CONSTRUCTION OF E-60 HIGHWAY SAMTREDIA-GRIGOLETI - SECTION Km 0 - Km11,5

ENVIRONMENTAL IMPACT ASSESSMENT

VOLUME II. ANNEXES

Project No

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Ministry of Regional Develo-pment and Infrastructure

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Contents

ABBRAVIATION AND ACRONYMS

BP	Bank Procedures
CAS	Center of Archaeological Search of the Ministry of Culture and Sports
CBR	Californian Bearing Ratio
CPS	Country Partnership Strategy
CCP	Contractor Control Plan
CMP	Contractor's Management Plan
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESA	Equivalent Standard Axel
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GP	Good Practices
GPS	Global Positioning System
HEC – RAS	Hydrologic Engineering Center – River Analysis System
IFI	International Financial Institution
JBIC	Japan Bank for International Cooperation
KP	Kilometer Point
MoE	Ministry of Environmental Protection and Natural Resources
MLHSP	Ministry of Labor, Health and Social Protection
MoI	Ministry of Interior
NTRC	National Transport Regulatory Commission
NSFSVPP	The "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture
OP	Operational Policy
PIU	Project Implementation Unit
RDMRDI	Roads Department of the Ministry of Economic Development
RoW	Right of Way
TEM	Trans European Motorway
TRRC	Transport Reform and Rehabilitation Center
USC	Unified Soil Classification

Annex 1.

1. Administrative structure and environmental legislation in georgia

1.1 Administrative Structure

Recent changes in the administrative structure, adopted by the Decree No 93 of the Government of Georgia dated 25.04.2013, resulted in redistribution of responsibilities between the Ministry of Environmental Protection (MoE) and the Ministry of Energy and Natural Resources and are reflected in current titles of the mentioned ministries. The MoE is renamed as the Ministry of Environmental Protection and Natural Resources (MoEPNR) and the Ministry of Energy and Natural Resources is now titled as the Ministry of Energy. The MoEPNR is considered as a leading ministry responsible developing the environmental policy of the government. The MoEPNR consists of several functional departments, which are responsible for different aspects of environmental protection, and other supporting departments, like administrative department, Legal Department, PR Department etc. Functional departments and their responsibilities:

Department of Permits	- Carrying out Ecological Expertise and issuing Environmental permits - Post EIA monitoring of compliance with the conditions of Environmental Permit
Department of Environmental Policy and International Relations	- Development of the State Policy and State Environmental Programs
Department of Integrated Management of Environment	- Ambient air and water protection strategy - Consent on the Reports of “Inventory of Stationary Sources of Emissions” and “Norms of Maximally Admissible Emissions” - Consent on the Report on “Norms of Maximally Admissible Discharges” - Consent on the technical regulations for Water Intake from the Surface Water Objects - Waste Management - Hazardous Substance Management - Climate change control - Environmental Standards and Norms

Biodiversity Protection Department	- Biodiversity protection policy and programs
Legal Department	- Development of Environmental Legislation
Agency of Protected Areas	- Protected areas development policy and programs
Environmental Agency	- Hydrometeorology - Pollution Monitoring - Geohazard monitoring - Monitoring of geo-ecological conditions of river basins, water reservoirs, Black Sea territorial waters, continental

As a result of recent reorganization of the ministries, two new entities have been created within the MoEPNR: National Forestry Agency and Department of Environmental Supervision.

The functions and responsibilities of the ex- Department of Natural Reources of the Ministry of Energy have been redistributed among the Department of Environmental Supervision, National Forestry Agency and National Environmental Agency (all under the MoEPNR) and State Agency on Oil and Gas. The National Environmental Agency is managing following environmental issues:

- Issuance of licenses on exploration of natural resources (except gas and oil). This includes also licenses for quarries and borrow pits supplying the road projects with the inert construction materials

Nuclear and Radiation Safety Department is responsible for

- Development of Nuclear and Radiation Safety Policy
- Radiation Safety Control

Department of Environmental Supervision is responsible for execution of controle over the environmental protection and use of natural resources. In particular, responsibilities of the Department cover matters like:

- Inspection of compliance with the natural resource use regulations

Inspection of **compliance** with the conditions of Environmental Impact Permit

In relation with the road projects, first of all it should be mentioned that Ministry of Environmental Protection is in charge of issuing Environmental Impact Permits. MoEPNR is also carrying responsibilities for the post EIA monitoring, although the efficient monitoring system still needs to be developed. MoEPNR is responsible for issuing licenses for quarries and borrow pits.

Ministry of Economy and Sustainable Development (MoESD)

MoESD is responsible for carrying out the review of technical documentation (including conclusion of independent experts) and issuing Permits on Construction for projects, as well as for supervision over constructing activities and for arranging Acceptance Commission after completion of construction.

State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the Ministry of Economy and Sustainable Development of Georgia.

Other Responsible Governmental Institutions:

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

The "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture (NSFSVPP). NSFSVPP is responsible for implementation of complex sanitary protection measures in case of identification of burial sites during earthworks. Information about suspicious burial sites should be delivered to the "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture by the Constructing Contactor (field environmental officer) and RDMRDI field officer.

[Note: Governmental institutions responsible for technical supervision and compliance with the design documentation and construction standards are described in Design Documentation and are not subject for EIA or EMPs]

1.2 Legal framework

1.2.1 Framework Legislation

The basic legal document is "**The Constitution of Georgia**", which was adopted in 1995. While the Constitution of Georgia does not directly address environmental matters, it does lay down the legal framework that guarantees environmental protection and public access to information with regard to environmental conditions.

Article 37, Part 3 states that "any person has the right to live in a healthy environment, use the natural and cultural environment. Any person is obliged to take care of the natural and cultural environment." Article 37, Part 5 states that "an individual has the right to obtain full, unbiased and timely information regarding his working and living environment."

Article 41, Part 1 states that "a citizen of Georgia is entitled to access information on such citizen as well as official documents available in State Institutions provided it does

not contain confidential information of state, professional or commercial importance, in accordance with the applicable legal rules.

Legislative execution of constitutional requirements in the sphere of environmental protection is implemented through framework Georgian "Law on Environmental Protection" (1996, as amended) and the set of specific laws developed on its basis. The framework law regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities (without distinction-legal form) in the scope of environmental protection and in the use of nature on all Georgia's territory including its territorial waters, airspace, continental shelf and special economic zone. The law deals with education and scientific research in the scope of environment, environmental management aspects, economic levers, licensing, standards, EIA and related issues. Considers different aspects on protection of ecosystems, protected areas, issues of global and regional management, protection of ozone layer, biodiversity, protection of Black Sea and international cooperation aspects. In particular, the law addresses broad spectrum of issues, like environmental management, environmental education and awareness building, licenses and permits, fines and enforcement, environmental impact assessment, which should be further regulated by specific laws. According to the requirements set forth in the framework law, numerous laws and normative–legal documents were adopted to regulate specific environmental issues in Georgia. Further below the environmental regulations most relevant to the project – and first of all, to the permitting process - are described.

1.2.2 Legislation Related to Environmental Permitting

At present, the environmental permitting procedure in Georgia is set out in three laws:

The project proponent, in implementing projects, will comply with (i) **The Law on Licenses and Permits (2005);** (ii) **The Law on Environmental Impact Permits (EIP),** and (iii) **The Law on Ecological Examination (EE) 2008**. In more details the EIA process and required content of the EIA document is described in the **Regulation on EIA issued by the MoE dated May 15, 2013 (Order of MoE No 31).**

The Law on Licenses and Permits was adopted by Parliament of Georgia, on June 24, 2005. The Law regulates legally organized activities posing certain threats to human life and health, and addresses specific state or public interests, including usage of state resources. It also regulates activities requiring licenses or permits, determines types of licenses and permits, and defines the procedures for issuing, revising and canceling of licenses and permits (Article 1, Paragraph 1).

The Laws on Environmental Impact Permit and on Ecological Examination have been published on 14.12.2007 and entered in force on 01.01.2008. These new laws integrate all the amendments introduced in legislation of Georgia during recent years.

The Law of Georgia on Environmental Impact Permit.

The Law of Georgia on Environmental Impact Permit determines the complete list of the activities and projects subject to the ecological examination (clause 4 p.1) and the legal basis for public participation in the process of environmental assessment, ecological examination and decision making on issuance of an environmental impact permit.

Under the “activities” subject to the ecological examination the law considers construction of new or upgrading of existing facilities imposing change of technology and operational conditions for the projects and activities included into the list. The routine maintenance works in relation with the same facilities do not require ecological examination and permit.

In case if the activity included into the list given in clause 4 p.1 at the same time requires Construction Permit, the administrative body responsible for issuance of the Construction Permit ensures involvement of MoE, as a separate administrative body, in the administrative procedures initiated for the purpose of issuing Construction Permit, as it is envisaged by the Law on Licenses and Permits. In such cases the MoE is issuing the Conclusion on the Ecological Examination of the project based on the documentation provided to MoE by the administrative body issuing the Permit. The Conclusion on the Ecological Examination is adopted by the administrative (executive) legal act of the MoE and compliance with the conditions of the Conclusion is obligatory for the project proponent. The conditions of the Conclusion on Ecological Examination is a part of conditions of the Construction Permit.

In case if the activity included into the list given in clause 4 p.1 does not require Construction Permit, based on the Conclusion on the Ecological Examination the MoE will issue the Environmental Impact Permit, supported by the administrative (executive) legal act issued by the minister. The ecological examination is carried out in accordance with the law of Georgia on Ecological Examination and the conditions set forth by the Conclusion present the Conditions of the Permit.

The aforementioned laws do not provide details of screening procedure and do not define responsibilities of parties. According to the practice, the screening of project proposals and the preliminary assessment of their environmental impact and proposed mitigation measures (scoping) are being carried out by the project proponent in consultation with the MoE.

Public Consultation Procedures.

The 6th clause of the law of Georgia on the Environmental Impact Permit provides detailed requirements and procedures for conducting public consultations and established timeframes for information disclosure and discussion, namely:

According to article 6 , developer is obliged to carry out public discussion of the EIA before its submission to an administrative body responsible for issuing a permit (in case of activity requiring construction permit before initiating stage 2 procedure for construction permit issuance).

A developer is obliged to disclose (publish) the draft EIA document and publish information regarding details fo the planned public discussion. Information is subject to publication in the central periodical as well as in the printing organ existing within the administrative territory of the same district (if such exists) where an activity is planned. Information (advertisement) shall contain the following information:

The objectives, title and location of the planned activity;

The location where interested individuals may obtain the activity related documents (including the EIA report);

Deadline for the submission of their opinions;

The place and time of public discussion.

A developer is entitled:

To submit a hard copy and an electronic version of the Environmental Impact Assessment to administrative body issuing a permit within a week from the date of the publication;

To receive and consider within 50 days from the date of publication from citizens written comments and suggestions;

Hold a public discussion on a planned activity not earlier than 50days and not later than 60 days from the publication of an advertisement;

To ensure invitation to public discussion of the representatives of respective local administration and governmental agencies representatives; the Ministry and the Ministry of Economic and Sustainable Development and other interested administrative bodies.

Discussion shall be held publicly and any citizen has a right to attend it. Public discussion shall be held in the administrative center of the district where an activity is planned.

According to the article 7 of the law, during 5 days after conducting the public disclosure meeting, the minutes of the meeting should be prepared to reflect all the questions and comments raised and explanations, provided by the project proponents in response. Appropriate corrections should be incorporated into the main text of the EIA, if required. If the comments and proposals of stakeholders are not accepted a letter of explanation should be sent to the authors. The minutes of the meeting, as well as response letters, explanations and corrections should be submitted to the MoE or the administrative body responsible for issuing the Permit as supplementary materials to the EIA. The mentioned documents should be considered as an essential part of the EIA.

<u>Procedure of Official Submission of EIA to MoE</u>

Article 8 of the Law specifies the documents to submit to receive a permit:

(1) An operator, in order to receive a permit, shall submit a written statement to the Ministry. A statement to receive a permit is submitted, considered and processed under the rule established by the 'Law of Georgia on Licenses and Permits'.

(2) An operator is obliged, in addition to the information specified by the 'Law of Georgia on Licenses and Permits', to submit the following documents:

(a) An EIA report drawn up under the standards specified by the legislation of Georgia (in 5 hard copies and 1 soft copy)

(b) A situation plan of the planned activity (with the indication of distances)

(c) Volume and types of the expected emissions (a technical report of inventory of the stationery sources of pollution and emitted/discharged harmful substances and project of maximum permissible concentrations of emitted/discharged harmful substances (in 4 copies))

(d) A brief description of the activity (as a technical summary)

(e) A statement about the confidential part of the submitted statement.

(3) An operator is obliged to submit a full diagram of the technological cycle to the permit issuing body even if the given activity contains a commercial and/or state secret. This part of the statement, according to sub-clause 'e' of clause 2 of the given Article should be submitted separately by the operator.

Issuance of the Permit on Environmental Impact

The article 9 of the law describes the procedures of issuing the Environmental Impact Permit. The same issue is addressed in the laws of Georgia on "Licenses and Permits" (2005) and "on Ecological Examination' (2008).

1. According to the law on "Licenses and Permits," the MoE takes decision on issuing Permit within the 20 days after submission of request on permit by the project proponent.
2. MoE , in accordance with the law on Ecological Examination, ensures expertise of the submitted documentation and issuance of Conclusion on Ecological Examination.

The Permit (Environmental Permit, or Construction Permit when the latest is required) is issued only in case of the positive conclusion of the Ecological Examination.

Regulation on EIA as of May 15, 2013.

The requirements related to EIA studies and the EIA report are set forth in the Regulation on EIA issued by MoE in May 2013.

The content of the EIA document is specified in the clause 5 of the Regulation as follows:

Article 5. Content of the environmental impact assessment

The Environmental impact assessment report should include the following information:

(a) Analysis of the existing state of the environment;

(b) Identifying the sources, kinds and objects of impact caused by the activity;

(c) Forecast of the changes of quantitative and qualitative characteristics of the environment;

(d) Determining the probability of emergency situations due to the activity and evaluating the expected results;

(e) Evaluation of the environmental, social and economic results of the planned activity;

(f) Specifying the reduction measures for the negative impact on the environment and human health and specifying the compensation measures as necessary;

(g) Identifying the residual (cumulative) impact and measures for its control and monitoring;

(h) Undertaking environmental and economic evaluation of the projects;

(i) Analysis of the alternative variants of the project implementation, selection and forming new variants;

(j) Identifying the ways and means to restore the initial environmental condition in case of terminating entrepreneurship or other activity;

(k) Informing the society and studying the public opinion;

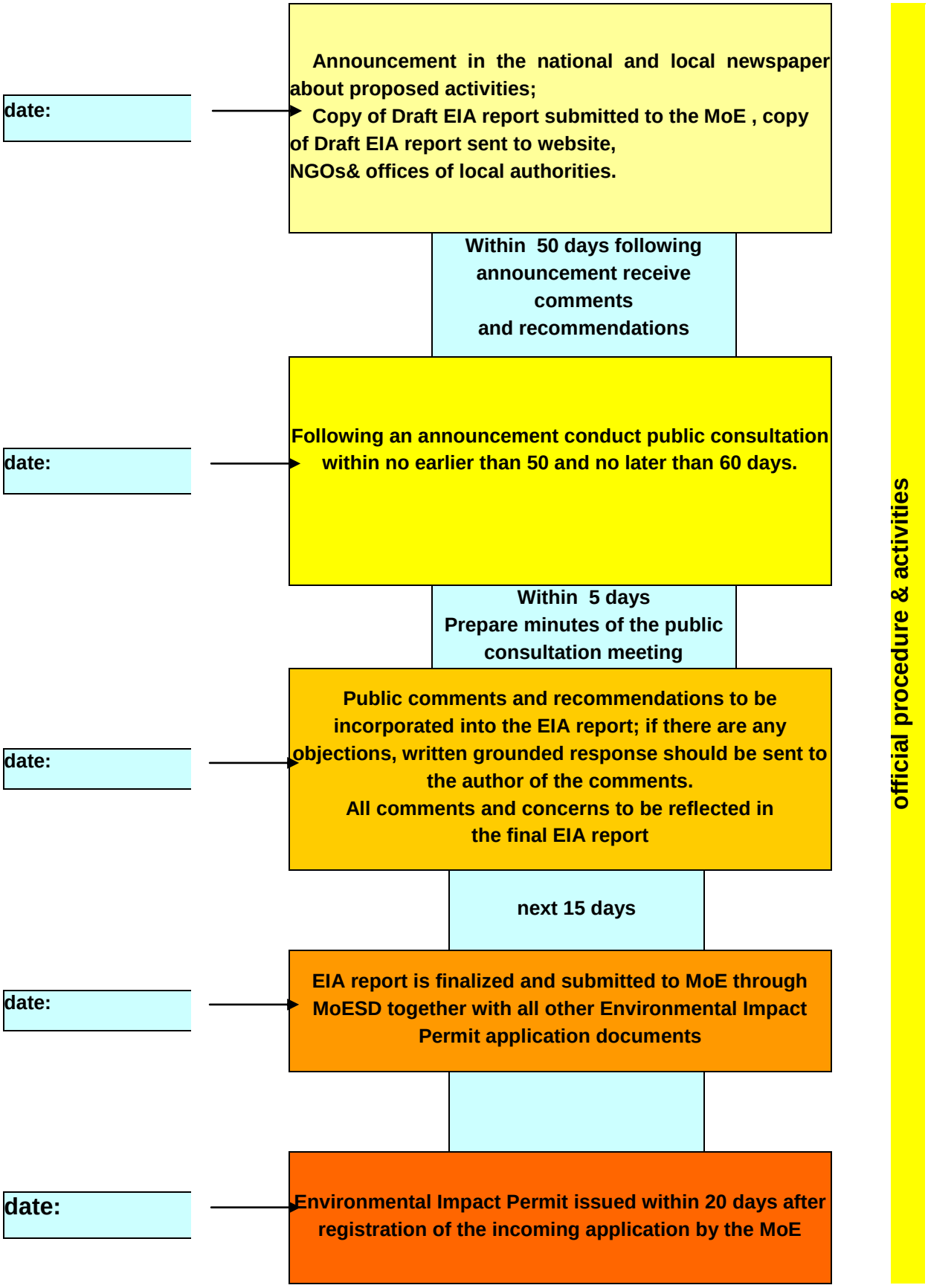
(l) Plan for the post-project situational analysis;

(m) Identifying the kinds and quantities of the expected emissions;

(n) Forecast of the expected environmental state gained through the environmental impact factors;

Decree also requires development of the Monitoring Plan during the implementation of the project and at the end of the activity.

