - Resettlement – high (Alternative 2), medium (Alternative 3), low (Alternative 1);
    - Cultural heritage - no impact;
    - Infrastructure – medium to high.

.

***Table 62. Compensation packages***

| Type of Loss | Application | Definition of AH/APs | Compensation Entitlements |
|---|---|---|---|
| **Land** | | | |
| Permanent loss of agricultural land | AP losing productive land regardless of impact severity | Registered Owner: | Cash compensation at full replacement cost. If the residual plot becomes unviable for cultivation, the project will acquire it if the owner so desire. |
| | | Lawful Owner: | The ownership rights of these APs will be recognized, the land registered in NAPR and the APs provided with cash compensation at full replacement cost. |
| | | Unlawful owners | One time minimum subsistence allowance in cash for 12 months |
| Non-Agricultural Land | AP losing their commercial/ non-agricultural land | Registered Owner: | Cash compensation at replacement cost or through replacement land equal in value to plot lost and at location acceptable to APs. The cash option has been selected for this project. |
| | | Lawful Owner: | The ownership rights of these APs will be recognized, the land registered in NAPR and the APs provided with cash compensation at full replacement cost. |
| | | Unlawful owners | One time minimum subsistence allowance in cash for 12 months |

| | | | |
|---|---|---|---|
| **Buildings and Structures** | | | |
| Residential and non-residential structures/assets | | All AHs regardless of their legal ownership/ registration status (including unlawful owners) | Cash compensation for building/structures losses at full replacement costs free of depreciation and transaction costs |
| **Loss Of Community Infrastructure/Common Property Resources** | | | |
| Loss of common property resources | Community/Public Assets | Community/Government | Reconstruction of the lost structure in consultation with community and restoration of their functions |
| **Loss of Income and Livelihood** | | | |
| Crops | Standing crops affected or affected agricultural land, used permanently for crop cultivation. | All APs regardless of legal status (including unlawful) | Crop compensation in cash at market rate by default at to gross crop value of expected harvest. |
| Trees | Trees affected | All APs regardless of legal status (including unlawful) | Cash compensation at market rate on the basis of type, age and productive value of the trees. |
| Business/Employment | Business/employment loss | All APs regardless of legal status | *Owner:*<br>1) Permanent impact: cash indemnity of 1 year net income or in the absence of income proof, One time minimum subsistence allowance in cash for 12 months;<br>2) Temporary impact: cash indemnity of net income for months of business stoppage. Assessment to be based on tax declaration or, in its absence, |

| | | | |
|---|---|---|---|
| | | | minimum salary.<br>*Permanent worker/employees*: indemnity for lost wages equal to One time minimum subsistence allowance in cash for 3 months. |
| **Allowances** | | | |
| Severe Impacts | >10% income loss | All severely affected AHs including informal settlers | One time minimum subsistence allowance in cash for 3 months |
| Relocation/Shifting | Transport/transition costs | All AHs to be relocated | An allowance covering transport and livelihood expenses for the transitional period. |
| Vulnerable People Allowances | | AHs below poverty line, headed by Women | One time minimum subsistence allowance in cash for 3 months and employment priority in project-related jobs where feasible |
| Temporary impacts during construction | | All APs | Due compensation to be assessed and paid when the impacts are identified based on the above provisions. |

### 6.10.2. ASSESSMENT OF IMPACT - ROAD OPERATION STAGE

In some sections where the road will cross arable land plots, faster traffic on the highway and presence of the median barriers may 'disconnect' the right and the left side properties. In case the new highway dividing original plot makes part of it unusable this section will also be acquired. In some sections where the road will cross arable land plots, the highway will 'disconnect' the right and the left side properties. 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 and/or the need for installation of cattle passages sand new culverts are 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, noise 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.

On the other hand 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.

There is no risk of impact on cultural heritage and infrastructure during operation.

Impact during operation on local community under condition of proper design of the road infrastructure and adequate compensation of the loss/damage of properties will be medium.

The ranking of impact on community for all alternatives depending on the section is as follows:

- Sensitivity of receptor – high,
- Likelihood of impact – high, medium to low, depending on location
- Magnitude of impact
    - Noise, dust, emissions – medium (for all alternatives in the sections running near the residential areas); high (for residential houses closest to the road);
    - Visual –medium or low (with time, as community gets accustomed to the new infrastructure, visual discomfort related to the change will diminish.);

- Cultural heritage - no impact;
- Infrastructure – no impact.

### 6.10.3. MITIGATION MEASURES

***Pre-construction and construction stages:***

- Keeping to the measures suggested for noise, air quality, vegetation impact reduction.
- Development and implementation of Resettlement Action Plan;
- Development and keeping to the Chance Find Procedure;
- Development and communication of external grievance mechanism;
- Development and implementation of Stakeholder Engagement Plan;
- Development and implementation of Traffic Management, Waste Management plans;
- Addressing employment issues carefully, keeping information transparent;
- Encouraging employment of local residents as far as feasible;
- Encouraging employment of women;
- Informaing community on works schedule;
- Keeping to the work hours. In case longer hours are required – informing community about duration of these works;
- Keeping to the optimum speed when crossing the residential areas;
- Installation of warning signs, fencing hazardous areas;
- Informing community about the possible restriction of services (water, power supply) and duration of disruption;
- Provision of alternative access roads – if exiting ones are temporarily not available for pedestrian and traffic (including non-motorized);
- Installation of warning signs and barriers, wherever appropriate.