Disclosure and Environmental Impact Permit Procedure



1.2.3 Other Environmental Laws

The Law on Environmental Inspectorate

The Law on Environmental Inspectorate has been adopted in 04.05.2010. This Law has been abolished in 2011, however its provisions are in force until the relevant authorized bodies will issue new regulations. This Law authorized Environmental Inspectorate to conduct post EIA monitoring on compliance with the Conditions of Environmental Permit and conditions of licenses for exploration of natural resources. For the moment of issuing of this law, the Environmental Inspectorate was under the MoE. Currently, as we have described in p. 1.1, the Environmental Inspectorate has been replaced by Department of Environmental Supervision. Department of Environmental Supervision is carrying responsibilities for the post EIA monitoring.

Waste Management. The following acts of the Ministry of Labour, Health and Social Protection of Georgia define the waste management rules to be met during the road rehabilitation projects:

The act on "Approval of the rules of collection, storage and neutralization of the wastes of preventive treatment establishments" 16 August of 2001, 300 ("Georgian Legislative Messenger" N90 24/08/2001);

The act on "Approval of arrangement of polygon/grounds for disposal of solid household wastes and adoption of sanitary rules and norms" 24 February, #36 (Georgian Legislative Messenger #17, 07.03.03);

The "Georgian Law on Ambient Air Protection" was put into effect from 1 January 2000.

The scope of the "Georgian law on Ambient Air Protection" is to protect ambient air on the whole territory of Georgia from harmful human impact. This law does not govern the field of air protection in work places. Main competences of governmental authorities in the field of ambient air protection (a) Development of environmental monitoring (observation) system; (b) Development and implementation of common policies and strategies; and (c) Development of integrated ambient air pollution control.

Types of harmful human impact include:

- introduction of pollutants into the ambient air;
- radioactive impact on ambient air;
- ambient air pollution with micro-organisms and microbial toxins;
- physical impact of noise, vibration, electromagnetic field etc on ambient air.

Types of ambient air pollution are specified:

- emission of pollutants into the ambient air from stationary pollution source;
- emission of pollutants into the ambient air from mobile sources of pollution;
- emission of pollutants into the ambient air from non-point sources of pollution;
- emission of pollutants into the ambient air from small-scale sources of pollution.

According to the Article 29[1], the inventory on emissions of air pollutants from stationary pollution sources is obligatory for physical and legal entities. The special inventory report is to be prepared for 5 years for each source of the atmospheric air pollution and each type of a harmful substance.

At preparing the EIA project, a full inventory on emissions (in case of existence) is to be carried out and maximum permissible concentrations or temporarily agreed permissible concentrations of the emitted harmful substances for stationary pollution sites are to be set. Maximum permissible concentration is an amount of permitted emissions of air pollutants from stationary pollution sources. Temporarily agreed permission concentrations can be approved for five years (maximum) without prolongation. The Maximum permissible concentration of the emitted harmful substances for stationary pollution sites is approved for 5 years for each source of the atmospheric air pollution and each type of a harmful substance.

Registration of emissions from stationary pollution sources comprises:

- self-monitoring of emissions;
- state emission registration system.

Self-monitoring of emission of pollutants from stationary pollution sources means that economical actor (operator) shall conduct adequate self-monitoring of pollutant emissions from stationary pollution sources. It includes:

- emission measurements (assessment)
- registration of emissions
- reporting of emissions

State emission registration system is a system of compilation, processing and analysis of emission reporting documentation. The Ministry of Environment Protection and Natural Resources of Georgia conducts state registration of emissions.

The Law of Minerals of 1996 provides provisions for the mineral resource exploration and management and establishes the requirement to obtain a license according to the procedures established under this law. The Law on Licensing and Permits (June 25, 2005) establishes the most recent regulations for licensing. According to the current legislation all quarries and borrow pits require to obtain a license.

The Wildlife Law of 1996 mandates the MoE to regulate wildlife use and protection on the whole territory of the country. The law empowers the MoE to issue hunting permits and licenses, declare hunting areas, control poaching etc. Potential poaching by the workers should be controlled also during construction works, especially in such a sensitive ecological areas as Borjomi-Bakuriani.

Forestry Code of Georgia (1999, including effective amendments)

The Forestry Code of Georgia regulates the legal relations connected to looking after, protection, restoration and application of the forest fund and its resources. The aims of the Forestry Code of Georgia are as follows:

Looking after, protection and rehabilitation of forests aiming at conserving and improving their climatic, water-regulating, protective, cultural, health, medicinal and other mineral wealth, conservation and protection of original natural and cultural environment and its individual components, including the vegetation cover and fauna, bio-diversity, landscape, cultural and natural monuments in the forests, rare and endangered plant species and others and regulation of their interaction in the benefit of the future generation.

Article 38 of the Forestry Code establishes the modes of protection of the state forest fund:

(1) Aiming at protecting the present state of the state economic forest fund and its biodiversity, originality of intact forests and relict, endemic and other valuable plant species, the general or special mode of protection of the state economic forest fund has been introduced by considering the priority functionality, historical, cultural and other values of the forest

(2) The mode of protection of the protected territories of Georgia is defined under the Georgian Law 'On the system of protected territories'.

Article 41 defines the modes of protection to be used for different categories of the state economic forest funds:

(1) The mode of special protection applies to the resort and green zones of the state economic forest fund, as well as flood-plain forests and forest sub-alpine zone.

(2) The mode of general protection applies to the soil conservation and water-regulation forests under the rule provided by Article 42 of the present Code.

Article 39 specifies the special limitations to certain types of activity defined by the special mode of protection:

(1) The following activities are prohibited in the state economic forests and lands where a special mode of protection is applied:

(a) Cutting of a principal use;

(b) Activities of the first and second categories as defined by the Law of Georgia 'On environmental permits', except the programs for rehabilitation of the protected areas and founding the hunting firms (02.03.2001 749).

Law of Georgia 'On the system of the protected areas' (1996)

The Law defines the categories of 'protected areas' and specifies the frames of activities admissible in the given areas. The permitted actions are defined by considering the designation of the areas and in accordance with the management plans

and provisions of the international conventions and agreements to which Georgia is a party. As a general requirement, the following activities are prohibited in the protected areas:

(a) Disturbance or any other changes of the natural ecosystems

(b) Demolition (destroy), arrest, disturbance, damage (invalidation) of any natural resource with the purpose of its exploitation or any other purpose

(c) Damage of the natural ecosystems or species by reason of the environmental pollution

(d) Bringing and breeding foreign or exotic species of living organisms

(e) Bringing explosives or toxic materials to the area.

According to the above-mentioned Management Plan, all kinds of economic and entrepreneurship activities are admissible in the support zone provided they do not hamper the functioning of the protected areas.

Law of Georgia 'On the Red List and Red Book' (2003)

The Law regulates the legal relations in the field of developing the Red List and Red Book, protecting and using the endangered species, except the legal issues of the international trade with endangered wild animals and wild plants, which within the limits of the jurisdiction of Georgia are regulated by virtue of the Convention 'On the international trade with the endangered species of wild fauna and flora' concluded on March 3 of 1973 in the city of Washington.

According to Article 10 of the Law, any activity, including hunting, fishing, extraction, cutting down and hay-mowing, except particular cases envisaged by the present Law, Law of Georgia 'On animal life' and legislation of Georgia, which may result in the reduction in number of the endangered species, deterioration of the breeding area or living conditions, is prohibited.

Possible harmful effect of anthropogenization on the endangered species should be taken into account when issuing the permit on environmental impact during the ecological expertise.

The Red List of Georgia was approved by the Presidential Decree No. 303 'On approving the Red List of Georgia' (May 2, 2006)

The water supply and wastewater system rehabilitation project is to be accomplished within the resort zone and accordingly, the Law of Georgia 'On Tourism and resort' and Law of Georgia 'On the zones of sanitary protection of resorts and resort areas' should be considered.

Decree No. 538; There is a chance that the project activity may cause harm to the environment, which will be impossible to mitigate even through planning and realizing

the preventive measures. The rules to estimate and compensate for the environmental damage have been developed for such cases under the Decree No. 538 ‘On approving the methods to estimate the environmental damage’ of the Minister of Environmental Protection and Natural Resources of Georgia adopted on July 5, 2006. Below we site the clauses, which may be useful to estimate the damage within the limits of the project.

Article 2. The rule to estimate the damage caused by the harmful anthropogenic action on the atmospheric air

Article 3. The rule to estimate the environmental damage caused by the soil pollution

Article 4. The rule to estimate the environmental damage caused by the soil degradation

Article 5. The rule to estimate the environmental damage caused by illegal action with forest resources

Article 6. The rule to estimate the environmental damage caused by damaging the green plantations in the capital of Georgia, other cities and towns, regional centers and settlements

Article 7. The rule to estimate the damage caused by damaging the fish reserve and other biological forms

Article 8. The rule to estimate the damage caused by illegal acquisition of the animal life objects

Article 9. The rule to estimate the environmental damage during the fossil exploitation

Article 10. The rule to estimate the environmental damage caused by the pollution of water resources.

The Law of Georgia on Soil Protection

(1994. Amended in 1997, 2002)

The aim of the Law is to protect the soil from the contamination and sets the limits for the hazardous substances concentration in it.

The regulates the usage of fertile soils for non agricultural purposes and strictly prohibits to undertake any kind of activity without removal of the fertile soil layer and makes compulsory to reinstate sites after open mining. It regulates uncontrolled pasturing of animals and protects forest as a mean to maintain the soil in a favourable condition. Prohibits and regulates any kind of activity related to the storage of chemicals and hazardous substances could pollute or damage the soil properties.

The Law of Georgia on Water 1998 as amended

This Act governs the legal relations: Between state authorities and natural and legal persons (regardless of the form of ownership and the legal-organizational status) in the sphere of water protection, study and use;

In the sphere of water protection, restoration and use on the land, in the continental shelf, territorial waters and in the special economic zone;

In the sphere of commercial water production and international trade in water;

Under the current law requirements no water discharge or abstraction license is required in case of discharge of the water the developer by Environmental Impact Permit might be required to submit Maximum Permissible Discharge Documents culculating the volumes of the discharge and impact on environment.

The '**Law of Georgia on Cultural Heritage**' was approved in May of 2007. Article 14 of the Law specifies the requirements for 'large-scale' construction works. According to this Article, a decision on career treatment and ore extraction on the whole territory of Georgia, as well as on construction of an object of a special importance as it may be defined under the legislation of Georgia, is made by a body designated by the legislation of Georgia based on the positive decision of the Ministry of Culture, Monument Protection and Sport of Georgia. The basis for the conclusion is the archeological research of the proper territory to be carried out by the entity wishing to accomplish the ground works. The entity wishing to do the ground works is obliged submit the Ministry the documentation about the archeological research of the territory in question. The preliminary research should include field-research and laboratory works. In case of identifying an archeological object on the territory to study, the conclusion of the archeological research should contain the following information: (a) a thorough field study of the archeological layers and objects identified on the study territory by using modern methodologies, (b) recommendations about the problem of conservation of the identified objects and planning of the building activity on the design territory, on the basis of the archeological research.

Georgian Law on Regulation and Engineering Protection of Coasts of Sea, Water Reservoirs and Rivers of Georgia (27.12.2006, No. 4131)

Article 9. Rules regulating the economic activity within the coast protection zone

(1) The body issuing a building permit within the zone of coast engineering protection is obliged to engage the Ministry in the permit issuing process as a concerned administrative body and send it proper documentation for the obligatory conclusion.

(2) The construction project of buildings and premises within the zone of coast engineering protection should envisage the compensation amounts for the expected coastal damage.

(3) Extraction of inert material within the zones of strict supervision of sea, water reservoir or river is prohibited, unless this is done for the purposes of coast-formation or control of streams.

1.2.4 International Commitments

International cooperation is a dominant feature and driving force for environmental reforms in Georgia. Some of the International Treaties and Conventions Ratified or Signed by Georgia are provided in the list below.

Short List of the Ratified or Signed Conventions

N	Title	Year of ratification
1	Ramsar Convention on Wetlands	1996
2	United Nations Framework Convention on Climate Change (UNFCC)	1994
3	Kyoto Protocol	1999
4	Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Their Disposal	1999
5	Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)	1999
6	United Nations Convention to Combat Desertification (UNCCD)	1999
7	Convention on Biological Diversity	1994
8	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1996
9	The Vienna Convention for the Protection of the Ozone Layer	1995
10	Montreal Protocol on Substances that Deplete the Ozone Layer	1995
11	Convention on Long-range Transboundary Air Pollutants	1999
12	Stockholm Convention on Persistent Organic Pollutants	2006
13	Convention on the Conservation of European Wildlife and Natural habitats	2008
14	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2006

Aarhus Convention June, 1998

The Aarhus Convention establishes a number of rights of the public (individuals and their associations) with regard to the environment. The Parties to the Convention are required to make the necessary provisions so that public authorities (at national, regional or local level) will contribute to these rights to become effective. The Convention provides for:

- The right of everyone to receive environmental information that is held by public authorities ("access to environmental information"). This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Applicants are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession;
- The right to participate in environmental decision-making. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for projects affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it ("public participation in environmental decision-making");
- The right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("**access to justice**").

Setting the goal to preserve its biological diversity and realising the importance of international cooperation, Georgia signed the Convention on Biological Diversity in 1994, thus accepting responsibility to safeguard the nation's rich diversity and of plant, animal, and microbial life to begin using biological resources in sustainable way, and to ensure equitable sharing of benefits from biodiversity

The Convention on Biological Diversity is the first global agreement, which, along with biodiversity conservation, necessitates the sustainable use of biological resources Georgia has been recognised as holding an important reservoir of biodiversity and is very important in the global context – according to the surveys and assessments conducted at an international level Georgia, as a part of the Caucasus, is recognized as:

.1. One out of 25 biologically richest and endangered land ecosystems (Conservation International);

2. One out of 200 vulnerable ecoregions (WWF);

3. One out of 221 endemic bird habitats (Bird Life International);

4. One of the World Agrobiodiversity Centres.

Georgia has implemented a number of measures on fulfilment of the guidelines defined by the International environmental treaties which is party to, in particular:

- The country acceded the most important international treaties on biodiversity, such as Convention on Biological Diversity, Convention on Wetlands of International Importance, Especially as Waterfowl Habitat**,** Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Convention on the

Conservation of Migratory Species of Wild Animals (the Bonn Convention) and its Agreements;

- A number of national legislative acts has been adopted in the field of conservation and sustainable use of biodiversity since 1996;
- Georgia conducted biodiversity assessment studies (National Biodiversity Assessment Program, UNEP, 1996);
- Strategy and Action Plan on conservation of Georgia's biological diversity was elaborated and approved (2005);
- With the financial support of the German Government and the Global Environment Facility (GEF), the Protected Areas - the Borjomi-Kharagauli and the Kolkheti National Parks were established; with the support of the German Government, new protected areas are planned to be established on the Javakheti Plateau in southern Georgia;
- With the support of the Global Environment Facility (GEF), the Project on Development of Protected Areas in Georgia is being implemented. The aim of the project is to elaborate management plans for three protected areas in eastern Georgia (Lagodekhi, Vashlovani and Tusheti), to develop infrastructure necessary for their effective management and to strengthen the State Department for Protected Areas in terms of improving skills for protected areas management;
- With the financial support of the World Bank, the forestry development project is under implementation in Georgia to promote conservation and sustainable use of Georgian forests.

Though the development of protected areas is the major strategy for protection of biodiversity in Georgia, some other priority directions in this field have emerged:

- conservation – preservation of rare and endangered species in bio-reserves;
- creation of genetic fund of wild nature;
- sustainable use of renewable natural resources;
- reproduction – breeding of rare and endangered species and their introduction in the nature.

The Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It has been signed in 1979 in Bonn (Germany.) Georgia ratified the treaty in 2000 together with its three agreements:

- Agreement on "Protection of Populations of European Bats" (EUROBATS);
- Agreement on "Conservation of Cetaceans of the Mediterranean Sea, Black Sea and Contiguous Atlantic Area " (ACCOBAMS);

- Agreement on " Conservation of African-Eurasian Migratory Waterbirds" (AEWA).

Taking into account, that the Agreements have been initially designed as an instrument for facilitating the implementation of the CMS, the compliance with and enforcement of CMS in Georgia is mostly reflected in implementation of the Agreements.

1.2.5 Environmental Standards and Norms

Environmental Quality Regulations and Standards

Within the context of the water supply and water drainage project, the environmental quality standards and norms are of primary importance. They define the quality of drinking water, admissible levels of surface waters pollution and measures of their protection including the zones of sanitary protection. The mentioned standards are considered under a separate clause (Clause 2.1.4). The maximum admissible levels of atmospheric air pollution and noise are also of a certain importance to the stage of building. Noise and atmospheric air pollution pose be a certain problem during the building operations (mainly, as the building techniques emissions and welding emissions) and exploitation of the rehabilitated objects (e.g. in case of operation of diesel-generators).

In accordance with the 'Law on public health', the environmental qualitative norms are approved by Decrees of the Minister of Labor, Health and Social Security of Georgia (Decrees Nos. 297/N of 16.08.2001, including the changes made to it by further decrees of the Ministry Nos. 38/N of 02.24.2003, 251/N of 09.15.1006, 351/N of 12.17.2007).

Ambient Air Quality Norms. The provisions for the protection of ambient air against contamination and the values of Maximum Admissible Concentrations of the harmful substances in the ambient air in the vicinity of the settlements is provided in the Environmental Quality Norms approved by the Order #297N (16.08.2001) of the Ministry of Labour, Health and Social Protection (as amended by the Order No 38/n of the same Ministry of 24.02.2003). The quality of atmospheric air (pollution with hazardous matter) is also defined by the order of the Minister of Environment Protection and Natural Resources (#89, 23 October 2001) on approval of the rule for calculation of index of pollution of atmospheric air with hazardous pollution.

Table 1.1 Maximum Admissible Concentration of Pollutants (MAC) in Ambient Air mg/m^3

N	Substance	N according to CAS	Formula	MAC (mg/m^3)		Class of harmfulness
				Maximum fugitive	Average Daily	
1	2	3	4	5	6	8
6	Nitrogen (IV) Dioxide	10102-44-0	NO_2	0.2	0.04	2
111	Sulfur Dioxide	9/5/7446	SO_2	0.5	0.05	3

359	Carbone Oxide	630-08-0	CO	5	3	4
360	Soot (Carbone black)	1333-86-4	C	0.15	0.05	3

Noise Standards. The Georgian standards for noise control are approved by the Decree of the Minister for Health, Labour and Social Affairs (297n of August 16, 2001) on the 'Approval of Environmental Quality Standards', which specify the tolerable and maximum admissible levels of noise for different zones.

Table 1.2. Georgian Noise Quality Standards in Residential Areas

Time	Indicative Level La dBA	Maximum Admissible Level La max dBA
7am – 11 pm	55	70
11pm – 7am	45	60

EIB Requirements on Environmental Assessment and Management

Environmental protection and improvement, and benefits to people's welfare form key operational priorities for the European Investment Bank, the European Union's long-term lending institution. The EIB's environmental and social safeguard policies are based on the EU approach to environmental sustainability. The principles, practices and standards derived from these policies are highlighted in the Declaration on the European Principles for the Environment (EPE), agreed to by the EIB and four other European multilateral financing institutions[1] in May 2006.

The general approach of the Bank is described in a number of public documents:

a. Document	b. Year	c. Comment
d. European Principles for the Environment	e. 2006	f. Launched in June 2006; key documents published on a dedicated website www.eib.org/epe
g. Environmental Statement	h. 2004	i. Next revision planned 2007
j. The EIB and its Contribution to Sustainable Development	k. 2002	l. To be revised in the light of the current review of EU Sustainable Development Strategy
m. The EIB Project Cycle	n. 2001	o.

The EIB aims to maximise the environmental benefits and to minimise the environmental costs of the projects that it finances through appropriate screening, mitigation and compensation measures.

Environmental considerations are taken into account at all stages of the project cycle. In the case of co-financing with other institutions, the Bank may agree to apply the environmental standards of the co-financing institution, where these are comparable to

EU standards, in the light of local conditions. However, the EIB will always carry out is own independent assessment.

The EIB's environmental safeguard measures include that:

the Bank's approach to financing projects is based on the precautionary principle, preventative action rather than curative treatment should be taken, environmental damage should be rectified at source and the polluter should pay, according to the Treaty Establishing the European Community

The following Euro Directives should be envisaged during preparation of EIA.

- Council Directive (27 June 1985) on Environmental Impact of Number of Social and Private Projects (85/337/EEC);
- Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC
- Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC - Statement by the Commission

All projects financed by the Bank are the subject of an Environmental Assessment (EA), normally carried out by its own staff, but if by others according to the requirements of the Bank. For this purpose, projects are screened into four categories, based on the guidelines of the EU Environmental Impact Assessment (EIA) Directive:

Cat. A - those for which an EIA is mandatory (Annex 1 of the Directive);

Cat. B - those for which the competent authority determines the need for an EIA according to specified criteria (Annex II of the Directive, with ref. to Annex III);

Cat. C - for which a limited environmental assessment, if any, is required according to any likely adverse environmental impacts of the project (projects outside the scope of the Directive);

Cat. D - no environmental assessment required.

all projects financed by the Bank are also screened according to their potential impacts on sites of nature conservation. Where the impacts are expected to be significant, a special biodiversity assessment is carried out, according to the principles and practices of the EU Habitats Directive (ref. Art. 6 of the Directive)

Bank projects are assessed for their expected impacts in terms of greenhouse gas emissions; the scope for improvements in energy efficiency and the need for measures to adapt to climate change are also reviewed

the principles, recommended practices and standards of the EU Water Framework Directive and EU Waste Framework Directive are applied for projects financed by the Bank in the sectors of water and waste, respectively

according to the sector, projects should comply with the relevant standards laid down in EU law, for instance those of the Large Combustion Plant Directive in the power generation sector and the Integrated Prevention Pollution and Control Directive in the industry sector

the Bank is also guided by recognised good international practices, such as those laid down by the World Commission on Dams (WCD) and the Extractive Industry Review (EIR)

all projects financed by the Bank should comply with the requirements of relevant multilateral environmental agreements (MEA) to which the host country - and/or the EU in the case of a EU Member State - is a party, including the Montreal Protocol (on ozone depleting substances), the UN Convention on Climate Change and the Kyoto Protocol (on greenhouse gas emissions) and the Aarhus Convention (on environmental information).

Environmental resources

The main responsibility for scrutinising the environmental aspects of projects lies with the Bank's Projects Directorate, which has about 80 engineers and economists, all with adequate environmental skills, who undertake the environmental assessment of projects at the EIB. The project teams, made up of engineers, economists, financial experts and lawyers, have front-line responsibility for managing environmental issues. They bring together significant cross-sectoral and cross-regional resources, experience and professional knowledge.

However, environmental management is further reinforced by a number of dedicated support units to provide direction and advice on the Bank's environmental policy, ensure a consistently high quality of assessment, improve awareness and create stronger capacity for external dialogue with relevant third parties:

The Environmental Steering Committee (ENVSC) that advises on environmental policy development and environmentally complex projects. The committee comprises high-level staff members from the different Directorates within the Bank.

The Environmental Assessment Group (ENVAG) safeguards the application of the environmental policies and procedures of the Bank and examines each project. ENVAG has some 10 members (environmental experts from the principal sectors in which the Bank operates).

The Environment Unit (ENVU), in conjunction with ENVAG and ENVSC, develops policy, procedures and guidelines, provides training, disseminates information and works closely with the European Commission, especially DG ENV, other financial institutions and governmental and non-governmental organisations.

A Centre of Expertise for the Environment and Energy in the Directorate for Lending Operations in Europe aims to develop the environmental lending of the Bank through appropriate financing instruments and to reinforce the application of good environmental

management practices to all financing activities in Europe. Similar arrangements exist in the Directorate for Lending Operations outside Europe.

The Bank also maintains an extensive professional training and awareness-building programme on environmental and social issues for its staff.

Social issues

The EIB has taken social safeguard issues into account for many years as part of its overall environmental assessment of projects. Social issues are now also assessed in their own right, where necessary, as part of an integrated assessment. For projects mainly located outside Europe, internal guidelines are based on internationally accepted good practices, and in developing countries related to the Millennium Development Goals. They focus on labour standards, occupational and community health and safety (including major communicable diseases), population movement (including involuntary resettlement issues), minority **rights (including indigenous people, women and vulnerable groups), public consultation and participation, and cultural heritage.**

In large complex projects co-financed with other International Financing Institutions (IFIs), responsibilities for appropriate social assessment is often shared and the Bank may utilise other co-investors' existing social safeguard policy frameworks.

2. Environmental Baseline Reports

2.1 Climate

According to the classification of the authorized climatologist M. Kordzakhia, the considered territory of the highway "corridor" - belongs to the a damp, subtropical climatic zone (East zone) in the west of Georgia. Climate of the first zone is formed under influence of its location on the border between subtropical and moderate latitudes, circulation processes in the atmosphere and the orographic patterns. Due to the influence of the mountain ridges bordering from three sides, the damp, unstable air masses coming from the West - from the Black Sea, undergoe convergence and then ascending flow up the west slopes of mountains. This causes the formation here of a damp climate, with big amount of precipitation almost any time of the year, against the background of high thermal regime. In general, the mention zone is subdivided into several climatic regions. Two of them are croosed by the Zestaphoni – Kutaisis section of the highway. The region - Kvemo_Imereti is the higher part the of Kolkheti Lowland. It extends up to the gorge of the river Kvirila. The sea influence here is weaker in comparison with the regions considered before. We describe the region according to data provided by the meteorological stations in Vani, Ajameti, Samtredia and Kutaisi. The annual mean temperature here varies between 13.9^{0}C and 14.5^{0}C. It is especially high in Kutaisi (Table 2) where it often causes the droughts . In the south part, near the Ajameti, the annual mean is equal to 14.1^{0}C. The average temperature in January varies between 4.1^{0}C and 5.2^{0}C. The average temperatures in July and August exceed 23^{0}C. The absolute maximumis 41 - 42^{0}C for all locations except Samtredia, while the absolute minimum varies in the range 17^0 - 18^{0}C.

The number of frosty days per year is in the range of 20 - 30. Frost can take place in the period from November to April.

In the region the east winds are dominating throughout the year. The annual evolution of the wind direction has seasonal character. In particular, in winter the east (continental) wind prevails, while in summer the west (from the sea) wind is dominating. The east winds have foehnic character; the foehns are especially frequent and strong in the north part of the region, e. g. in Kutaisi, where they often cause droughts against the background of the high temperature field. In the south part of the region, directly on the pipeline route, the wind speed is comparatively low. This can be explained by the existence of Ajameti State reserve, where there are the big forest tracts.

Relative humidity is considerably lower (70 - 74%), than in the whole damp subtropical region. Its maximum (76%) is observed in July, and minimum - in December (64%).

Precipitation amount varies in the range of 1,040 - 1,380 mm (Table 12). Precipitation can take the form of snow during the period from November to April. In Samtredia the number of snowy days in year is equal to 15, in Kutaisi - to 20. But in some years there are no snowy days at all. Against the background of the high thermal field, even snow

coming in January - February is thawing quite soon and does not form the stable snow cover.

The annual average temperature of the soil surface is 15^0C everywhere. The soil surface temperature is maximal in July and minimal in January (Table 5). During the observation period the absolute maximum in Kutaisi reached the vallue of 63^0C (Table 6). The absolute minimum has been observed in January and fell down to -23^0C (Table 7). The soils here are mainly alluvial. The level of ground water in Samtredia and nearby is 1 - 1.5 m. During the pouring rains ground water often flow out to the surface. This fact requires special attention. The most sensitive part of the region is Ajameti reserve. This reserve, which is situated between the two rivers - Khanistskali and Kvirila - is broken by a number of small tributaries.

The region - lower reaches of the river Kvirila basin. This region is a direct continuation of the Kvemo Imereti region (up to 400 - 500 m altitude). At a greater distance from the sea coast the winter becomes more cold and the summer - hotter and relatively dry. The temperature annual amplitude is greater here than in previous regions. Its value exceeds 21^0C.

We describe the region according to the data provided by the meteorological stations in Saqara. It must be mentioned, that the proposed routes of the highway pass very close to Saqara. Therefore, its data describe exactly the climatic conditions of the route.

The mean annual temperature is within the range of 13 - 14^0C. The temperature of the coldest month, January, varies between 2.4^0 and 4.3^0C. The absolute minimum is equal to -17 -20^0C. The number of frosty days per year is between 35 and 50 (from November till April). It can be said, that here, as well as in the previous regions, the maximal temperature reaches 42^0C in August almost everywhere.

In spite the fact, that region territory is absolutely open from the west side, the east winds are dominating throughout the year. They have foehnic nature and are characterized by relatively high speed.

The annual amount of precipitation equals 1,040 - 1,095 mm with the increased value falling on autumn and winter; the lowest level of precipitation is in summer. The daily maximum of precipitation in Saqara is equal to 120 mm. Snow cover in the most parts of the region is unstable.

The relative humidity during the year varies between 68% and 76%. The minimum (68%) is observed in April, and the maximum (76%) - in October.

Region is characterized by the high level of solar radiation, quite hot and long summer and moderate humidity. Among the all subtropical regions, prolonged duration of the solar radiance is typical for this region.

Table 2.1.1. Duration of sunshine (hour).

Meteorological station	Months												Annual Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Saqara	98	106	134	176	214	247	248	254	215	182	123	103	2100

Table 2.1.2. Air temperature °C.

Meteorological station	Months												Average Annual	Annual Amplitude
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Samtredia	4.7	5.6	8.8	13.0	18.0	21.0	23.2	23.5	20.4	16.2	11.2	7.0	14.4	18.8
Vani	4.1	4.8	8.2	12.6	17.6	20.7	23.0	23.4	20.0	15.6	10.8	6.3	13.9	19.3
Kutaisi	5.2	5.8	8.4	12.9	17.9	21.0	23.2	236	20.5	16.4	11.5	7.5	14.5	18.4
Ajameti	4.3	5.0	8.1	12.7	17.6	20.8	23.2	236	20.3	16.0	10.8	6.3	14.1	19.3
Saqara	3.7	4.5	7.8	12.8	18.0	21.2	23.6	23.9	20.3	15.5	10.1	5.7	13.9	20.2

Table 2.1.3. Absolute minimf of atmospheric temperatures °C.

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	-17	-15	-10	-2	2	8	11	11	5	-2	-10	-15	-17
Vani	-18	-14	-11	-3	2	8	11	10	4	-3	-13	-15	-18
Kutaisi	-17	-13	-10	-5	2	9	11	11	5	-2	-10	-13	-17
Ajameti	-20	-15	-11	-3	0	6	10	10	4	-4	-11	-17	-20
Saqara	-20	-16	-12	-4	1	6	10	9	3	-4	-12	-17	-20

Table 2.1.4. Absolute maxima of atmospheric temperatures °C.

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	20	25	33	35	37	40	41	40	38	34	30	23	41
Vani	21	24	32	36	36	41	41	41	39	33	29	22	41
Kutaisi	21	25	32	35	37	40	41	42	40	35	30	25	42
Ajameti	22	24	32	35	37	40	41	42	40	34	31	24	42
Saqara	22	25	32	35	37	41	41	42	41	35	30	24	42

Table 2.1.5. Soil surface temperature °C.

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	4	5	9	14	21	25	27	26	22	16	10	5	15
Kutaisi	3	4	8	14	21	25	27	27	22	16	10	5	15
Saqara	2	3	8	15	22	26	30	28	22	16	8	3	15

Table 2.1.6. Absolute maxima of soil surface temperatures °C.

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	23	30	42	49	56	62	62	62	55	49	33	25	62
Kutaisi	22	28	42	55	57	60	63	61	57	47	35	27	63
Saqara	28	35	46	55	63	66	71	65	61	49	36	27	71

Table 2.1.7. Absolute minima of soil surface temperatures °C.

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	-23	-23	-9	-4	1	6	10	11	4	-3	-13	-17	-23
Kutaisi	-19	-15	-12	-4	1	8	10	10	4	-4	-11	-15	-19
Saqara	-27	-25	-19	-6	-1	5	9	8	2	-3	-21	-25	-27

Table 2.1.8. Annual repetition of wind directions.

Meteorological station	Main Points								
	N	N/E	E	S/E	S	S/W	W	N /W	Calm
Samtredia	0	1	45	6	1	11	34	2	35
Vani	2	2	36	9	2	3	39	7	45
Kutaisi	1	3	53	2	1	3	35	2	27
Dimi	2	7	25	14	16	2	29	5	15
Saqara	1	4	35	12	4	4	38	2	51

Table 2.1.9. Wind Speed (m/sec).

Meteorological station	Months												Average Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	3.2	3.4	3.6	3.4	2.8	2.3	1.8	1.8	1.8	2.3	3.6	3.6	2.8
Vani	2.9	3.3	3.5	3.3	2.6	2.2	1.8	1.9	1.7	2.2	3.2	3.3	2.7
Kutaisi	5.6	5.6	5.9	5.7	4.6	3.7	3.0	3.4	3.6	4.8	7.2	6.7	5.0
Dimi	3.5	3.5	3.5	3.2	2.5	2.2	1.8	2.2	2.2	2.5	3.4	3.6	2.8
Saqara	1.9	2.1	3.1	3.0	2.6	2.4	2.3	2.2	1.8	1.5	2.2	1.8	2.2

Table 2.1.10. Mean number of strong wind days (≥15m/sec).

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	2.9	2.8	2.9	2.7	1.8	1.0	0.5	0.8	0.9	1.7	3.0	3.0	24
Vani	3.2	3.4	4.2	3.0	2.0	1.4	0.8	2.0	2.1	2.2	4.3	4.2	33

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Kutaisi	7.5	6.9	8.5	8.1	7.1	4.2	2.7	4.3	5.4	7.2	9.6	9.6	81
Saqara	2.7	3.1	4.8	4.6	3.5	2.5	1.8	2.0	2.0	2.0	3.0	2.0	34

Table 2.1.11. Average atmospheric precipitation (mm).

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	142	130	102	78	64	90	11	93	130	150	146	149	1375
Vani	129	120	94	72	58	82	94	86	121	137	134	137	1264
Kutaisi	136	131	113	99	84	97	110	91	116	131	131	141	1380
Ajameti	111	110	90	75	63	71	56	53	75	101	116	119	1040
Saqara	127	126	104	86	72	81	64	61	85	116	132	136	1190

Table 2.1.12. Maximal atmospheric precipitation (mm).

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	347	375	251	196	161	195	287	200	287	402	378	374	1795
Saqara	307	384	245	208	159	174	193	143	187	326	483	353	1570

Table 2.1.13. Minimal atmospheric precipitation (mm).

Meteorological station	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	12	9	10	5	9	26	10	9	15	12	2	3	943
Saqara	9	25	17	3	10	13	8	12	6	12	1	7	827

Table 2.1.14. Maxsimum daily precipitation.

Meteorological station	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Samtredia	73	60	62	58	76	103	98	87	97	111	111	73
Saqara	77	62	94	79	87	60	56	74	72	92	91	120

Table 2.1.15. Relative air humidity (%).

Meteorological station	Months												Average Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	76	75	73	72	73	75	78	80	81	79	72	72	76
Vani	77	74	73	69	71	72	76	76	78	77	75	74	74
Kutaisi	68	68	69	66	69	72	76	75	74	71	65	64	70

Meteorological station	Months												Average Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Ajameti	70	69	69	67	70	72	75	73	74	72	68	67	70
Saqara	75	75	72	68	70	71	73	72	75	76	73	72	73

Table 2.1.16. Absolute air humidity (mb).

Meteorological station	Months												Average Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Samtredia	6.6	6.8	7.7	10.1	14.4	18.6	22.3	22.5	18.5	13.4	9.8	7.3	13.2
Vani	6.8	6.7	7.5	9.7	13.8	17.8	21.0	21.4	18.1	13.2	9.6	6.9	12.7
Kutaisi	6.0	6.2	7.0	9.6	13.5	17.6	21.6	21.4	17.4	12.4	9.0	6.8	12.4
Ajameti	5.9	6.1	6.8	9.4	13.6	17.4	20.8	20.3	16.8	12.1	8.7	6.5	12.0
Saqara	6.1	6.4	7.2	9.7	13.8	17.6	20.9	20.5	17.0	12.5	9.2	6.8	12.3

Table 2.1.17. List of meteorological stations along the Highway "corridor"

#	Meteorological station	Aaltitude m. (a.s.l)	Operation period
11	Samtredia	25	1923-60
12	Vani	46	1936-58
13	Kutaisi	114	1935-60
14	Ajameti	107	1922-35
15	Saqara	148	1892-1960

2.2. Geology, Geomorphology and Hydrogeology

2.2.1. Geomorphology

The first stage of construction of the design object is planned to realize from the city of Samtredia to the city of Lanchkhuti. The design object is a 31-km-long road of a strategic designation connecting these two municipal centers. The city of Samtredia is distanced by 268 km from Tbilisi (with the existing road) and the city of Lanchkhuti is located in 291 km from Tbilisi.