***Operation stage***

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

- Installation of signs, barriers to reduce access of pedestrians to the carriageway;
- Ensuring maintenance and cleanness of cattle passages and routes for non-motorized transport and pedestrians;
- Implementation of grievance procedure;

- Implementation of dust, emissions, noise and vibration reduction/mitigation measures;
- Maintenace of the roadside vegetation;
- Regular clean up.

Part of the above listed mitigation measures are included into the design (passes, junctions), some are subject to the restoration of livelihood as part of Resettlement Action Plan (alternative employment), and others are subject to the Road Safety Action Plan of RD (signage, barriers).

## 6.11. OCCUPATIONAL HEALTH AND SAFETY

Construction phase

Main impacts on workers during construction are related to operation of heavy machinery, traffic accidents, work on height, near and over water (bridges, overpasses), noise (most of the road construction activities will result in noise levels exceeding 85 dBA) and vibration. People working at the construction sites will be exposed to elevated noise and vibration levels. Most of the road construction activities will result in noise levels exceeding 85 dBA.:

Health and safety impacts for all considered alternatives are of the same scale and type.

The ranking of impact of considered alternatives is as follows:

- Sensitivity of receptor – high,
- Likelihood of impact – medium to low, depending on location;
- Magnitude of impact – low to medium, depending on location .

### 6.11.1. MITIGATION MEASURES

To mitigate impact on health and safety of the workforce it will be necessary to:

- Ensure proper maintenance of vehicles and machinery;
- Inspect machinery prior to use to ensure it is in safe condition;
- Check the machine perimeter before moving to exclude any possibility of collision with people/objects;
- Use seat-belts while operating machine;

- Prohibit leaving machinery unattended with engine running;
- Preserve safe speed;
- Assign designated spotter, if backing is required, to guide the move. (Note: The spotters must wear high-viz vests and stay in sight of the driver. The driver must stop if he loses sight of the spotter.);
- Ensure compliance with work on height safety measures;
- Provide adequate on site First Aid Boxes and treatment facilities;
- Provide and enforce use of PPE and safety gear during works on height and elsewhere as appropriate. This includes use of hearing protective devices capable of reducing sound levels at the ear to at least 85 dBA;
- Control 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, through the choice of equipment, installation of vibration dampening pads or devices, and/or limiting the duration of exposure (EHS Guidelines, 2007);
- Prohibit alcohol use;
- Prohibit mobile phone while driving;
- Train drivers and other personnel;

## 6.12. CUMULATIVE IMPACT

The project area is rural. The only sources of nuisance/impact are railway, road itself and Supsa Terminal. No other existing or planned projects or sources capable to add to the impact of this project are known. No cumulative impact is therefore expected.

# 7. ANALYSIS OF ALTERNATIVES AND IDENTIFICATION OF THE PREFERRED OPTION

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 alternative and allows their comparison. In order to encompass potential impacts 8 different components have been selected and analysed. Rank was assigned to each component:

| | Ranking components | Ranking value |
|---|---|---|
| 1 | Landscape visual impact | 5 |
| 2 | Local air-quality | 15 |
| 3 | Noise | 15 |
| 4 | Impact on biodiversity & ecological integrity | 20 |
| 5 | Impact on surface water | 10 |
| 6 | Impact on soil | 5 |
| 7 | Socio-economical | 10 |
| 8 | Resettlement | 20 |
| | | 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 |
| Very low (VL) | 0.3 |
| Low impact (L) | 0.5 |
| Medium impact (M) | 1 |
| High impact (H) | 1.5 |

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.

Comparison/ranking of alternative alignments for Grigoleti-Kobuleti bypass is given in **Table 63**.

***Table 63. Preliminary comparison of alternatives***

| Description | A -1 | | | | | | A2 | | | | | | A3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction | | | Operation | | | Construction | | | Operation | | | Construction | | | Operation | | |
| | Ranking | Score | Score value | Ranking | Score | Score value | Ranking | Score | Score value | Ranking | Score | Score value | Ranking | Score | Score value | Ranking | Score | Score value |
| **LOT 1** | | | | | | | | | | | | | | | | | | |
| Local air-quality | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 |
| Noise | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 | 15 | 0.5 | 7.5 |
| Impact on soil | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 |
| Impact on surface water | 10 | 1 | 10 | 10 | 0.5 | 5 | 10 | 1 | 10 | 10 | 0.5 | 5 | 10 | 1 | 10 | 10 | 0.5 | 5 |
| Impact on biodiversity & ecological integrity | 20 | 1 | 20 | 20 | 0.5 | 10 | 20 | 1.5 | 30 | 20 | 0.5 | 10 | 20 | 1.5 | 30 | 20 | 0.5 | 10 |
| Landscape visual impact | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 | 5 | 1 | 5 | 5 | 0.5 | 2.5 | 5 | 0.5 | 2.5 |
| Socio-economical | 10 | 0.5 | 5 | 10 | 0.3 | 3 | 10 | 0.5 | 5 | 10 | 0.3 | 3 | 10 | 0.5 | 5 | 10 | 0.3 | 3 |
| Resettlement | 20 | 1 | 20 | 20 | 0 | 0 | 20 | 1.5 | 30 | 20 | 0 | 0 | 20 | 1 | 20 | 20 | 0 | 0 |
| Total score | 100 | | 75 | | | 38 | | | 95 | | | 40.5 | | | 85 | | | 38 |
| | 113 | | | | | | 135.5 | | | | | | 123 | | | | | |

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

Comparison of alternatives shows that the lowest score belong to Alternative 1, which is considered as preferable option for the Grigoleti-Kobuleti road. (Note: the lowest score means less impact.).

***Table 64. Ranking of alignments***

| | **Score value (construction)** | **Score value (operation phase)** | **Total score** |
|---|---|---|---|
| Alternative 1 | 75.0 | 38.0 | **113.0** |
| Alternative 2 | 95.0 | 40.5 | 135.5 |
| Alternative 3 | 85.0 | 38.0 | 123.0 |

(Note: the lowest score means less impact.).

# 8. SUMMARY OF IMPACT ASSESSMENT FOR THE PREFERRED ALTERNATIVE

## 8.1. RANKING OF IMPACTS

***Table 65. Environmental and social impacts - construction***

| # | Potential Impacts | Severity | Sites |
|---|---|---|---|
| 1 | Impact on natural landscape in the right-of-way | Low 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 | Increased suspended sediment in stream/river (canal, ravines) affected by erosion at construction sites, fills and waste dumps. Declined water quality and increased sedimentation | Low to Medium | Bridge construction area, road section next to the surface water streams |
| 4 | Risk of flooding triggered by blockage of canals, ravines | Low/medium | Sections running close/crossing the river |
| 5 | Soil and water contamination during construction – spilled oil, grease, fuel, paint. | Low to Medium | Water –ravines, canal ; Soil – along the whole alignment; camps, equipment yards /concrete mixing sites |
| 6 | Poor sanitation/solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management) | Low to medium | Note: Location to be defined by constructing contractor. |
| 7 | Construction wastes alongside the RoW, spoil; roadside litter. | Medium | Along alignment; at worksites; spoil disposal areas |
| 8 | Air pollution from vehicle operations, dust. | Low to medium | Near the settlement, along alignment, in quarry/borrow pit areas, along the traffic route |
| 9 | Air pollution from concrete plants. | Medium | Supplier site |
| 10 | Noise from machinery/vehicle traffic, local | Medium to high | Near the settlements |
| 11 | Poaching by construction workers | Negligible to low | Supsa, Sepa, tributaries, forest area |
| 12 | Impact on biodiversity (noise, emissions, barriers for movement water pollution) | Low to medium | Supsa, along the route; forest area |
| 13 | Creation of stagnant water bodies in borrow pits, quarries etc. suited to mosquito breeding and other disease vectors. | Low | |
| 13 | Health hazards by noise, air emissions/dust (workers) | Low | Near the Operation ground |
| 14 | Impacts on archaeological sites | Low | Along the RoW |

| | | | |
|---|---|---|---|
| 15 | Hazardous driving conditions where construction interferes with existing roads. | Low to medium | Whole alignment ; Near the settlements |
| 16 | Impact on existing infrastructure | Medium | Communications, optical cable and transmission line crossing areas |
| 17 | Traffic related accident risks | Low | Whole alignment; Most sensitive sites are near the settlements |
| 19 | Physical and economical displacement of people living on the right of way | Medium to High | Affected households |
| 20 | 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 66. 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 | Low | During repair |
| 3 | Roadside litter | Low | Along alignment, landfills |
| 4 | Alteration of land/subsoil drainage patterns | Low | The existing culverts and drainage systems d |
| 5 | Soil and water contamination by oil, grease, fuel and paint alongside the highway | Low to medium | Most of the alignment |
| 6 | Air pollution from machinery during maintenance works. | Low | Most of the alignment |
| 7 | Air pollution from traffic | Low to Medium | Most of the alignment |
| 8 | Noise pollution from traffic | Medium to high | Most of the alignment |
| 9 | Disturbance of fauna (noise, collision risks) | Low to medium | Most of the alignment |
| 10 | Creation of a transmission corridor for pests and weeds | Medium | Most of the alignment |
| 11 | Health hazards - dust and exhaust emissions | Low | Near the settlements: |
| 12 | Obstruction of routes from homes to farms, increasing travel time. | Low | Near the settlement |
| 13 | Impairment of non-motored transportation and pedestrians in the highway corridor due to reduced or impeded rights-of-way. | Low | Near the settlement |
| 14 | Impact on businesses | Medium to high | Businesses along the bypassed section of the road through Ureki |
| **#** | **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 67. Impact matrix - Construction Stage***

| Activity | Impact | Direct/ Indirect (D/I) | Positive/ Negative (P/N) | Reversible/ Irreversible (R/I) | Temporary (term) (Short-S, Medium-M, Long-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 |
| | Resettlement neds | D | N | R/IR | S-L |
| 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 |

| Activity | Impact | Direct/ Indirect (D/I) | Positive/ Negative (P/N) | Reversible/ Irreversible (R/I) | Temporary (term) (Short-S, Medium-M, Long-L) |
|---|---|---|---|---|---|
| | 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 68. Character of the Main Anticipated Impacts - Operation Stage***

| Activity/ Factor | Impact | Direct/ Indirect (D/I) | Positive/ Negative (P/N) | Reversible/ Irreversible (R/I) | Temporary (term) (Short-S, Long-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 | + |

## 8.2. RESIDUAL IMPACT

Residual impact will be low if mitigation measures are in place, environmental management and best construction and operation practices are kept to.

# 9. 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 subsequent approval the following thematic management plans:

- Waste Management Plan;
- Traffic Management Plan;
- Health and Safety 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.