Fig. 1. Aerial photograph of Samtredia-Lanchkhuti section. The view of photographed from the height of 24,19 km

In a geographic respect, the given section is located on the southern edge of the central part of Kolkheti Valley. From south, it is bordered by Sairao ridge of South Mtianeti of Georgia (the Lesser Caucasioni). The low, but sharply contoured relief of “Sairao” low-mountain ridge (with “Talakha” (absolute height of 666.5 m) and “Sairao” (with the absolute height of 479.4 m) as its nearest peaks) on the background of even lower absolute heights (15-20 m) of Kolkheti Valley even better accents the two different geographical units. Their morphological contrast is well seen on a topographic map (Photo 2). The slightly inclined prominent alluvial and alluvial-marine lowland of Kolkheti is the accumulative surfaces of the first and second floodplain and over-floodplain terraces of the rivers Rioni, Tskhenistskali, Khobi, Enguri and others. Its slightly inclined surfaces vary between 20 and 70 m and in the south, immediately lean against Guria foothill, the foot of Sairao ridge. Its slightly inclined surfaces are covered with the large

rivers mentioned above and small rivers running down Sairao ridge and numerous drainage channels.

The floodplain terrace of the alluvial lowland of the river Rioni is elevated off the bed by at least 3 m and it gets covered with water during the floods on a periodic basis. This has led to the formation of clay-sandy bunds built with river silt near the bed, in parallel to the river. The alluvial lowland surface of the river Rioni is slightly inclined to the riverbed and towards the Sea at the same time.

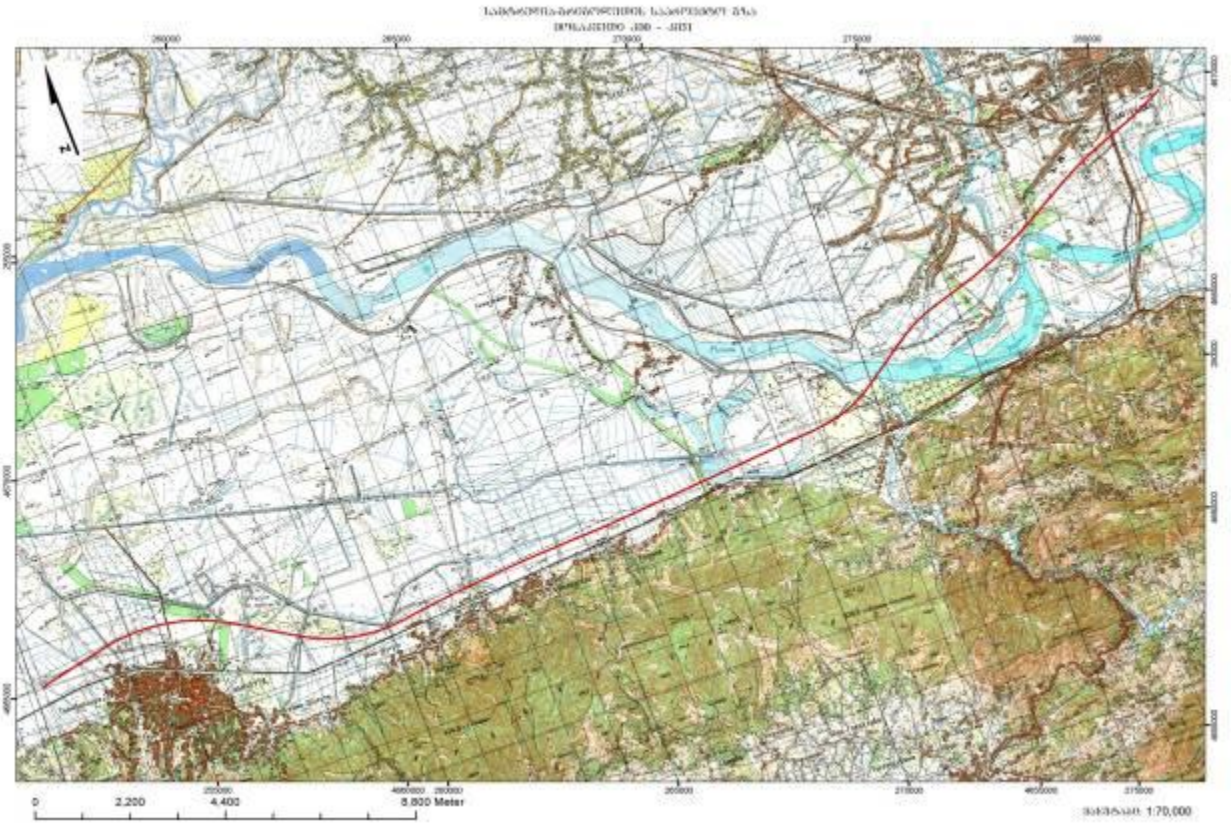


Fig. 2. Location of the geomorphologic elements and hydrographic network of the design road, Samtredia-Lanchkhuti section of the modernization road and its adjacent area. The red line marks the design road (topo-base scale: 1:70 000)

The second terrace surface of the river Rioni, which gets almost insignificantly elevated to south, at the low-mountainous Guria ridge foot, gradually merges with the surface covered with the Late Quaternary and Modern delluvial-prolluvial sediments with its inclination changing within the limits of 0.01° and 0.007° only. Its absolute heights are small and vary from 10 to 50 m.

The design road is crossed by two long rivers of west Georgia, the Tskhenistskali and Rioni and lower sections of the small rivers and gullies, which head on the northern slope of Guria ridge. These small rivers, were made rectilinear past the railway line what was necessary for trouble-free functioning of the drainage systems in the region. Many small rivers and gullies have their natural beds changed above the railway line. Their

artificial bed runs along the railway line and after merging with the neighboring gully, it is rerouted to run under the railway bridges and through branch pipes and then, through the rectilinear bed. The river Rioni as the main artery of the hydrographic network. The length of the river is 327 km and it heads on the southern slope of Caucasioni Ridge, at 2620 meters above sea level. It crosses the whole of Kolkheti Valley and flows into the Black Sea at the city of Poti. The area of its catch basin is 13 400 km^2.The catch basin of the river covers almost half of West Georgia, with Kolkheti Valley occupying only 19% of it. The river Rioni is fed with glaciers, snow, rain and ground waters. Its water regime is characterized by spring floods and freshets. A relatively stable low-flow period is fixed in autumn and winter months. The river is flown by its most important tributaries as it flows across Kolkheti valley, such as Jojora (with the length of 50 km), Kvirila (140 km), Khanistskali (57 km), Tskhenistskali (176 km), Noghela (59 km), Tekhuri (101 km), Tsivi (60 km). The length of eight tributaries is from 25 to 50 km, that of 14 tributaries is from 10 to 25 km and the length of each of other 355 tributaries does not exceed 10 km making the total length of 720 km.

The river Rioni is widely used for power generation and irrigation purposes. Gumati water reservoir with the power engineering designation is constructed on the river Rioni and it must guarantee the necessary output of Gumathesi-I and Gumathesi-II. There is a head structure of Rionhesi (Rioni Hydropower station) located here, which has been put into exploitation since 1934.

South of city Kutaisi, where the rivers Rioni, Kvirila and Khanistskali join, there is Vartsikhe water reservoir of a power generation designation created, supplying water to the cascade of Vartsikhe hydropower stations.

The second largest river to be considered during the construction of the design road and being an important hydrographic unit for the given region is the river Tskhenistskali. It also heads on the southern slopes of the Caucasioni ridge, in its central part, south of Sharivtseki pass, at 2.700 m above sea level, and flows into the river Rioni from its right side at village Gautskinari. The length of the river Tskhenistskali is 176 km. The area of its catch basin is 2120 km^2. The river Tskhenistskali is flown by 897 tributaries of different ranges, with the rivers Zeskho (with the length of 19 km), Gobishuri (12 km), Laskanura (20 km), Kheledula (34 km), Lektareshi (24 km) and Janaula (21 km) being most important of them. Out of other tributaries, the length of 13 rivers exceeds 10 km. The most of the river basin is located on the southern slopes of the Caucasioni Ridge, while the smaller lower part of the basin (30-35 km) is located on Kolkheti Valley. The basin has sharply distinguished high-mountainous, mountainous and lowland areas. The lowland zone interesting to us located in the eastern part of Kolkheti Valley, is characterized by lowland relief with the maximum heights of 15-18 m.

The design section and its adjacent areas in respect of soil spreading, according to the soil zoning of Georgia by Sabashvili M. (1964) is located in the region of podzolic and alluvial soils of the elevated area of the lowland of the zone of boggy and podzolic soils of Kolkheti Valley of intermontane lowland of west Georgian soil zone (Photo 8).

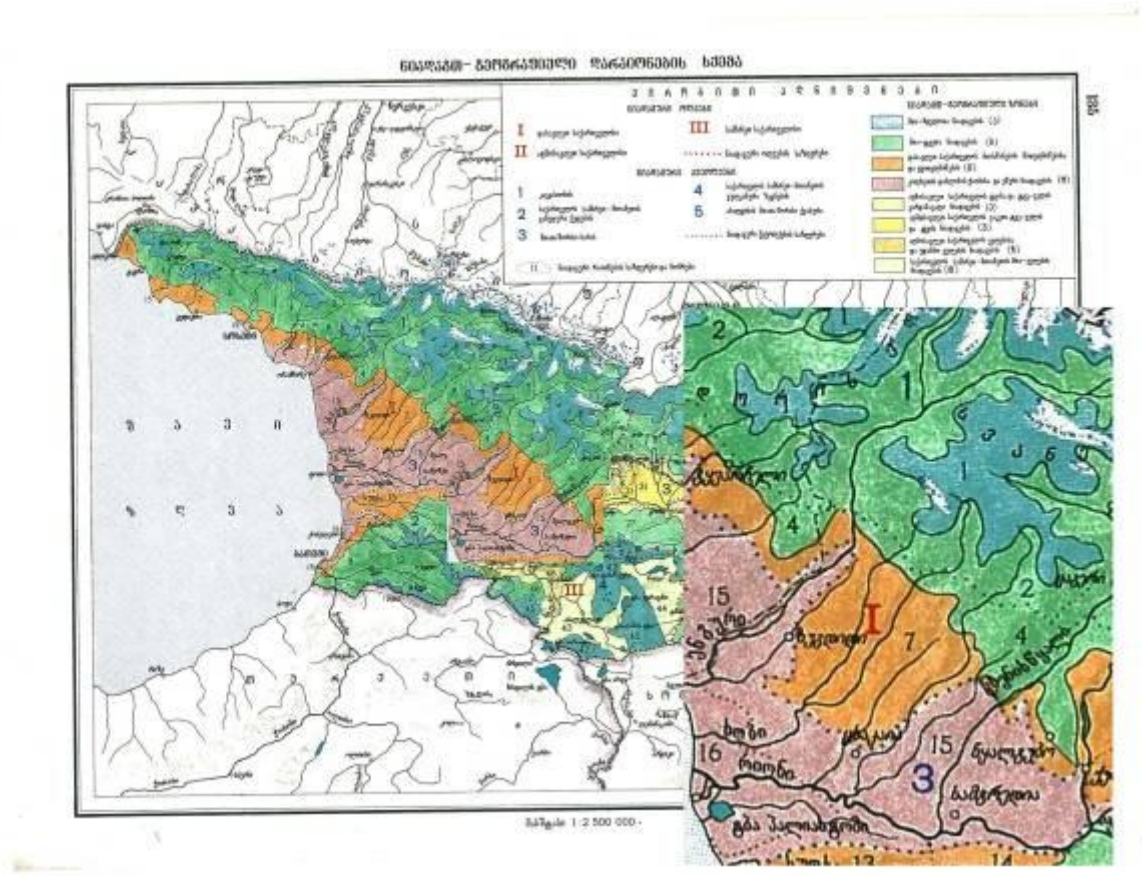


Fig.3 Soil Map

Mostly alluvial soils are spread here. These are the soils originated on the river deposits (alluvion) in terms of regular flooding. On the left bank of the river Rioni, there are so called saturated alluvial soils, and on the right bank of the river, in addition to them, there are alluvial carbonate soils and rarely acid alluvial soils. Floodplain vegetation is typical to the alluvial soils. There are subtropical podzolic soils with humus horizon of a minor thickness in the west-south of the region, in the areas adjacent to Lanchkhuti. In parallel to the design road, south of it, at the starting points of Samsari ridge, there are zheltozem soils spread. The nature of the soil spreading in the design area and areas adjacent to it is well seen on the soil map drafted under the guidance of Urushadze T., a corresponding member of the Academy of Sciences of Georgia (Photo 9).

In respect of modern geodynamics (landslides, mudflows), the design section and its adjacent areas are located in the I category zone with 0 probability.

Fig. 4 Soil Map

2.2.2. Geology and Tectonics

The study area, according to the tectonic division plan by Gamkrelidze P. (1961), (Photo 3) is located in Kolkheti subzone of west subsidence of the Georgian block zone. It is mostly structured with Mesozoic and Cainozoic rocks, which are covered with terrigene deposits of the Quaternary Age and therefore, no older deposits are seen on the surface.

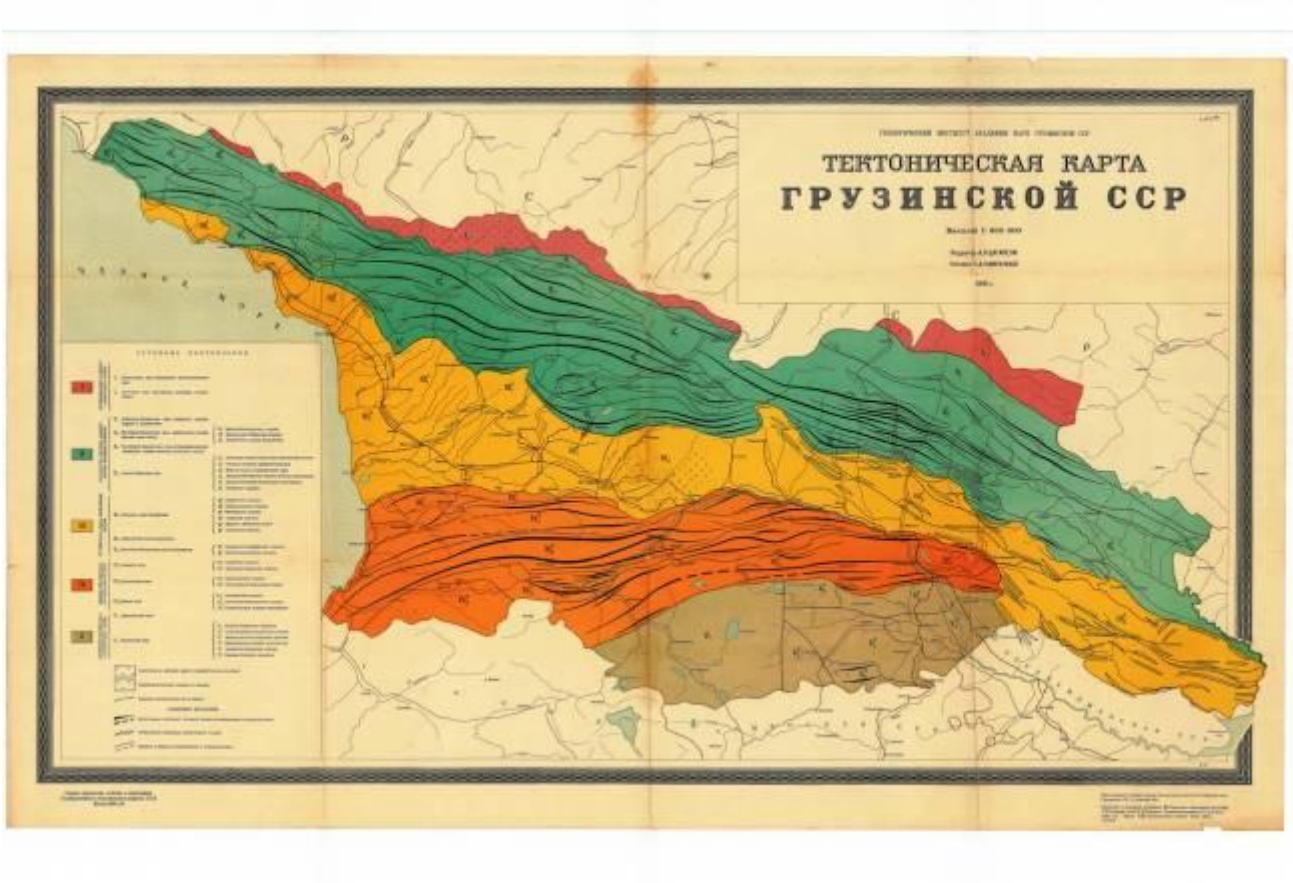


Fig.5. Tectonic map of Georgia. Scale: 1:600 000 (Gamkrelidze P. 1961)

Kolkheti Valley was drilled at many places in different times in the attempt to find oil, helping identify the essence and age of its constituent rocks (Photo 4). This is on average 2.500-m-thick, Jurassic-Cretaceous (J+K), mostly laguna deposits with gypsum and anhydride and 1700-1800-m-thick Tertiary (Eocene (e) and Miocene (m)), mostly Terrigene and volcanic rocks, covered with quite thick Quaternary or Modern Terrigene and clay deposits with 500 m thickness at some places.

The river deposits (alluvion) of the gullies merging with the Rioni developed on the both banks of the river Rioni and sites of old rivers are also important, as they are seen in the map (fig. 6. Geological Map).