## 9.1. 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 (if relevant);
- 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;
- Log of material inventories and consumption;

- Chance find records (if any);
- Complaints register;
- Incidence register (environmental limits expedience 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 on monthly basis through including safeguard compliance section into the general reporting. Supporting photo material shall also be attached. RD will make monthly reports from the works supervisor available to the World Bank upon demand. Also, RD will include analytical sections on the EMP implementation and overall safeguard performance into the regular project progress reporting to the lender. 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 69. 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 will be identified with consideration of environmental issues (to avoid negative impacts on humans and wildlife). | Getinsa-Payma, Eurostudios/Contractor, contractor | RD |
| Noise | • Planning of auxiliary and haulage routes will be done with maximum use of existing roads and/or away from densely populated areas to reduce nuisance related to noise. | Getinsa-Payma, Eurostudios/Contractor | RD |
| Surface water pollution | • Need for installation of drainage system will be identified. Surface water protection measures for facilities/works near or in the riverbed (Supsa, Sepa and its tributaries) will be identified | Getinsa-Payma, Eurostudios | RD |
| Loss of land/harvest Loss of a source of income/business | • Land acquisition/resettlement action plan (RAP) is developed<br>• Damages/loss will be compensated according to the RAP | Getinsa-Payma, Eurostudios | RD |
| Landscape visual change | • Design, colour and shape will be identified with consideration of peculiarities of the landscape | Getinsa-Payma, Eurostudios | RD |
| Impact on surface water | • River crossing are designed allowing minimum interference with active riverbed | Getinsa-Payma, Eurostudios | RD |

***Table 70. 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.<br>• Idling of engines will be prohibited..<br>• Use of poorly maintained machinery or equipment that cause excessive pollution (e.g., visible smoke, fuel/oil leaks) will be banned.<br>• Staff will be trained in best practice | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Dust generated during loading/unloading and hauling of friable materials | • Construction materials (gravel, sand, etc.) will be transported in covered (for example, by tarpaulins) vehicles.<br>• Unpaved roads and significant areas of uncovered soil will be sprayed with water every four hours on working days, during dry and windy weather;<br>• Optimum speed will be kept to while moving through the residential area to reduce dust emissions;<br>• Dumping of material from high will be prohibited to avoid dust related nuisance;<br>• Staff will be trained in best practice. | *Details are given in Table 72* | | |

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|---|---|---|---|---|
| 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 suppression.<br>• Optimum speed will be kept to while moving through the residential area to reduce dust emissions. | *Details are given in Table 72* | | |
| ***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 (If any), 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 72* | Contractor | RD Construction supervisor |
| Noise Impact – Disturbance to residents | • Work hours will be restricted between 06:00 to 21:00 hours within 500 m of the settlements.<br>• Noise on construction site will be limited. Idling with switched gear will be prohibited, shields used, if required. Other measures include design and construction of noise barrier - a wall, an earthen berm, or a combination of wall and berm, use of green barrier (tree planting);<br>• Dialogue will be maintained, grievance mechanism used to allow residents to contact Project staff and ask for additional measures;<br>• Traffic schedule will be developed and kept to;<br>• Optimum travel speed during offsite travel will be set; | *Details are given in Table 72* | Contractor | RD Construction supervisor |

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| | • Distance to the nearest residence building or inhabited area will be kept to;<br>• Proper state of maintenance of machinery and vehicles will be maintained;<br>• Vegetation will be preserved as far as feasible to act as a natural noise barrier;<br>• Train staff will be trained in construction best practice. | | | |
| 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.<br>• Personal Protection Equipment (PPE) (e. g., ear defenders) will be provided and used.<br>• Noise exposure will be limited to 85 dB(A). | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| ***SOIL AND WATER*** | | | | |
| ***Potential impact*** | ***Mitigation/Enhancement Measure*** | ***Monitoring requirements*** | ***Responsibility*** | |
| | | | ***Development/ Implementation*** | ***Control*** |
| Pollution of soil and water (Supsa, Sepa and tributary) | • Contractor will be requested to provide<br>○ information about location and floor space of the area required and layout of the work camp;<br>○ description and layout of equipment maintenance areas and lubricant /fuel storage facilities including distance from water | *Details are given in Table 72* | Contractor | RD Construction supervisor,<br>MENRP |

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|---|---|---|---|---|
| | sources and irrigation facilities;<br>• Storage facilities for fuels and chemicals will be located away from watercourses. The storage will 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 will be inspected for approval;<br>• Each parking, service, or cleaning and washing site will be equipped with waste water treatment facilities (temporary);<br>• Sewage management plan and proper sewage collection and disposal system will be available to prevent pollution of watercourses (if discharge in surface water is planned);<br>• 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.<br>• Waste management plan will be prepared;<br>• Storing and disposal of waste/used oil will comply with environmental regulations and standards;<br>• 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 | | | |

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| | start of construction;<br>• After completion of construction works the contractor will 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);<br>• 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 Supsa, Sepa and tributary and/or impact on soils due to improper disposal of excess materials | • Sheet piles will be used to avoid pollution of the water;<br>• Bank protection measures will be used to avoid erosion;<br>• Monitoring of bank stability will be implemented. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Soil compaction due to operation of heavy equipment | • Operation of heavy equipment will be confined within the corridor to avoid soil compaction and damage to land. | *Details are given in Table 72* | Contractor | RD 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.<br>• Topsoil will be stripped and reused during recultivation of disturbed sites;<br>• Soil management plan will be provided. The plan will describe measures to be undertaken to minimize effects of wind and water | *Details are given in Table 72* | Contractor | RD Construction supervisor |

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| | erosion on stockpiles, measures to minimize loss of fertility of top soil, timeframes, haul routes and disposal sites;<br>• Prior to operation of borrow pits, the contractor will 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). | | | |
| Wastewater collection and disposal/treatment | • Camps (if any) 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 72* | Contractor | RD Construction supervisor |
| Sand and gravel borrow pit-disturbance of river bed, water quality, ecosystem disturbance | • Preference will be given to use of existing borrow pits or buying material at licensed facilities;<br>• Borrowing from the stream will be prohibited. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| ***ECOLOGY AND NATURAL ENVIRONMENT*** | | | | |
| ***Potential impact*** | ***Mitigation/Enhancement Measure*** | ***Monitoring requirements*** | ***Responsibility*** | |
| | | | ***Development/ Implementation*** | ***Control*** |
| Potential damage of vegetation/flora during excavation/ construction and transportation | • Boundaries of RoW and operation area will be strictly kept to -to avoid impact on the adjacent vegetation;<br>• Any damage to the existing trees during construction activities will be avoided; temporary vegetation protection fence – established; | *Details are given in Table 72* | Contractor | RD Construction supervisor |

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| activities | • Dust, water, soil impact mitigation measures will be implemented;<br>• Clearing up and removal of vegetation will be minimized to the extent necessary for the execution of works.<br>• Vegetation will be preserved as much as feasible;<br>• In case taxation reveals any protected plant species in the area, the latter will be removed from the environment in accordance with sub-paragraph (v), Article 24, first paragraph of the law of Georgia on 'Red List and Red Book' only;<br>• Re-vegetation will be performed. "Replacing' lost vegetation by triple amount of the same species replanted in the area (whether deemed advisable), maintenance of vegetation for 2 years minimum;<br>• Replacing Colchis Water-Chestnut (*Trapa colchica*) and Spring snowflake (*Leucojum vernum*) to similar area out of the project impact zone will be organised. | | | |
| Maintaining animal mobility through culverts and bridges | • Designed culverts and underpasses will be used as animal crossing points. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Domestic and wild animals straying onto the road and being killed | • 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 will be Installed. Protective fences will be of various density. For small animals boards or corrugated metal shields will be used. For larger animals colour ribbons will be used as a generally accepted practice. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Disturbance of wildlife | • Adherence to no horn policy will be enforced; | | | |

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| | • Dust, noise, water, soil impact mitigation measures will be Implemented;<br>• Strict keeping to traffic routes during the construction will be ensured to avoid impact on vegetation;<br>• Vegetation will be preserved as much as feasible;<br>• Works will be scheduled to the season less sensitive for fauna. Special attention will be given to the avian fauna in the spring-summer (April to July). Tree cutting in the season most sensitive for birds (nesting/hatching) will be avoided;<br>• Poaching will be prohibited. | | | |
| Damage to aquatic ecosystems, habitats and fish | • Movement of machines inside rivers, streams, or on their banks will be prevented except when it is unavoidable due to the construction of a structure or construction;<br>• Vegetation on the slopes will be preserved to reduce the risk of siltation.<br>• Construction in sensitive for biodiversity periods will be avoided. Construction in/near the riverbed in the fish spawning season (June-September) will be avoided. Contractors will prepare management plans for such works as a part of their Construction Method Statements<br>• All the works to be performed in water or near watercourses will follow statement or plan for the execution of particular works.<br>• 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 | *Details are given in Table 72* | Contractor | RD Construction supervisor |

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| | embankment and siltation of watercourses that may result from such activities.<br>• Poaching will be prohibited;<br>• "Dropping structures" into rivers/streams will be avoided. 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.<br>• 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 settling lagoons or tanks prior to final discharge.<br>• Staff will be trained in construction best practice. | | | |
| Damage to river morphology | • Digging and making the foundations for bridge piers, retaining walls, and structures located at, or near, surface water bodies, will take place in low water period to minimize negative impacts on rivers and their banks. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| ***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 | • Landscape planting will be developed and implemented;<br>• Vegetation will be protected from non-deliberate damage – achievable by keeping to the boundaries of the work areas and travel routes. | *Details are given in Table 72* | Contractor | RD Construction supervisor |

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| losses | • Erosion prevention measures (straw bales, fibre rolls, other) in sensitive locations will be provided;<br>• Stability of the slope of deep excavations for bridge piers will be ensured. For this purpose boarding can be used. | | | |
| Damage to agricultural lands, including impacts of drainage and irrigation infrastructure | • Grievance procedure will be developed before start of construction;<br>• Machinery and vehicle access will be strictly limited;<br>• All the affected areas will be restored. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Livestock resources damaged by machinery and vehicles | • Grievance procedure will be developed before start of construction;<br>• Machinery and vehicle access will be strictly limited;<br>• All the affected areas will be restored. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Arrangement of new borrow pits or stone quarries, possibly damaging agricultural or archaeological | • Contractor will be encouraged to use the Borrow pits on specific locations which are predefined within the detailed design.<br>• Advantage will be given to already licenced sourcing areas, Existing quarries will be used or licence to run own quarry will be obtain (if deemed advisable). | *Details are given in Table 72* | 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 will immediately, without delay, halt works and inform the authorized Institution for Protection | *Details are given in Table* | Contractor | RD Construction |