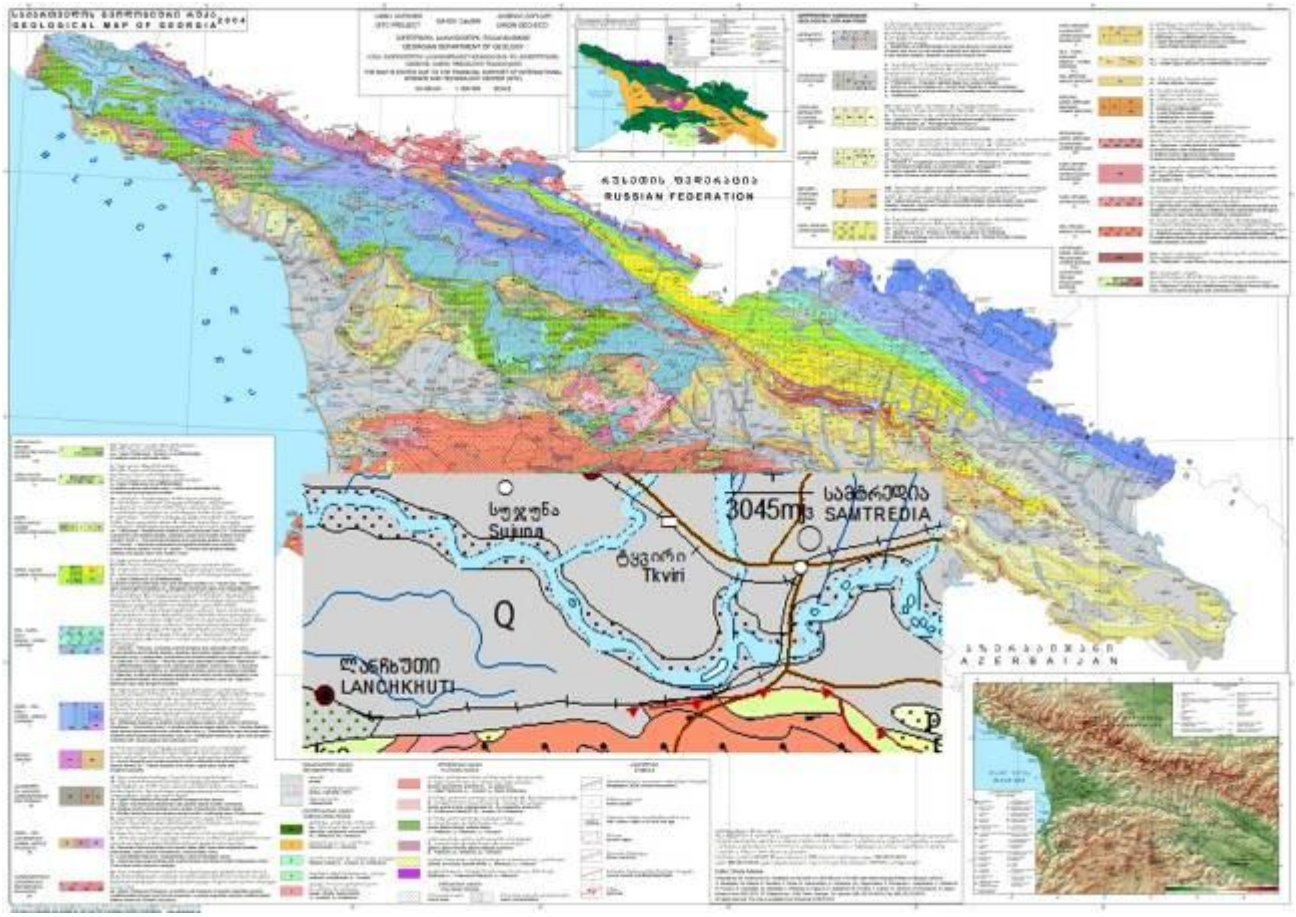


Fig.6 Feological Map

2.2.3 Seismic Risks

According to the modern plan of seismic hazards of Georgia (photo 5), with a 2% probability of 50-year-long expectation, the design section and its adjacent areas are located in the zone with 7-point macroseismic intensity.

In respect of seismic stability, the maximum acceleration of ground oscillations caused by earthquakes is even more important (Fig. 7). This is marked with the abbreviation PGA (Peak Ground Acceleration) and measured in the units of free fall acceleration of a solid body (marked by *g*).

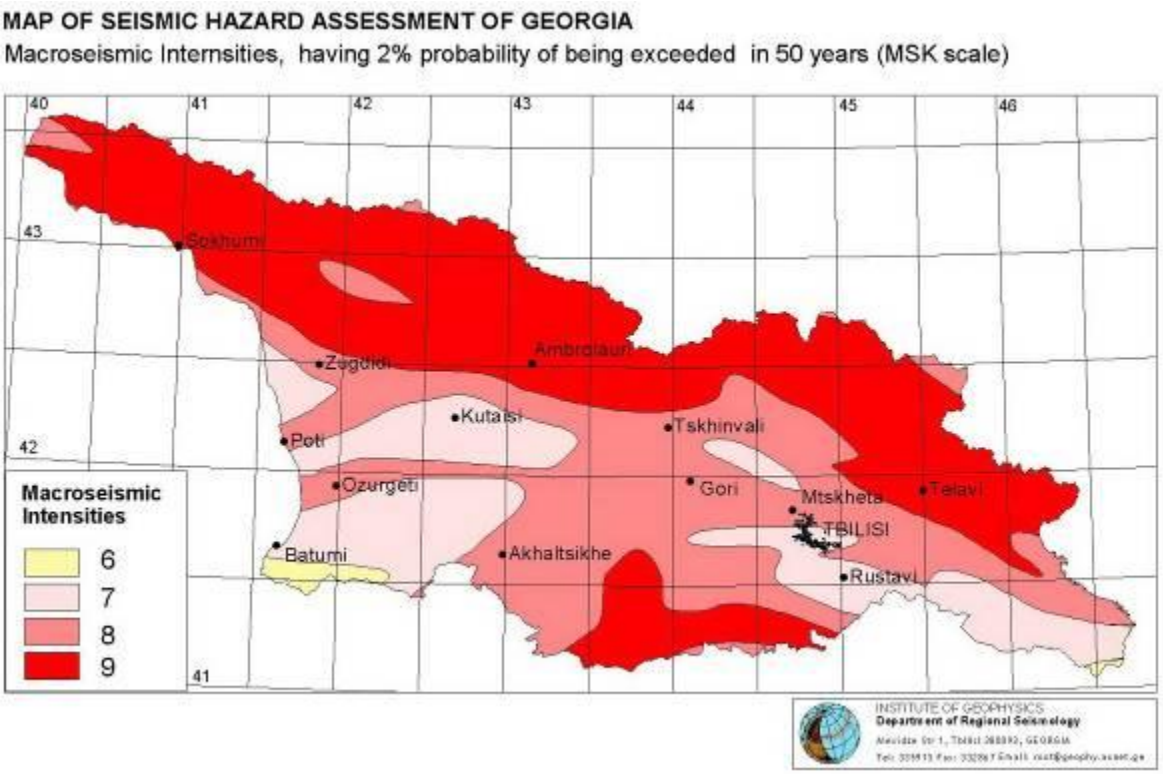


Fig. 7 Seismic Hazard Map of Georgia: Macroseismic Intensities;

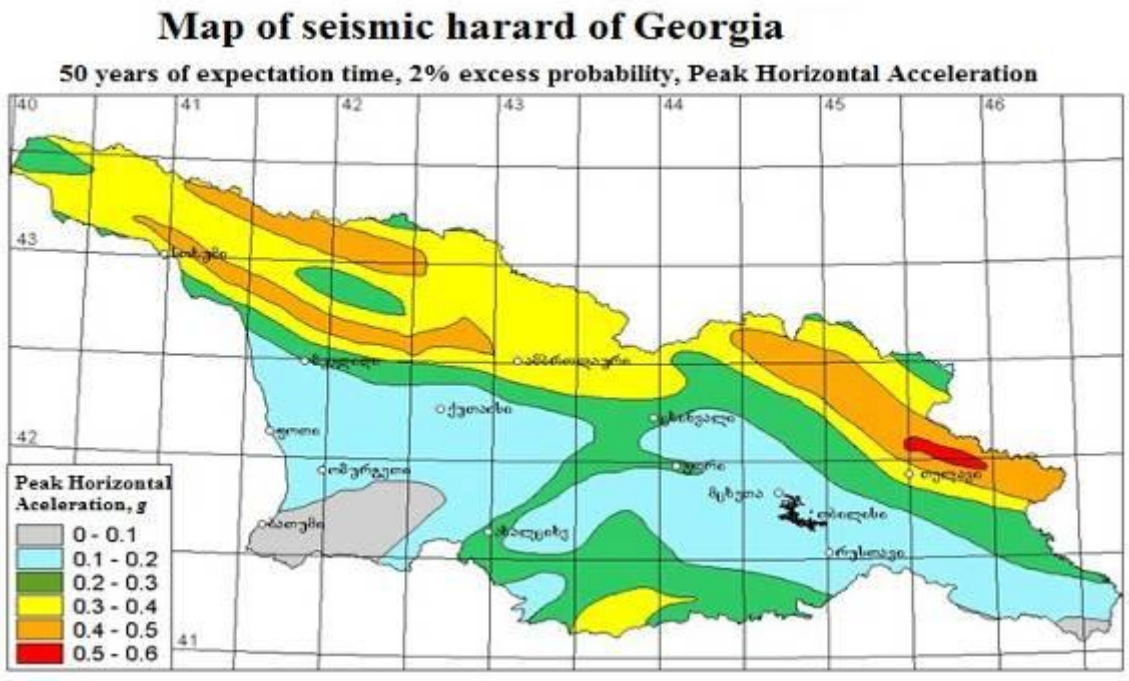


Fig.8 Seismic Hazard Map of Georgia; Peak Horizontal Axelrations;

2.2.4 Hydrogeology

In a hydrogeologic respect, the given area is located in Artesian zone of the Georgian block (Fig 9) and is the area in the extreme southern part of the hydrogeological region of porous, fissure and fissure-karst waters of Tskaltubo Artesian basin and spreads over the south-western periphery of the hydrogeological region of porous, fissure and fissure-

karst waters of Kolkheti Artesian basin (Buachidze I. 1970). Here, on Kolkheti Valley there are also waters associated with bedrocks, i.e. deep-circulation waters associated with deeply located rocks (from 500 to 4500 m), which do not outcrop on the surface and are fixed in wells only. These are also Mesozoic (J_3+K_2) and Tertiary (Pg+Ng) deposits, as well as delluvial and alluvial, Quaternary (Q) deposits, or the ones associated with Modern deposits, i.e. non-deep circulation ground waters, i.e. the ones located near the surface.

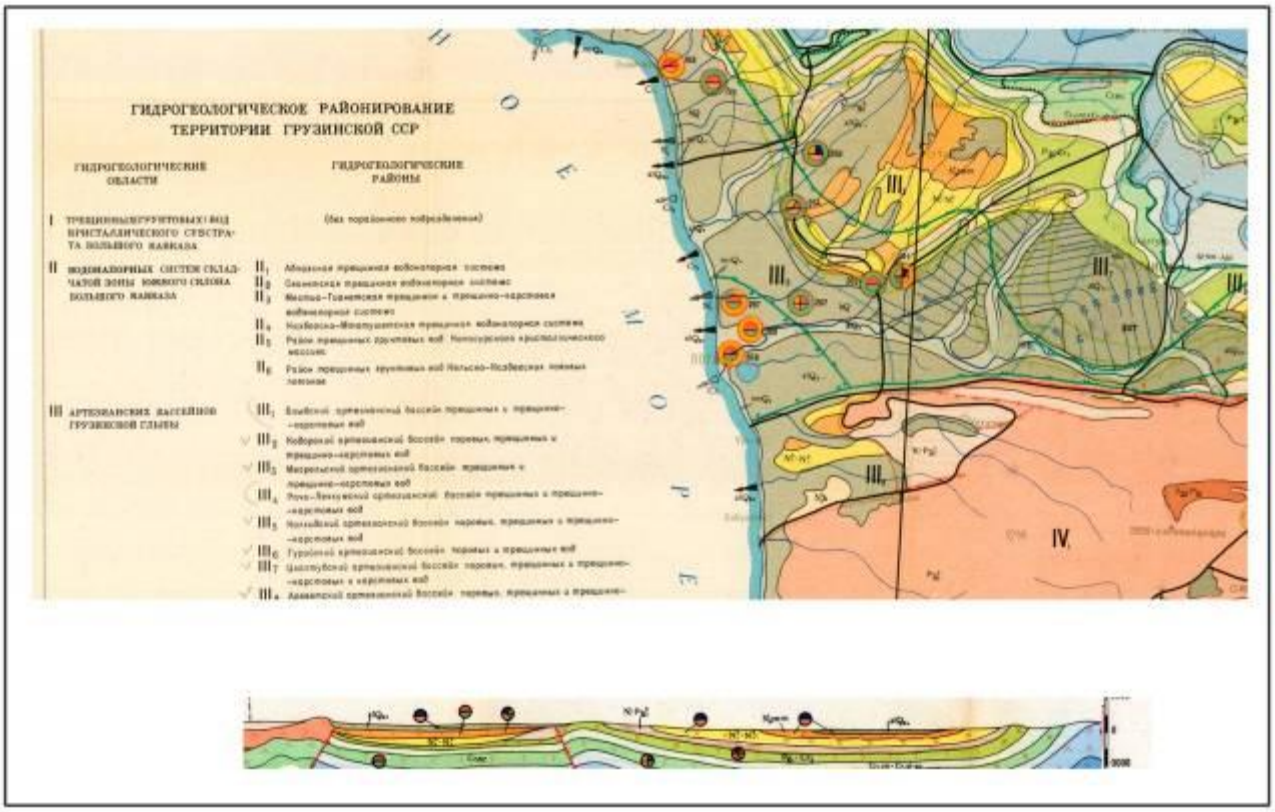


Fig. 9. Fragment of the map "Hydrogeological map of Georgian SSR" (Buachidze I., Chumburidze B., 1970), Scale: 1: 600 000

The water-bearing horizon of underground waters of Modern alluvial deposits, which spreads along the gorges of the rivers Rioni and Supsa, where their width in the cross section of the rivers varies between 1 and 2.5 km, is important for these areas. The lithologcal-grain content of these deposits mostly depends on the geology of the river gorges and erosive and accumulative potential of the rivers, and their filtration properties depend on the grain size and density of the deposits. Accordingly, the rate of water filtration in these deposits varies from 1-3 m to 15-20 m a day. The specific output of the wells cut in these deposits sometimes exceeds 5 l/sec, and where the deposits are mostly presented with clay-sandy filler, the specific output falls to 0.5-1.0 l/sec.

The chemical content of the waters is mostly hydrocarbonate-calcium or calcium-magnesium, with their general hardness varying from 5 to15 g/eqv. The temperature of the waters is 14-20°C. The regime of the ground waters in these deposits is variable and varies together with the river levels. The drinking properties of the waters are satisfactory.

2.2.5 Geotechnical Characteristics of Samtredia-Lanchkhuti section of the design road

The study area, as already mentioned in the previous chapter, is mostly structured with Mesozoic and Cainozoic rocks, which are covered with terrigene deposits of the Quaternary Age and therefore, no older deposits can be seen on the surface. Following the project terms, the object interesting for our study is river (or alluvial) and slope (the same as delluvial and colluvial) deposits, which structure a 20-30-m-thick upper portion of the section and which is fully included in the Upper Pleistocene and Holocene range. Quite a wide bed of the river Rioni and I flood and floodplain terraces are also of the Quaternary and Holocene Ages. These deposits are represented by sandy-loam and loam facies of typical lowland rivers, meanders and sites of old rivers. As mentioned above, the thicknesses of the formations of these stratigraphic level exceeds 20 m and they are located on the older facies of the Upper Pleistocene and Quaternary Ages.

West of Samtredia, along Sajavakho meridian, in the natural remains of the river, sandy and gravely fraction dominates. West of this location (Vazisubani-Japana-Kviani-Cholabargi-Zemo Shukhuti-Lanchkhuti direction), it is substituted by sandy-silty material. The edge of the left terrace lowland of the river Rioni, which immediately leans against the bottom of the northern slope foothill of Guria ridge, is covered by slope and prolluvial trains (i.e. material drifted by temporal flows and accumulated as cones). Such deposits are spread immediately at the piedmonts. As for other sites, mostly clay facies dominate on them. The thickness of these deposits varies greatly and only rarely does it exceed 20 m.

South-west of Samtredia, the territory of the section from CH 0 to CH 54 of the design road, in a geomorphological respect is presented by the I right accumulative terrace of the river Rioni described above. The terrace is structured with the Quaternary clay and gravely deposits of an alluvial genesis, with concomitant coarse material of slope and prolluvial sediments. On its plain surface, which is slightly inclined south-west there are cut-in dry gullies of a minor height (max. 3 m) and beds cut by the action of temporal water currents developed. There are also artificial irrigation channels here.

The design road from CH 54 to CH 55 crosses the river Tskhenistskali. This is a highway stream crossing. In a geomorphological respect, this section too, is the I accumulative terrace of the river Rioni. The depth of the river Tskhenistskali at this point reaches 6 m. There are alluvial clay and gravely deposits seen in the zone of the highway stream crossing.

The design road from CH 55 to CH 91 also runs over the I left accumulative terrace of the river Rioni. The surface of the terrace is plain and is slightly inclined south-west. The relief here is also characterized by the beds of minor depth (1 to 3 m) cut by the action of temporal water currents. This part of the terrace is also structured with the Quaternary clay and gravely deposits of an alluvial genesis.