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|---|---|---|---|---|
| | of Cultural Monuments and undertake measures to ensure the findings are not destroyed or damaged and to protect the area and position in which they are discovered. | *72* | | supervisor |
| ***HEALTH AND SAFETY*** | | | | |
| ***Potential impact*** | ***Mitigation/Enhancement Measure*** | ***Monitoring requirements*** | ***Responsibility*** | |
| | | | ***Development/ Implementation*** | ***Control*** |
| Health and safety risks to workers | • The following will be provided: Adequate health care facilities (including first aid facilities) within construction sites;<br>• All construction workers will be trained in basic sanitation, general health and safety matters, and on the specific hazards of their work;<br>• Personal protection equipment (PPE) for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection required in accordance with HSE legislation will be provided and used;<br>• Clean drinking water will be made available to all workers;<br>• Drainage throughout the camps (in case available) will be arranged to avoid puddling;<br>• Periodic cleaning of latrines (if available) and waste container will be implemented to prevent outbreak of diseases;<br>• Where feasible contractor will arrange temporary integration of waste collection from work sites into existing waste collection systems and | *Details are given in Table 72* | Contractor | RD Construction supervisor MENRP |

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|---|---|---|---|---|
| | disposal facilities of nearby communities.<br>• 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 will be provided;<br>• International HSE standards will be implemented in all contracts.<br>• Working on height and other safety requirements relevant to the task will be enforced.<br>• Proper maintenance of vehicles and machinery will be ensured - machinery examined prior to use to ensure it is in safe condition;<br>• Machine perimeter will be checked before moving to exclude any possibility of collision with people/objects;<br>• Seat-belts while operating machine will be used;<br>• Leaving machinery unattended with engine running will be prohibited;<br>• Safe speed will be preserved;<br>• Designated spotter will be assigned, if backing is required, to guide the move. (Note: The spotters must wear high-viz vests and stay in sight of the driver. The driver must stop if he loses sight of the spotter.);<br>• Compliance with work on height safety measures will be ensured;<br>• PPE and safety gear during works on height and elsewhere as appropriate will be provided, use - enforced. This includes use of hearing protective devices capable of reducing sound levels at the ear to at least 85 dBA;<br>• Adequate on site First Aid Boxes and treatment facilities will be | | | |

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|---|---|---|---|---|
| | provided;<br>• 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 will be controlled through the choice of equipment, installation of vibration dampening pads or devices, and/or limiting the duration of exposure (EHS Guidelines, 2007);<br>• Alcohol use will be prohibited;<br>• Use of mobile phone while driving will be prohibited;<br>• Drivers and other personnel will be trained;<br>• Measures suggested for noise, air quality reduction will be kept to;<br>• Traffic Management, Waste Management plans will be developed and implemented;<br>• Warning signs and barriers will be installed wherever appropriate. | | | |
| Health and safety risks to adjacent communities | • Barriers and warning signs at all hazardous areas will be installed to protect general public;<br>• Measures suggested for noise, air quality reduction will be kept to;<br>• Community will be informed about the possible restriction of services (power supply) and duration of disruption;<br>• Alternative access roads will be provided – if exiting ones are temporarily not available for pedestrian and traffic (including non-motorized);<br>• Traffic Management, Waste Management plans will be developed and implemented;<br>• Safety awareness campaigns, focusing on schools and children will be implemented. | *Details are given in Table 72* | Contractor | RD Construction supervisor |

| | | | | |
|---|---|---|---|---|
| Community tension and disruption | • Locations for camps (if any) will be designed by contractor. Project. Contractor will prepare Camp Management Plan.<br>• Grievance mechanism will be in place;<br>• Priority will be given to employment of local population (under condition that required qualification/skills are available) | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| ***TRAFFIC, MACHINERY*** | | | | |
| ***Potential impact*** | ***Mitigation/Enhancement Measure*** | ***Monitoring requirements*** | ***Responsibility*** | |
| | | | ***Development/ Implementation*** | ***Control*** |
| Asphalt plants | • Existing asphalt plants will be used, in case decision is made to use own asphalt plant - permit from MENRP will be obtained. | *Details are given in Table 72* | Contractor | RD Construction supervisor |
| Traffic disruption | • Traffic Management Plan will be developed in conjunction with road authorities to manage all temporary accesses, delivery of material and machinery;<br>• Traffic management plan will be submitted to local traffic authorities prior to mobilization;<br>• Information about the scope and schedule of construction activities and expected disruptions and access restrictions will be provided to the public;<br>• Adequate traffic flow around construc. areas will be allowed for;<br>• Adequate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control will be provided. | *Details are given in Table 72* | Contractor | RD Construction supervisor |

***Table 71. 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 | • Maintenance works will be planned so to prevent runoff contamination;<br>• Surface sweeping and development of better cleaning methods – are considered as mitigation;<br>• Culverts will be cleaned routinely, and repaired as far as required;<br>• Water from bridge will be collected and retained prior to discharge. | Road Maintenance Contractor | RD,<br>Traffic Police |
| Road resurfacing | Road/bridge | Water bodies pollution by heavy metals, hydrocarbons and debris | • Maintenance paving will be performed only in dry weather to prevent runoff contamination;<br>• Proper staging techniques will 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 |

| Activity | Location | Issue | Mitigation measure | Responsible authority (implementation) | Responsible agency (monitoring) |
|---|---|---|---|---|---|
| Noise | Residential area | Disturbance of local residents by traffic related noise | • In those locations where the nighttime noise is expected to slightly exceed allowable limit green barriers and speed reduction are recommended. In other areas (A1+Aw, B, D1, E,F) noise barriers are assumed to be an option. Dimensions of the walls are calculated with consideration of the distance and topography of the area. In Black Sea Arena section the modelled noise value is in allowable limit, however, keeping in mind that this is a concert hall, arrangement of green barriers is deemed to be necessary. Additional measures may be required later during operation in case monitoring reveals expedience of the limit or complaints from the resident received. | n/a | n/a |
| Littering | Along the new road | Possible negative impact on wildlife, Water pollution, Aesthetic impact | • Community will be informed of the level of fines that littering incurs;<br>• Awareness raising in proper waste disposal (no littering, no fly tipping);<br>• Installation of signage as a part 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;<br>• Cleaning up will be provided. | Road Maintenance Contractor | RD |

| Activity | Location | Issue | Mitigation measure | Responsible authority (implementation) | Responsible agency (monitoring) |
|---|---|---|---|---|---|
| Status of biodiversity | Along the new road | Impact on vegetation,<br><br>Road kills of animals | • Faded plants will be removed, replaced with new saplings;<br>• Records of accidents will be kept;<br>• If accident hot spots with large mammals are identified, appropriate protective measures will 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) | • Warning signs will be installed. | 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,<br>Safety issues,<br>impact on non-motorized transport | • Smooth operation of underpasses, overpasses, road junctions, and secondary roads within the highway area will be ensured. | Contractor, supervision by RD | RD |

***Table 72. 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 (if applicable) | Quality parameters of waste water from construction camps and portable sites, according to relevant standards | At construction camps (if available) and portable facilities at work sites | Inspection of wastewater units, latrines and septic tanks | Frequency defined by Georgian Environmental standards | RD, Construction Supervision |
| Community tension and disruption | Satisfaction/disturbance level of the residents | Camp (if available), Construction sites | Observation, surveys | Regular frequency or when changing operations | RD, Construction Supervision |
| Impact on topsoil | Striping of the topsoil<br>Stockpiling,<br>Protection from erosion and washing away<br>Reintroduction | Worksite | Inspections; observation | During removal of the topsoil layer and preparation of the sites,<br>After stockpiling,<br>After completion of works – during reintroduction | 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 |

| 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 |
|---|---|---|---|---|---|
| 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 |
| Impact on fauna | Injury cases | Along alignment | Visual inspection | After begin of construction works | RD Construction Supervision |
| Air pollution from improper maintenance of equipment/ machinery (general) | Exhaust emissions, dust | At site | Visual inspection, measurements of exhaust emissions | Unannounced inspections during construction works | RD Construction Supervision, MENRP |
| Dustiness | Visual presence of dust | At construction sites | Visual monitoring | Regularly during construction | RD, Construction |

| 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 |
|---|---|---|---|---|---|
| | | | | | Supervision |
| Contamination of surface water during construction – Supsa, Sepa, tributaries | 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<br>Unannounced inspections during works near watercourses | RD,<br>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,<br>Construction Supervision |
| Material supply<br>Concrete production | Obtaining valid operation license or purchasing from licenced provider | Asphalt /concrete plant (if available) | Inspection | Before work begins | RD,<br>Construction<br>Supervision |
| Material supply<br>Borrow areas | Obtain a licence for material extraction | Sand and gravel borrow pit | Inspection | Before work begins | RD,<br>Construction<br>Supervision |
| Damage to irrigation and other | Visual damages | Agricultural lands | Visual observations | Weekly | RD,<br>Construction Supervision |

| 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 |
|---|---|---|---|---|---|
| infrastructure | | | | | |
| Material production/ extraction | Asphalt/concrete plant - possession of official approval or valid operating license | Asphalt /concrete plants (if available) | 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 | Vibration levels | Job site | Supervision, | Regular inspections during | RD, |

| 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 |
|---|---|---|---|---|---|
| appropriate) | | | observations | work and on complain | 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 areas | Status of vegetation | Planted vegetation areas | Visual control | Seasonally | RD, Construction Supervision |
| OHS | Use of personal protective equipment (PPE) relevant to | Worksite | Inspection; interviews; comparisons with the | Unannounced inspections during | RD, Construction |

| 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 |
|---|---|---|---|---|---|
| | the task;<br>Training records;<br>Organization of traffic on the construction site<br>Keeping to the safety rules while working on height | | Contractor's method statement | construction and upon complaint | Supervision |
| **OPERATION PHASE** | | | | | |
| Road safety | Proper signage and traffic control arrangements in place | Entire length of constructed section | Inspection | Recurrent | RD |
| Adequate operation and maintenance of drainage and retention systems | Drainage/retention infrastructure in good technical condition and cleaned regularly | Entire length of constructed | Inspection | Recurrent | RD |
| Environmental performance during maintenance works | Temporary on-site storage of construction materials and waste organized to prevent environment pollution;<br>Final disposal of construction waste and excess material into | Maintenance sites | Inspection | During conduct of maintenance works | RD |

| 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 |
|---|---|---|---|---|---|
| | designated locations;<br>Conduct of maintenance works in adequate seasonal and weather conditions;<br>Appropriate installation of traffic regulation and warning signs. | | | | |
| Regular maintenance and periodic replacement of greenery within the alignment corridor | Trees planed for compensation of removed plants and grass seeded for slope stabilization properly safeguarded, watered as needed, and replaced 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 worse than prior to the project implementation | Settlements of the project-affected municipalities | Inspection,<br>Interviews,<br>Review of statistical data | Medium-term post-project | Administrations of project-affected municipalities |