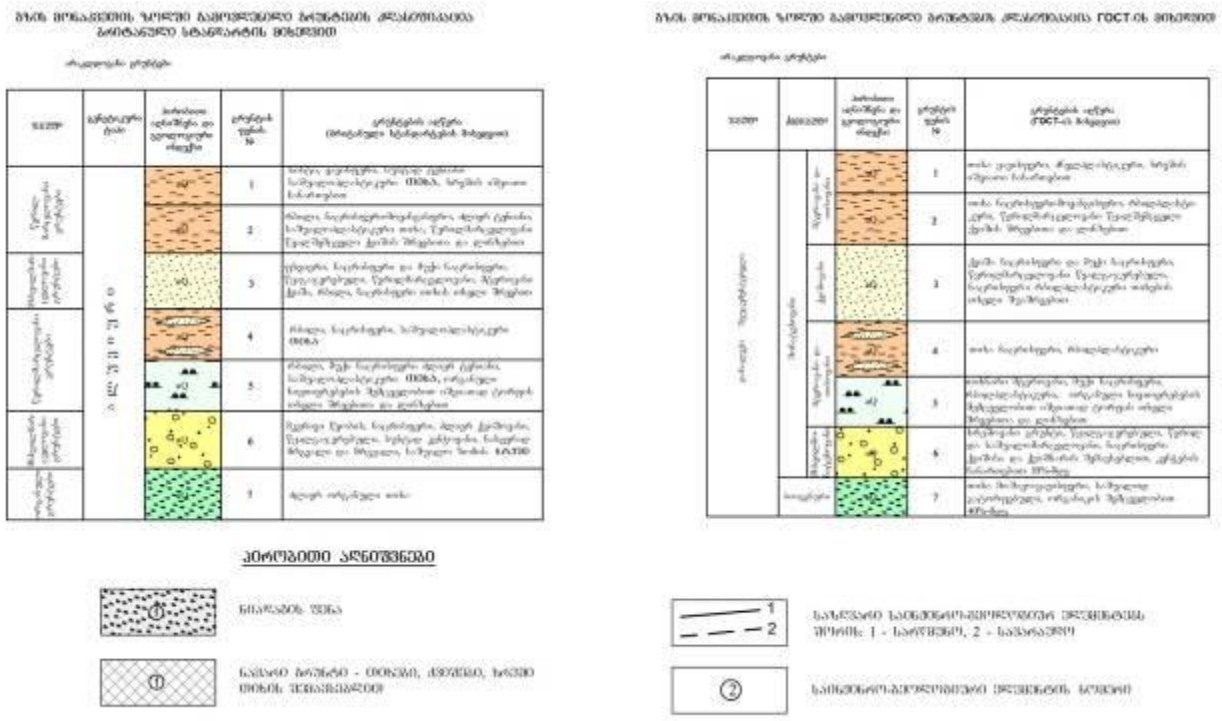


Fig.10. Classification of the grounds identified along Samtredia-Lanchkhuti section of the design road (GEOENGINEERING, 2012)

It is known that the rivers of Kolkheti Valley are characterized by clearly seen intense meandering when the curve of the meanders is nearly circular and at the places where the major bends join, the rivers get rectilinear. A site of an old river is remained from the old meander in Georgian called “Narionali” (the site of old river) by the people right from the outset. This term has been successfully introduced to Georgian geography and geology. The design road from CH 91 to CH 100 crosses two sites of old rivers – the Big Narionali and Lesser Narionaly. Their depth is 3 to 4 m on average. The depth of the present, functioning bed is 6 m on average. The mentioned beds are structured with the rocks typical to alluvial deposits (Photo).

Even more westwards, including the end section of the design road, from CH 116 to CH 119, the design road is the I plain accumulative terrace of the river Rioni, whose surface is crossed by numerous melioration and drainage channels with their depth of mostly 3 to 4 m. The terrace surface shows negative reliefs of different levels at many places. There are also pools with typical vegetation. From 100 to 300, from CH 116 to CH 119 and CH134 to CH138 of the design section, highway stream crossings are to be made.

2.3. Hydrology

2.3.1 Brief hydrographic description of the rivers and gullies crossing Samtredia-Grigoleti upgrading road

As 1:25000 topographic map shows, Samtredia-Lanchkhuti section of Samtredia-Grigoleti modernization road crosses 67 surface water objects, including 29 rivers and gullies, 29 local drainage channels of local designation, 3 minor nameless brooks, 3 marshy lakes (site of former river), 2 artificial pools and one wetland. The modernization road is crossed by two long rivers of west Georgia, the Tskhenistskali and Rioni. The ending sections of the small rivers and gullies mentioned above, which head on the northern slope of Guria ridge, were made rectilinear past the railway line what was necessary for trouble-free functioning of the drainage systems in the region. Many small rivers and gullies have their natural beds changed above the railway line. Their artificial bed runs along the railway line and after merging with the neighboring gully, it runs through the bridges and branch pipes under the railway and through the rectilinear bed.

As already mentioned, the design road is crossed by two large rivers of west Georgia. Below, we give their Brief hydrographic description.

The river Tskhenistskali heads at 2.700 m above sea level, south of Sharivtseki pass in the central part of the Caucasioni ridge and flows into the river Rioni from its right side at village Sajavakho. The length of the river is 176 km, its total fall is 2684, m, its mean slope is 15,0‰; the area of its catch basin is 2120 km^2 and the average altitude of the basin is 1660 m.

The river is flown by 897 tributaries of different ranges, with the rivers Zeskho (with the length of 19 km), Gobishuri (12 km), Laskanura (20 km), Kheledula (34 km), Lektareshi (24 km) and Janaula (21 km) being the most important of them. Out of other tributaries, the length of 13 rivers exceeds 10 km. The area of the glaciers in the river basin is 12,9 km^2.

The most of the river basin is located on the southern slopes of the Caucasioni Ridge, while the lower smaller part of the basin (30-35 km) is located on Kolkheti Valley. The basin has well distinguished high-mountainous, mountainous and lowland areas. The high-mountainous zone is located at 2200-4000 m altitude and has cliffy relief. The mountainous zone occupies the most of the river basin and is characterized by deeply cut gorges of the tributaries and dissectioned relief. The altitude of the mountainous zone varies within the limits of 2000-3000 m. The lowland zone located in the eastern part of Kolkheti Valley, is characterized by lowland relief with maximum height of 15-18 m.

The geology of the mountainous zone is presented by granites, gneisses, sandstones, limestones and conglomerates, while the geology of the lowland zone is presented by new alluvial mantles. Mostly loamy soils are spread in the river basin. The vegetation cover in the basin has vertical zoning. There grows hardwood forest up to 800 m altitude in the basin, there grows a mixed forest from 2100 to 2300 m and there are

alpine meadows even higher. A great part of Kolkheti valley within the limits of the river basin is cultivated with agricultural crops.

The river gorge is a V-shaped one in the mouths; it is box-like past settlement Tsageti and it has no clear shape across Kolkheti valley. Double-side terraces are spread from village Mele to village Sakdari. Their width varies from 50-100 m to 500-700 m; their height varies from 4 to 8 m. The width of the river floodplain varies from 10-20 m to 200-400 m.

The river bed in the mouths is meandering and non-branched. The river branches along the section from settlement Tsageti to village Larchvala and from village Matkhoji to village Khunjulora, and flows as one branch across Kolkheti valley. The width of the river current across Kolkheti valley varies from 20 to 120 m, its depth is from 0,6 to 1,5 m and its velocity is 0,8 m/sec to 1,5 m.sec.

The river is fed with snow, rain, ground and glacier waters. The water regime of the river is characterized by spring and summer floods and well-established winter low-water periods. 70-75% of the annual flow flows in spring and summer, 18-20% flows in autumn and 8-10% flows in winter.

The river is used for power engineering and irrigation purposes. Above settlement Tsageri, there is a 6,5-km-long tunnel made from the left bank of the river delivering the water of the Tskhenistskali river to Lajanuri water reservoir, which is of the power engineering designation, at the rate of 60,0 m^3/sec. The water reservoir across the river Lajanuri additionally fed from the river Tskhenistskali, runs Lajanurhesi (Lajanuri hydropower station), with its wastewater discharged into the river Lajanuri and then into the Rioni. Thus, the water from the river Tskhenistskali is discharged into the basin of the river Rioni.

There is headworks of Khoni-Samtredia irrigation system constructed across the river, at village Matkhoji. The mentioned irrigation system is used to irrigate 1200 ha area in Imereti region. The modernization road crosses the river at about 1,5 km above the confluence, where the area of the water catch basin of the river Tskhenistskali is 2120 km^2.

The river Rioni heads at mount Pasi, on the southern slope of Caucasioni Ridge, at 2620 meters above sea level and flows into the Black Sea at the city of Poti. The length of the river is 327 km, its mean slope is 7,2‰,the area of the catch basin with its mean height of 1084 m, is 13 400 km^2.

The Rioni is flown by large important tributaries as it flows across Kolkheti valley, such as Jojora (with the length of 50 km), Kvirila (140 km), Khanistskali (57 km), Tskhenistskali (176 km), Noghela (59 km), Tekhuri (101 km), Tsivi (60 km). The length of eight tributaries is from 25 to 50 km, that of 14 tributaries is from 10 to 25 km and the length of each of other 355 tributaries does not exceed 10 km making the total length of 720 km.

The catch basin of the river Rioni occupies half the territory of west Georgia. Its major part (68%) is located on the southern slope of main Caucasioni dividing ridge, 13% of the river basin is spread over the northern slopes of Ajara-Imereti and the rest 19% is located over Kolkheti valley.

The river Rioni is fed with glaciers, snow, rain and ground waters. Its water regime is characterized by spring floods and year-round freshets. A relatively stable low-flow period is fixed in autumn and winter months.

The river Rioni is widely used for power generation and irrigation purposes. A water reservoir of Gumati of the power generation designation is created by means of a 30-metre-high concrete gravity dam at the village Zhoneti, above the city of Kutaisi. The total design volume of the water reservoir is 39,0 million m^3 and its conservation zone is 13,0 million m^3. At present, the water reservoir is almost totally filled up with solid matter and as a result, its volume does not exceed 1,2 million m^3. Therefore, Gumathesi-I and Gumathesi-II dependent on it, function only with the river flow.

There is a head structure of Rionhesi (Rioni Hydropower station) located at about 12 km from Gumati water reservoir, at the city of Kutaisi. This has been put into exploitation since 1934. The water from the mentioned head structure through the derivation tunnel and channel is supplied to Rionihesi at the village of Rioni. The total length of the derivation is approximately 9600 metres, its delivery value up to the daily regulating basin arranged at the village Sarbevi is 80,0 m^3/sec and that of the pressure pipes is 100 m^3/sec. The width of the channel bed varies from 5,4 to 10,5 metres and its velocity is from 1,5 to 2,0 m/sec. The water generated by the hydropower station flows into the river Tskaltsitela.

There is a head structure of the irrigation system “Mashveli” constructed from the head structure of Rionhesi to the aggregate works of the hydropower station, on the derivation site, in the city of Kutaisi serving the purpose of irrigation of the agricultural plots of land in Tskaltubo and Samtredia Regions.

South of city Kutaisi, where the rivers Rioni, Kvirila and Khanistskali join, there is Vartsikhe water reservoir of a power generation designation created, which regulates the water supplied to the cascade of Vartsikhe hydropower stations via a derivation channel. The mentioned channel falls into the river Rioni, at the confluence of the river Gubistskali.

The modernization road crosses the river on Kolkheti valley, past the confluence with the river Khevistskali. The area of the water catch basin of the river Rioni in the given section is 11725 km^2. The water catch basins of the small rivers and gullies crossing the modernization road, which at the mouths cover certain areas of the northern slope of Guria ridge, open onto Kolkheti valley, where there flow not very much distinct middle and lower sections of their basins. This is why the wet air masses transferred from the Black Sea easily access their basins forming freshets all around the year.

The modernization road crosses 29 small drainage channels of a local designation, with their water peak discharges specified during the melioration of the given region in the

1960s, what makes obtaining their values difficult. In addition, most of the mentioned channels have their function lost, as their beds are filled with solid drift and they fail to discharge the design amount of water. Some of the channels have their design parameters (depth, width and gradient) preserved and therefore, anyviolation of the parameters during the construction is strictly prohibited.

Water peak discharges

Out of the rivers crossing Samtredia-Lanchkhuti section of Samtredia-Grigoleti modernization road, only the rivers Tskhenistskali and Rioni were studied hydrologically. As for other small rivers and gullies, they are not studied hydrologically. The peak discharges of **the river Tskhenistskali** at the crossing points with the modernization road are specified by using an analogue method.

The data of the hydrological station Khidi for the longest observation period near the design section are taken as an analog, with the observations over the peak discharges of the river Tskhenistskali carried out for 53 years (1930, 1934-35, 1937, 1940-45, 1948-59, 1961-91), but with the data officially published only through 1986. According to the 48-year-long officially published observation data of the river Tskhenistskali, the water peak discharges in the section of the hydrological station Khidi varied between 145 m^3/sec (1973) and 721 m^3/sec (1966).

Through the statistical treatment of the variation series of the data of the mentioned period with the maximum likelihood method, under which the variation and asymmetry coefficients are defined by special nomograms as λ_2 and λ_3 statistical function, when $\lambda_2 = \frac{\Sigma \lg K}{n-1}$ and $\lambda_3 = \frac{\Sigma K \lg K}{n-1}$, the following parameters of the distribution curve are gained:

The average multi-year value of the average annual discharges $Q_0 = 336$ m^3/sec.

The variation coefficient is $C_v = 0{,}40$;

The asymmetry parameter Cs=2,5Cv=1,00.

The gained parameters of the distribution curve and three-parameter gamma-distribution rated ordinates were used to fix the different-provision values of peak discharges of the river Tskhenistskali in the section of Khidi hydrological station. The transition from the analogue, i.e. from the hydrological station Khidi, to the design section (passage of the modernization road) is made by using the transition coefficient, whose value is gained by the following expression:

$$K = (\frac{Fsapr.}{Fan.})^n$$

Where $F_{sapr.}$ - is the area of the catch basin of the river Tskhenistskali in the design section (i.e. in the section of the modernization road passage), with $F_{sapr.}$ = 2120 km^2.

$F_{an.}$ - is the area of the catch basin of the river Tskhenistskali in the analog section, i.e. in the section of the hydrological station Khidi.

n - is the indicator of the degree of reduction with its value taken as 0,5 for the maximum water discharges.

By inserting the given numerical values in the expressions above, we gain the value of the transition coefficient from the analogue to the design section at 1,043. By multiplying the peak discharges fixed in Khidi hydrological station section by the transition coefficient we gain the peak discharges of the river Tskhenistskali in the passage section of the modernization road. The values of the peak discharges of the river Tskhenistskali of different provisions are given in the Table 2.3.1 below.

Table 2.3.1. Peak discharges of the river Tskhenistskali of different provisions fixed with the analog method, Q (m^3/sec)

Section	F km^2	QQ_0 m^3/sec	Cv	Cs	K	Provision, P%			
						1	2	5	10
Analogue	1950	336	0.40	1.00	_	745	695	585	515
Design	2120	350	_	_	1.043	780	725	610	540

As Table 1 shows, the water peak discharges of the river Tskhenistskali in the design section are lower than the data published in hydrological literary sources or the values of the peak discharges specified in early projects what can be explained by the periods between the observations over the real water peak discharges and their resultant non-registration.

Therefore, aiming at examining the gained values, the water peak discharges were calculated by using the regional empirical formula designed for the river Tskhenistskali basin, which is used for the catch basins with over 400 km^2 area and is given in a hydrological reference book “Resources of the USSR surface waters, v. IX, issue I”.

The mentioned formula is as follows:

$$Q_{5\%} = \left[\frac{12{,}2}{(F+1)^{0{,}44}}\right] \cdot F \cdot \text{ m}^3\text{/sec}$$

Where $Q_{5\%}$ is the water peak discharge with 5% provision.

F - is the area of the catch basin of the river Tskhenistskali in the design section and equals to 2120 km^2 in our case.

By inserting the value of area of the catch basin in the formula above, we gain a 5%-provision water peak discharge. Transition from 5% provision to other provisions is done by specially designed transition coefficients given in the same hydrological reference book.

The water peak discharges of different provisions in the design section specified by the above-mentioned regional formula for the river Tskhenistskali are given in Table 2.3.2 below.

Table 2.3.2. Peak discharges of the river Tskhenistskali of different provisions in the design section, Q (m^3/sec)

P%	1	2	5	10
Q m^3/wsec	1335	1160	890	760

The water peak discharges of the river Tskhenistskali given in Table 2 above are taken as design values in the design section, i.e. passage section of the modernization road.

The flow of **the river Rioni** was studied in different periods and for different terms at 19 hydrological stations. Its discharge near the section of the design road was studied at the city of Kutaisi, near Samtredia and at village Sakochakidze. It should be noted that past Kutaisi, the discharge of the river Rioni is regulated with Vartsikhe water reservoir, and the observations over the discharge of the river near Samtredia (at Dapnari bridge) took place for one year only. Therefore, it was decided to use the multi-year observation data of the hydropower station Sakochakidze as analogue to determine the water peak discharges in the design section.

The observations over the flow of the river Rioni in the hydropower station Sakochakidze section took place from 1928 to 1988. The examination of the given 60-year-long variation series for its uniformity carried out in accordance with SNiP 2.01.14-83 and SP 11-103-97 requirements, by using the methodology recommended by "The recommendations for the uniformity analysis observation series for the river flows" and "The international reference book of the calculation methods for the major hydrological characteristics" has revealed a disruption of the uniformity of the 60-year-long variation series of the peak discharges the river Rioni from 1928 to 1939 and from 1977 to 1988. The non-uniformity of the mentioned variation series revealed by using Wilcoxon and Kolmogorov-Smirnoff rank tests was caused by the following reasons:

- In 1939, the construction of the bank reinforcement dikes along the river Rioni was over having prevented the process of bifurcation along the lower reaches of the river (from the confluence with the river Tsiva to the city of Poti), i.e. during the floods this prevented the water flooding the right bank of the river and its flowing into the basin of the river Khobi through the bed of the river Tsiva.
- In 1977, Vartsikhe water reservoir with the power engineering designation was put into exploitation. The given water reservoir regulated the water flow of the river along its lower reaches and significantly impacted the formation of its peak discharges.

Due to the reasons cited above, the variation series of the peak discharges of the river Rioni from 1939 through 1976 was considered uniform. The uniformity of the given series is also established through Wilcoxon rank test.

The 38-year-long uniform variation series of the peak discharges of the river Rioni (from 1939 through 1976) was statistically treated in accordance with the requirements of the same normative documents by using the method of moments and maximum likelihood method.

As a result of treatment by the method of moments, when the variation coefficient is gained by the expression $C_v = \sqrt{\frac{\Sigma(K-1)^2}{n-1}}$ and the value of the asymmetry coefficient is specified through the closest coincidence of the empirical and theoretical points on the probability cell, the following parameters of the distribution curve are gained:

- Average multi-year peak discharge Q_0 =1787 m^3/sec;
- Variation coefficient Cv=0,29;
- The value of the asymmetry coefficient was fixed as Cs=4Cv=1,16.

After the treatment by the maximum likelihood method, when the variation and asymmetry coefficients are defined by means of special nomograms as λ_2 and λ_3 statistical function and when $\lambda_2 = \frac{\Sigma \lg K}{n-1}$ and $\lambda_3 = \frac{\Sigma K \lg K}{n-1}$, the following parameters of the distribution curve are gained:

- The average multi-year value of the average annual discharges $Q_0 = 1787$ m^3/sec.
- The variation coefficient is $C_v = 0{,}29$;
- The asymmetry parameter is Cs=3Cv=0,87.

The parameters to evaluate the representativeness of the variation series are specified and are within the norm, as the mean relative quadratic error of the mean multi-year discharge ε_{Q_0} = 4,7% and is less 5% and the mean relative quadratic error of the variation coefficient is less 15% in both cases (ε_{C_v} = 11,9% if specified by the method of moments and ε_{C_v} = 11,3% if fixed by using the maximum likelihood method). Thus, a 38-year-long uniform variation series of peak discharges can be considered as representative.

By using the gained parameters and 3-parameter gamma-distribution rated ordinates, the water peak discharges of the river Rioni of different provisions in the section of the hydrological station Sakochakidze were determined.

Transition from the section of the hydrological station Sakochakidze to the design section, i.e. to the section of Samtredia-Grigoleti modernization road passage (past the confluence with the river Khevistskali) is done by using the transition coefficient, whose value is gained by the following expression:

$$K = (\frac{Fsapr.}{Fan.})^n$$

where $F_{sapr.}$ - is the area of the catch basin of the river Rioni in the design section, $F_{sapr.}$ = 11725 km^2;

$F_{an.}$ - is the area of the catch basin of the river Rioni in the section of analogue, or hydrological station Sakochakidze, $F_{an.}$ = 13300 km^2;

n - is the reduction index, whose value in case of water peak discharge is fixed at 0,5.

By inserting the given numerical values in the expression above, the value of the transition coefficient from the analogue section, i.e. the section of the hydrological station Sakochakidze to the design section is gained and equals to 0,939. By multiplying the water peak discharges fixed in the section of the hydrological station Sakochakidze by the transitional coefficient, we gain the water peak discharge values in the design section.

The peak discharges of the river Rioni of different provisions in analogue (hydrological station Sakochakidze) and design sections are given in Table 2.3.3.

Table 2.3.3. Water peak discharges of the river Rioni, m^3/sec

Section	F km^2	Method	Q_0 m^3/sec	Cv	Cs	K	Provision, P%			
							1	2	5	10
Analogue	13300	Moments	1787	0.29	1.16	–	3400	3200	2750	2450
		Max. lik.	1787	0.29	0.87		3300	3100	2750	2450
Design	11725	Moments	1678	–	–	0.939	**3195**	**3005**	**2585**	**2300**
		Max. lik.	1678	–	–		3100	2910	2585	2300

The peak discharges of the river Rioni gained by the method of moments are taken as design values in the design section, i.e. in Samtredia-Grigoleti modernization road passage section.

The small rivers and gullies crossing Samtredia-Lanchkhuti section of Samtredia-Grigoleti road, as already mentioned, are not hydrologically studied. Therefore, their water peak discharges are specified by the method referred to in “The technical reference to calculate the peak discharges of the rivers in the Caucasus”.

The water peak discharges are specified only for those rivers and gullies, whose rectified beds cross the design road. The water peak discharges along the small irrigation channels and minor brooks heading on the territory adjacent to the village or north of it, past the railway, were not calculated as the area of their catch basins is too small.

Under the method referred to in “The technical reference to calculate the peak discharges of the rivers in the Caucasus”, the water peak discharges of the rivers and gullies with their catch basins not exceeding 400 km^2 are calculated by the formula:

$$Q = R \cdot \left[\frac{F^{2/3} \cdot K^{1,35} \cdot \tau^{0,38} \cdot \bar{i}^{0,125}}{(L+10)^{0,44}} \right] \cdot \Pi \cdot \delta \cdot \lambda \text{ m}^3/\text{sec}$$

Where *R* is the regional parameter and its value is taken as 1,35 for West Georgia;

F is the area of the catch basin of a river or gully (km^2);

K is the river climatic coefficient with its value taken from the specially designed map and varies from 7 to 8 in our case (*L=8* is taken from crossing No. 28 through crossing No. 32);

τ is the occurrence during the year;

$\bar{i}$ is the mean weighted gradient of the river or gully in units from the riverhead to the design section;

L is the length of the river from the riverhead to the design section (km);

Π is the coefficient characterizing the soil cover in the river basin. Its value is taken from the specially designed map and proper table and equals to 1,19 in our case.

δ is the basin form coefficient, with its value gained from the expression:

$$\delta = 0{,}25 \cdot \frac{B_{\max}}{B_{sas}} + 0{,}75$$

Where $B_{\max}$ is the maximum basin width (km);

B_{sas} is the average basin width (km), and its value is taken from the expression $B_{sas} = \frac{F}{L}$.

λ is the percentage of forest land of the basin and its value is calculated by the formula:

$$\lambda = \frac{1}{1 + 0{,}2 \cdot \frac{F_t}{F}}$$

Where F_t is the area of the basin covered with forest, %.

When calculating the water peak discharges of the small rivers and gullies with the area of their catch basins of less than 5 sq.km, the formula above additionally includes the specially designed coefficients for the areas of the catch basin referred below.

F km^2	<1	1	2	3	4	5
K^1	0.70	0.80	0.83	0.87	0.93	1.00

The values of the morphometric elements to calculate the water peak discharges of the rivers and gullies crossing the design road fixed via the topographic maps scaled 1:25000 and values of water peak discharges with different reoccurrences calculated by the formula above, are referred to in Table 2.3.4 below.

Table 2.3.4. Water peak discharges of the rivers and gullies crossing Samtredia-Lanchkhuti section of Samtredia-Grigoleti modernization road, m^3/sec

Crossing No. and name of the river	kn	F km^2	L km	i Cal	λ	K^1	Peak discharges			
							$\tau=100$ years	$\tau=50$ years	$\tau=20$ years	$\tau=10$ years
#1. Riv. Ochopa	0+000	33.2	17.8	0.0035	0.95	1.0	140	107	75.8	58.2
#2.Riv. Lagoba	2+000	45.0	24.5	0.0032	0.95	1.0	154	118	83.6	64.2
#3.Riv. Lagoba	3+880	48.0	27.6	0.0028	0.95	1.0	154	118	83.6	64.2
#4.Riv. Lagoba	4+500	48.2	28.2	0.0028	0.95	1.0	154	118	83.6	64.2
#5. Tskhenistskali	5+350	2120	_	_	_	_	1335	1160	890	760
#6. Shavitskali	7+800	1.20	3.50	0.0017	0.98	0.71	13.9	10.7	7.57	5.81
#7. Riv. Rioni	9+600	11725	_	_	_	_	3195	3005	2585	2300
#8. Site of former river	11+275	_	_	_	_	_	_	_	_	_
#9. Site of former river	11+750	_	_	_	_	_	_	_	_	_
#10. Site of former river	13+400	_	_	_	_	_	_	_	_	_
#11.Gully (Japana)	13+600	4.26	3.00	0.142	0.86	0.93	66.1	50.8	35.8	27.5
#12. Gully-channel	14+735	0.54	1.40	0.143	0.85	0.70	13.0	10.0	7.08	5.44
#13. Gully-channel	15+050	0.34	0.90	0.135	0.87	0.70	9.91	7.62	5.38	4.13
#14.Pichori channel	15+450	1.38	2.30	0.164	0.85	0.80	27.5	21.2	14.9	11.5
#15. Porkhali channel	16+150	3.88	3.80	0.159	0.87	0.93	61.9	47.6	33.6	25.8
#16. Gully-channel	17+310	3.06	4.05	0.096	0.88	0.87	46.6	35.8	25.3	19.4
#17. Gully-channel	18+060	3.31	3.40	0.096	0.87	0.87	49.6	38.1	26.9	20.7
#18. Gully-channel	18+675	3.28	3.00	0.117	0.90	0.87	53.0	40.7	28.7	22.1
#19. Gully-channel	20+030	3.77	3.45	0.105	0.91	0.93	61.1	46.9	33.1	25.5
#20. Gully-channel	21+085	3.18	3.50	0.104	0.91	0.87	50.8	39.1	27.6	21.2
#21. Gully-channel	22+500	2.71	3.31	0.102	0.91	0.87	45.8	35.2	24.9	19.1
#22. Gully-channel	23+450	2.87	3.46	0.080	0.93	0.87	47.0	36.1	25.5	19.6
#.23 Ukan-Brook	24+500	5.29	4.23	0.071	0.96	1.00	80.7	62.0	43.8	33.7
#24.Natekhi channel	25+740	1.48	3.71	0.067	0.98	0.75	26.6	20.4	14.4	11.1
#25.Lashis-Brook	26+340	7.03	8.17	0.049	0.92	1.00	80.3	61.7	43.6	33.5
#26. Gully-channel	27+525	4.03	5.20	0.076	0.96	0.93	61.3	47.1	33.3	25.6
#27. Gully-channel	28+310	0.33	1.15	0.065	099	0.70	10.0	7.68	5.42	4.17
#28.Oragvisgele	28+440	9.75	10.0	0.039	0.90	1.00	109	84.0	59.3	45.6

Crossing No. and name of the river	kn	F km^2	L km	i Cal	λ	K^1	Peak discharges			
							$\tau=100$ years	$\tau=50$ years	$\tau=20$ years	$\tau=10$ years
#29. Spring-channel	29+120	0.45	0.95	0.088	0.99	0.70	15.5	11.9	8.40	6.45
#30. Spring -channel	29+520	0.20	0.68	0.073	0.99	0.70	8.88	6.82	4.82	3.70
#31. Spring -channel	29+850	0.26	0.70	0.057	0.99	0.70	10.2	7.88	5.56	4.28
#32. Gully-channel	30+335	0.77	1.37	0.066	0.98	0.70	20.8	16.0	11.3	8.68

The numbering of surface water objects given in Table 4 is plotted on 1:25 000 topographic map.

Water quality

The water quality of the rivers and gullies crossing Samtredia-Lanchkhuti section of Samtredia-Grigoleti modernization road near the crossing points is not specified. It should be noted that water intake of the small rivers and gullies crossing the modernization road is the river Pichori flowing across the territory of Kolkheti Park and channel at the bottom of the mountain known as “Didi Arhi” (Great channel). This channel is joined by the rectified beds of the rivers and gullies flowing down Guria ridge, and the water from their beds through the Great channel is discharged into the river Kaparcha and then, into Paliastomi lake and river Maltakva flowing into the Black Sea. The river Pichori flowing into one of the most important surface water objects of Kolkheti National Park, Paliastomi lake, is also the water intake for the rectified beds of the small rivers and brooks flowing from the eastern part of Guria ridge.

The Great channel, like the river Pichori, crosses the territory of Kolkheti Park. Therefore, arranging temporal beams in the beds of small rivers and gullies during the construction seems a necessary measure to prevent the pollution of the mentioned water courses and Kolkheti National Park accordingly. The beams shall retain the construction and domestic remains accidentally fallen into the beds of the rivers and gullies and shall protect the surface water on Kolkheti National Park against pollution.

Following the significance of Kolkheti National Park and Palistomi lake in it, aiming at specifying the water quality, several chemical analyses of the river Pichori were conducted by different organizations, including the National Environmental Agency of Georgia (former Hydrometeorologic Department) and World Bank in different years. The results of the analyses are given in Table 2.3.5 below.

Table 2.3.5. Water quality indicators of the river Pichori at the end of the rectified bed, 1.7 km above the mouth

Organization and year		Ion content, mg/l								mg/l	Pb mg/l	mg/l
		Ca^{2+}	Mg^{2+}	Na+K	HCO_3	SO_4^{2-}	CL	NO_3	NO_2			
Hydromet. Dept. 198	_	_	_	_	_	_	_	0.51	0.044	0.020	_	0.14
WB 2003	6.50	54.0	25.4	150.7	201.3	20.0	23.0	15.0	0.06	20.0	0.046	0.98

Organization and year		Ion content, mg/l								mg/l	Pb mg/l	mg/l
		Ca^{2+}	Mg^{2+}	Na+K	HCO_3	SO_4^{2-}	CL	NO_3	NO_2			
WB 2004	6.12	100.2	30.4	82.16	317.2	10.0	200	5.8	0.04	3.50	0.03	0.125
WB 2005	6.20	55.66	16.88	45.18	238.73	5.55	111.09	11.0	0.23	0.14	0.02	0.10

2.4. Ecological Receptors – Landscape and Flora

2.4.1 Landscape

The recommended route of the planned road starts on the agricultural areas, south of Samtredia and crosses the river Rioni, the sites of former rivers.

The Lowland accumulative landscapes **with oak forest with evergreen understory** here and there **Lowland landscapes** covers the area from the crossing of the river Rioni to village Mejinistskali. Here, riverside ash tree forest fragments and settled areas with absolute altitude of 20-60 (200) m asl or more are presented.

Orographic units. Kolkheti valley, **relief:** accumulative, subject to subsidence. Migration regime: elluvial-accumulative. **Geology**: Quaternary, Neogenic, rarely Paleogenic-Continental and marine sediments (clays, sandstones). **Forms of economic impact**: mostly agriculture (cattle raising, maize growing, partly tea-growing, subtropical fruit-growing, vine-growing), **main threats to landscape:** floods, wet humidity, heavy soil and ground, soil and ground polluted with chemicals, land cultivation, rail and road mains, industrial enterprises, settled areas, population density.

Wet areas of the sites of a former river are the sensitive area of the project, which are crossed by the probable main at three points. The said area is considered by the Ramsar Convention secretariat as the compensation area in lieu of the Ramsar territory occupied by the construction of Kulevi terminal. However, in recent years, the said territory was alienated to private owners and is now used to make artificial ponds and for agricultural purposes, and has largely lost its ecological value.

2.4.2 Botanical Survey: Flora and Vegetation in the Project Area

General Geobotanical Description of the Project Area

The Project area covers the western geo-botanical area of Kolkheti Lowland geobotanical zone. The vegetation in the densely populated area is preserved in certain patches and in a fewer large sections. The characteristic features of the vegetation are phytocoenological and genetic variety. The dominant vegetation types are hygromesophilic, hygrophilous and hydrophilic plants in marshy forests and bogs. This vegetation is primary and characteristic of the Rioni area, while the higher (peripheral) areas are dominated by relic mesophilic broad-leaved forests. Relic plant communities, such as bay laureal (*Laurus nobilis*) and Turkish pine (*Pinus pithyusa*) forests, are spread in certain specific soils.

The marshy forests of Kolkheti Lowland are mainly monodominant communities of black alder (*Alnus barbata*) forests. The most characteristic polydominant communities include wingnuts (*Pterocarya pterocarpa*), white poplar (*Populus canescens*), willow

(*Salix*) varieties. The underbrush mostly consists of sea-buckthorn (*Hippophaë rhamnoides*), Yellow Azalea (*Rhododendron luteum*), Elder (*Sambucus nigra*), Caucasian bilberry (*Vaccinium arctostaphylos*), cherry laurel (*Laurus officinalis*), Pontic rhododendron (*Rhododendron ponticum*), etc. The most widespread plants are Colchis ivy (*Hedera colchica*), silk vine (*Periploca graeca*), traveller's joy (*Clematis vitalba*), common hop (*Humulus lupulus*), giant bindweed (*Calystegia sylvestris*), greenbrier (*Smilax excelsa*), etc. The alder forests contain photophygous and hydrophilic grasses like *Oplismus undulatifolius*, *Poa trivialis, Potentilla reptans, Picreus colchicus, Trifolium repens,* etc. The mire vegetation which alternates with alder forests consists of *Carex gracilis, Juncus effuses*, etc. The plant varieties of Kolkheti marshy forests include the following main communities: alder forests with *Carex gracilis,* bulrush (*Typha latifolia*), common reed (*Phragmites communis*), soft rush (*Juncus effusus*) or various grass. Besides alder forests Kolkheti swampy woods consist of wingnuts (*Pterocarya pterocarpa*) and white poplar (*Populus canescens*) forests, which are relatively rare.

The marshy forests (mainly alder forests) cover quite large areas in various parts of Kolkheti Lowland, namely Abkhazia, Samgerelo, Guria and Ajara regions. The floodplain forests growing along the river banks are similar to marshy forests. Kolkheti floodplain forests consist of wingnuts (*Pterocarya pterocarpa*) and alder (*Alnus barbata*).

Marsh plants (helophytes) spread in the lowest part of Kolkheti Lowland, namely in Samegrelo-Guria downstream the Churia, Khobi and Rioni rivers, around Paliastomi Lake (Chaladidi swampy area), near Kobuleti, etc. The so called Narionali (the Rioni river meanders) are covered with marsh plants. The most widespread types of swamps are those with polydominant grasses (the most characteristic varieties are *Butomus umbellatus, Carex gracilis, Iris peudocorus, Juncus effuses, J. laersii, Polygonum hydropiper, Rhampicarpa medwedewii, Typha latifolia*, etc). In some swamps one variety of grass dominates, e.g. common reed (*Phragmites communis*), bulrush (*Typha latifolia*), yellow iris (*Iris pseudocorus*), acute sedge (*Carex gracilis*), soft rush (*Juncus effusus*), etc. Monodominant swamps are more rare (common reed-bulrush, bulrush-iris, acute sedge – soft rush). Another type of swamp is a marshy forest, which consists mainly of alder (*Alnus barbata*). Such forests are located in swamps (they may be peat bogs, swamps with acute sedges, multivariety grasses, etc.).

The western part of Kolkheti Lowland geo-botanical zone is characterized by relic mesophilic broad-leaved forests. These forests were quite widespread in the areas where groundwater is located relatively deep beneath the surface and soil is not bogged. Most of the forests have been destroyed and only some patches of various size, fragments of forests, isolated trees and groups of trees have survived. These remnants show that relic mesophilic forests of Kolkheti Lowland were mixed broad-leaved forests. Some of them were monodominant. The most common trees of mixed broad-leaved forests are as follows: Imeretian oak (*Quercus imeretina*), Colchis oak (*Quercus hartwissiana*), chestnut (*Castanea sativa*), oriental beech (*Fagus orientalis*), hornbeam (*Carpinus caucasica*), alder (*Alnus barbata*), etc. The underbrush consists of evergreen and deciduous bushes, namely cherry laurel (*Laurus officinalis*), Pontic

rhododendron (*Rhododendron ponticum*), Spineless Butcher's Broom (*Ruscus hypophyllum*), Colchical holly (*Ilex colchica*), Caucasian bilberry (*Vaccinium arctostaphylos*), yellow azalea (*Rhododendrum luteum*), Colchis bladdernut (*Staphyllea colchica*), etc. The underbrush of Kolkheti relic forests (cherry laurel, Pontic rhododendron, Colchical holly, etc) are not as widespread as in the borad-leaved forests of foothills and lower zones of the mountains. Due to intense shadow grass cover is not well-developed and its floristic composition is poor. The typical varieties include *Blechnum spicant, Brachypodium sylvaticum, Brunella vulgaris, Calamintha umbrosa, Driopteris borrari, Fragaria vescaa, Lapsana intermedia, Opliemenus undulatifolius, Phyllitis scolopendrium, Pteridium tauricum, Salvia glutinosa, Veronica officinalis, Viola alba*, etc. The relic mesophilic forests of Kolkheti lowland are home to liana varieties, which are best developed at forest fringes and in sections where vegetation is scarce. The typical liana varieties are as follows: Colchis ivy (*Hedera colchica,*), wild grape (*Vitis sylvestris*), blackberry (*Rubus sanguineus, R. candicans*), greenbrier (*Smilax excelsa*), Traveller's Joy (*Clematis vitalba*), common hop (*Humulus lupulus*), Black Bryony (*Tamus communis*), etc. The epiphytes include lichens, angiospermous plants (*ardamine imeretiens, Oxalis villosa*) and ferns (*Polypodium serratum*).