## 9.2. 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 73.*** **Rough cost estimate for mitigation measures and monitoring for selected alternative**

| Description | Cost (LARI) |
|---|---|
| - Dust suppression by spraying water | 158.655,79 |
| - Seeding and sodding works on slopes | 158.655,79 |
| - Planting and landscaping works within the RoW | 158.655,79 |
| - Noise barriers: Provisional Sum | 2.100.000,00 |
| - Retention chamber for liquids. Operation Phase | 8.722,03 |
| - Monitoring quality parameters (air quality, water) (each sampling*1 site) | 1.380,60 |
| - Noise monitoring (1 sampling) | 276,12 |
| - Monitoring during construction (biodiversity) (1 year) | 27.612,00 |
| - Monitoring during operation (biodiversity) (1 year) | 69.030,00 |
| **Total cost** | **2.682.988,12** |

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.

## 10. PUBLIC CONSULTATION AND DISCLOSURE

The ESIA process includes public participation, consultation and focus group discussions to help RD achieve public acceptance of the Project. The consultation process is to follow IFIs safeguard requirements and relevant national regulations.

The major approach and principles for public engagement and consultations during the ESIA includes:

- Development and implementation of grievance mechanism to receive and resolve concerns and grievances from stakeholders.
- Consultation with affected people and informed participation as early as possible and throughout the project implementation.
- Consideration of the consultations carried out during feasibility study stage of the Project
- Disclosure of draft ESIA and organisation of public meeting no earlier than 50 and no later than 60 days from disclosure.
- Consultations with expert consultation, meetings and consultations with RD and MENRP – as appropriate.

Meetings and consultations with local community representatives in the project impact corridor were carried out by social survey team in August 2016, December 2016.

General information about the project, layout of suggested alignments, objectives of environmental and social impact assessment and basics of resettlement procedure have been communicated.

First meeting was organised on February 9th, 2017. The minutes of the meeting are attached (Annex volume 1 – Annex #8). Information on procedure, objectives, stages, needs for engagement and role of community in the process have been explained.

Main issues raised during the meetings were related to possible restriction of free movement, noise and dust impact during construction as well as resettlement/impact compensation issues. Employment issues and possibility of being employed were mentioned by all participants. Everybody was unanimous that proper compensation for land and structures is to be paid.

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

- Road department of Georgia - 12 Al.Kazbegi avenue, Tbilisi;
- Local administration office- 1 Kostava street, Ozurgeti;
- Tbilisi office of Gentinsa-Payma-Eurostudios – 24b Al.Kazbegi avenue;
- Office of Gamma Consulting Ltd – 17a D.Guramishvili avenue, Tbilisi.

Another meeting, organised by the RD in compliance with requirements of the law on environmental impact permit, was held in Ozurgeti on August 29th, 2017. Minutes of the meeting are attached.

Feedback from stakeholders will be considered and incorporated in the final version of the ESIA report.

## 11. CONCLUSIONS

According to the project construction of four lane road from Grigoleti to Kobuleti bypass is planned. The new alignment will be 14.5 km long and include five interchanges and three river crossings. According to the national regulations and the Lenders' safeguards the project belongs to the category of activities subject to environmental impact assessment.

Assessment of impact of Grogoleti-Kobuleti project (including alternatives) revealed a number of negative and positive impacts on biophysical and social environment. (Note: on Feasibility stage zero alternative was excluded from consideration.)

Main sources of impact on pre-construction and construction stages of the project are transport and construction machinery. During pre-construction and construction stages removal of vegetation, stripping the topsoil and temporary stockpiling (before reuse during recultivation), certain volume of earthworks, preparation of embankment, construction of interchanges and bridges is planned. The works will have certain impact on biodiversity, cause nuissance – discomfort related to dust, emissions, vibration. Soil and water quality may deteriorate is also expected.

For assessment of impact baselime data on physical, biological and socio-economical environment were collected, impact recipients and their sensitivity were evaluated, mitigation measures were defined, culumative and residual impact ranked. In the course of assessment noise and emission modelling was carried out. Paticular attention was paid to protected species and potential impact on them.

Impact on environment during pre-construction, comstruction and operation staged has been ranked as medium. Suggested mitigation measures allow to conclude that impact of the projects at dissferent staged of the life-cycle can be controlled, avoided as far as feasible and mitigated. Monitoring will be carried out to assessment of efficiency of suggested measures and estimate the need for additional mitigation measures for impact avoidance/control.

Residual impact during construction will not be high. As for the operation stage – the impacts such as noise and emission related nuisance and visual impact on the residents of the houses closest to alignment can not be fully avoided. This fact is particularly important since Ureki is a resort zone and therefore – rather sensitieve.

Positive impacts related to the project include temporary employment and development of satellite businesses in the project area. Additional income from renting accommodation to workers can also be considered as positive factor.

Design alignment is a part of program for rehabilitation/modernisation of main roads being implemented by the government with financial aid fro, international financial institutions. The program aims to improve transportation and transit of goods to surrounding countries, which is a significant and growing contributor to GDP. This fact demonstrates the importance of the project as a component of this program, for the country.

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