The relic broad-leaved forests of Kolkheti include the following monodominant communities: hornbeam (*Carpinus caucasica*) forests, oriental beech (*Fagus orientalis*) forests, chestnut (*Castanea sativa*) forests. Monodominant and polydominant forests consist of the communities: hornbeam-beech (*Carpinus caaucasica, Fagus orientalis,*) beech-chestnut (*Fagus orientalis, Castanea sativa*), chestnut – Imeretian oak (*Castanea sativa, Quercus imeretina*), hornbeam-bech-chestnut (*Carpinus caaucasica, Fagus orientalis, Castanea sativa*), etc. The remnants of these forests are preserved in many parts of Kolkheti Lowland.

Over the last decades weeds have spread widely in the western part of Kolkheti geo-botanical zone, most of which are invasive and ruderal varieties. (*Amaranthus retroflexus, Ambrosia artemisiifolia, Daucus carota, Digitaria sanquinalis, Erigeron Canadensis, Paspalum digitaria, Plantago maior, Pteridium tauricum, Setaria glaugca, Sorgum halepense, etc*).

Botanical Survey: Detailed Description of the Project Corridor Flora and Vegetation

So far as the botanical survey has been carried out for the entire Samtredia – Lanchkhuti section of the design road, this report describes results of field assessment of vegetation cover within the entire Samtredia - Lanchkhuti, including Lot 1 (Km 0 – Km 11,5; survey sites 1 - 8) and Lot 2 (Km 11,5 – Km 30; survey sites 9 - 14). For the needs of impact assessment only data related to Lot 1 (Km 0 – Km 11,5; survey sites 1 - 8) was used in chapter 4.4.2 vol 1 of the EIA.

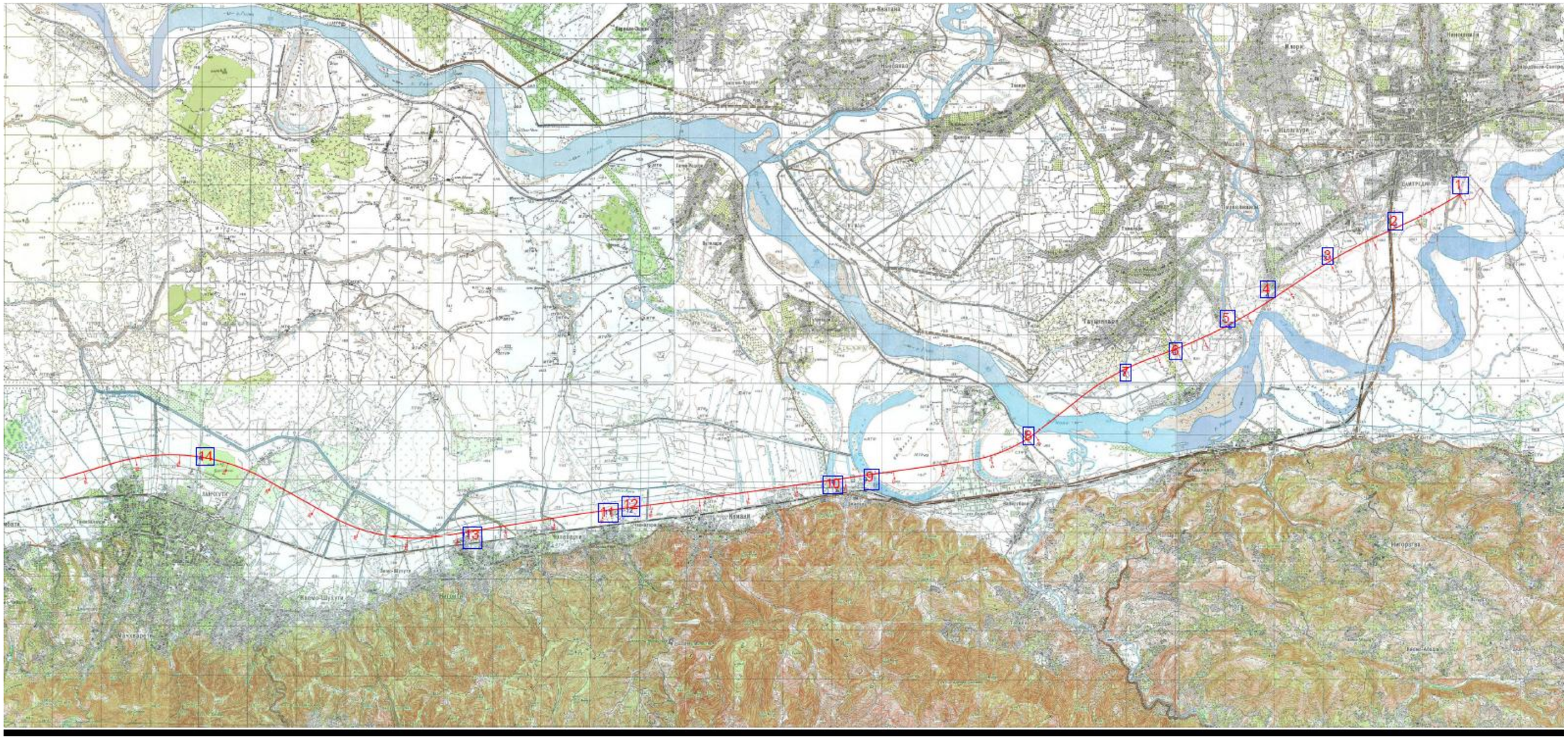


Fig.11. Botanical Survey Sites: Sites 1 to 8 Lot 1 Km 0 – Km 11.5; Sites 9 – 14 Lot 2 Km 11.5 – Km 30;

It is worthy of note that detailed botanical surveys were carried out along the planned design corridor. The survey identified the potential negative impacts of the highway contruction and operation and long-terms impacts on the flora and vegetation were identified both in the construction corridor and in the adjacent areas. The project impact area contains some plant communities important in terms of conservation (endemic, rare), as well as economically valuable plants.

Section No1 GPS coordinates N42009’00.8’’/E 042021’07.7’’, 24m above sea level, the left bank of the Churtava River. This area has an agricultural landscape of maize fields and is a low-value habitat.

Fig.12 Section No1. An agricultural landscape of maize fields

Section No2. GPS coordinates N42^{0}08’43.9’’/E 042^{0}20’05.4’’, 21m above sea level. On one side of the road there is a wind-belt consisting of poplars (*Populus gracilis*) and oriental plane (*Platanus orientalis*). The other side of the road is covered with degraded (due to cutting) wind-belt of shrubs, including black locust (*Robinia pseudoacacia*), mulberry, honey locust (*Gleditsia triacanthos*), false indigo bush (*Amorpha fruticosa*), blackberry (*Rubus sanguineus*). There are agricultural lands - maize fields and pastures on both sides of the road. The habitat has low conservation value.

Fig.13. Section 2. Oriental plane (*Platanus orientalis*) wind-belt

Fig.14. Section 2. Poplar (*Populus gracilis*) wind-belt

Fig.15. Section №2. Degraded wind-belt of shrubs

Fig.16. Section №2. Degraded wind-belt of shrubs

Section No3. GPS coordinates N42008’19.3’’/E 042019’00.2’’, 20 m above sea level. This section is covered with bulrush (*Typha latifolia*) swamps and damp *Paspalum digitaria* monodominant meadows. The habitat has low conservation value.

Fig.17. Section No3. Dam *Paspalum digitaria* monodominant meadow

Fig.18. Section 3. Bulrush (*Typha latifolia*) swamp

Section No4. GPS coordinates N42^{0}07’52.9’’/E 042^{0}18’14.7’’, 24 m above sea level. The area has agricultural landscape including fields, pastures and bushes of honey locust (*Gleditsia triacanthos*), black alder (*Alnus barbata*), silk vine (*Periploca graeca*), blackberry (*Rubus sanguineus),* greenbrier (*Smilax excelsa*), poplars (*Populus gracilis*), mulberry (*Morus alba*), tree of heaven (*Ailanthus altissima*). The habitat has low conservation value.

Fig.19. Section №4. Agricultural landscape-fields

Fig.20. Section №4. bushes along the canals

Section No5. GPS coordinates N42^{0}07’38.0’’/E 042^{0}17’37.2’’, 23 m above sea level near Gautskinari Village. In this section the highway crosses the river. Hybrid poplar (*Populus hybrida*), honey locust (*Gleditsia triacanthos*), black locust (*Robinia pseudoacacia*), fig trees (*Ficus carica)*, willows (*Salix alba*). The underbrush consists of blackberry (*Rubus sanguineus*), American Pokeweed (Phytolacca americana), Colchis ivy (*Hedera colchica*), greenbrier (*Smilax excelsa*). The habitat has low conservation value.

Fig.21. Section №5. Floodplain

Fig.22. Section №5. Floodplain

Section No 6. GPS coordinates N42^{0}07’23.8’’/E 042^{0}16’53.2’’, 26m above sea level. The area is covered with black alder (*Alnus barbata*), mulberry (*Morus alba*), fig tree (*Ficus carica*), common hazel (*Corylus avellana*) plantations. There is a fragment of wind-belt including Hybrid poplar (*Populus hybrida*), poplars (*Populus gracilis*), oriental plane (*Platanus orientalis*).The habitat has low conservation value.

Fig.23. Section №6. Black alder (*Alnus barbata*)

Fig.24. Section №6. Black alder (*Alnus barbata*)

Section No 7. GPS coordinates N N42^{0}07’16.2’’/E 042^{0}16’09.4’’, 24m above sea level. The area is covered with the degraded wind-belt consisting of black locust (*Robinia pseudoacacia*), black alder (*Alnus barbata*), oriental plane (*Platanus orientalis*). There is agricultural landscape (pastures and maize fields) on both sides of the road. The habitat has a low conservation value.

Section No 8. GPS coordinates N42^{0}06’27.3’’/E 042^{0}14’35.7’’, 22 m above sea level. There is a cryptomeria (*Cryptomeria japonica*) wind-belt in this area. On both sides of the wind-

belt there are agricultural landscapes, such as pastures and maize fields. There is also bushes of false indigo (*Amorpha fruticosa*), honey locust (*Gleditsia triacanthos*), blackberry (*Rubus sanguineus*), cherry plum (*Prunus divaricata*), fig (*Ficus carica*), greenbrier (*Smilax excelsa*), danewort (*Sambucus ebulus*), silk vine (*Periploca graeca*). The habitat has low conservation value.

Fig.25. Section №7. Degraded wind-belt

Fig.26. Section №8. Cryptomeria (*Cryptomeria japonica*) wind-belt

Section No 9. GPS coordinates N42^{0}05'56.1''/E 042^{0}12'15.1'', 12 m above sea level. The section is covered with blackberry (*Rubus sanguineus*), danewort (*Sambucus ebulus*), American pokeweed (*Phytolca americana*), honey locust (*Gleditsia triacanthos*) and fig (*Ficus carica*). The habitat has a very low conservation value.

Fig.27. Section No9. Blackberry, danewort, American pokeweed, honey locust, fig

Section No 10. GPS coordinates N 42^{0}05'59.0''/E 042^{0}11'43.7'', 46 m above sea level. The wind-belts consisting of poplars (*Populus gracilis*) also include blue gum (*Eucalyptus globulus*), honey locust (*Gleditsia triacanthos*), Cypress (*Cupressus sempervirens*). The habitat has a medium conservation value.

Fig.28. Section №10. Wind-belt of poplars

Fig.29. Section No 10. Poplar wind-belts with blue gum, honey locust, cypress

Section No 11. GPS coordinates N42005’35.3’’/E 042008’24.0’’, 19 m above sea level. The section is covered with poplar (*Populus gracilis*) wind-belts and pastures. The habitat has a low conservation value.

Fig.30. Section No 11. Poplar (*Populus gracilis*) wind-belts and pasture.

Section No 12. GPS coordinates No 42^{0}05’35.2’’/E 042^{0}08’37.5’’, 13 m above sea level. The section is covered with black alder (*Alnus barbata*) forests. Some parts of this section are waterlogged and *Lemna minor, Juncus effusus, Hydrocotyle ramiflora* grow there. The habitat has a low conservation value.

Fig. 31. Section No 12. Waterlogged alder forest

Fig.32. Section №12. Soft rush (*Juncus effusus*)

Fig.33. Section №12. Common duckweed (*Lemna minor*)

Fig.34. Section №12. Hydrocotyle (*Hydrocotyle ramiflora*)

Section No 13. GPS coordinates No 42^{0}05’19.1’’/E 042^{0}06’17.6’’, 21 m above sea level. The section is covered with degraded wind-belt consisting of poplar (*Populus gracilis*), honey locust (*Gleditsia triacanthos*), black alder (*Alnus barbata*), false indigo bush (*Amorpha fruticosa*), blackberry (*Rubus sanguineus*), greenbrier (*Smilax excelsa*). There are also agricultural landscapes – pastures, maize fields. The habitat has a low conservation value.

Fig.35. Section No13. Degraded wind-belt

Section No 14. GPS coordinates are N42^{0}06’19.6’’/E 042^{0}02’23.1’’, 9 m above sea level. There is a fragment of the oriental plane (*Platanus orientalis*) wind-belt and a pasture covered with blackberry bushes (*Rubus sanguineus*) in this section. The habitat has a low conservation value.

Fig.36. Section No 14. The fragment of oriental plane wind-belt and the pasture covered with blackberry bushes.

Fig.37. Section No 14. The fragment of oriental plane wind-belt and the pasture covered with blackberry bushes.

Sensitive Areas

The planned detailed botanical survey will enable us to identify sensitive areas and provide their detailed description. No medium or high sensitive areas have been identified withing the Lot 1 (KM 0 – Km 11.5); Only one site of medium sensitivity have been identified within the Lot 2 (KM 11,5 – 30) based on the reference data and field surveys:

- Section No10. GPS coordinates N42^{0}05'59.0''/E 042^{0}11'43.7'', 46m above the sea level. In this section there is a wind-belt of poplars (*Populus gracilis*) with blue gum (*Eucalyptus globulus*), honey locust (*Gleditsia triacanthos*), the Mediterranean cypress (*Cupressus sempervirens*);

Occurrence of the Endangered Plant Varieties Included in the Red List of Georgia in the Design Corridor

It is worthy of note that the Red List of Georgia including 56 species is incomplete. The List is being amended, namely grasses are being grouped by IUCN (International Union for Conservation of Nature) categories by defining their condition and conservation status. The extrapolation of these data will significantly increase the number of protected species in the Red List of Georgia.

At this stage the field botanical surveys did not identify any plant varieties included in the Red List of Georgia in the design corridor. During the botanical survey, which has to be conducted prior to the construction, **no plant varieties protected under the Red List of Georgia** are likely to be found in the design corridor.

Besides, there are some rare, endangered and vulnerable varieties in the design area, e.g. fig trees (*Ficus carica)*. After the preconstruction botanical surveys the present list of rare plant varieties may be amended.

2.5 Zoological Survey Report

So far as the zoological survey has been carried out for the entire Samtredia – Grigoleti section of the design road, the introductory part of this chapter describes zoogeographic characteristics of entire Samtredia – Grigoleti area, including Lot 1 (Km 0 – Km 11,5;), Lot 2 (Km11,5 – Km30;) and Lots 3 and 4. Results of field survey are given for Lot 1 (Km 0 – Km 11,5;) and this data is used for the needs of impact assessment in chapter 4.5 vol 1 of the EIA.

Legal framework

Existing nature conservation legislation in Georgia corresponds to internationally accepted principles and criteria in the sphere of nature conservation and biodiversity protection and consequently provides a framework for EIA. The Georgian legislation and international obligations of Georgian Republic, resulting from the signed International Conventions in the field of the Nature Protection, form a legal side of a framework of our examination.

The main laws on nature conservation relevant to this report are:

- the Environmental Protection Law of Georgia (the Frame Law on Nature conservation)
- the Law of Georgia on the System of Protected Areas
- the Law on Establishment and Management of Kolkheti Protected Territories (1998).
- the Wildlife Law of Georgia
- the Law on Red Data List of Georgia
- Decree #303 of May 2, 2006 of the President of Georgia, “On Approval of the Red List of Georgia” (Endangered Species List)

Pursuant to the Georgian legislation, 135 species and 4 sub-species of animals are protected (Red data list of Georgia, 2006). Taking into consideration the species, which are protected by the International Agreements, the whole number of protected species can reach up to 250. Most of these species are listed in the Red Data List of Georgia, Red Data List of IUCN, and in Attachments to different Conventions.

International Conventions

The following list gives an overview on Multilateral International Conventions related to nature conservation and biodiversity enforced in Georgia, which are relevant to this review:

- Convention on Biological Diversity (CBD), 1992, - accepted at 02/06/1994

- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) – ratified at 07/02/1997
- Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn, 1979, date of entry into force 01/06/2000
- Convention on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Bern Convention) - ratified in 30/12/2008.
- Agreement on the Conservation of Bats in Europe (EUROBATS) – ratified at 21/12/2001; This Agreement protects 28 species of bats occurring in Georgia
- Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) - ratified in April 2001, This Agreement increased a number of the bird species that are protected by the law (up to 98 species listed in the Agreement occur in Georgia, most of them are not mentioned in Georgian Red Data List.

Physical-geographic Characteristics of the Project Area

From the physical-geographic point of view, the highway lies on the Colchic Lowland in the Transcaucasian depression. This area is located between mountain ridges of the Great Caucasus and the Lesser Caucasus. Western part of the Transcaucasian depression covers the Colchic province (Kolkheti), including two sub-provinces - of Colchic (Kolkheti) lowland and Colchic (Kolkheti) foothills. All rivers and streams here belong to the basin of the river Rioni and, thus, to the basin of the Black Sea. The Samtredia-Grigoleti Highway corridor is located in the Colchic (Kolkheti) lowland province.

The territory of Georgia, lying in the western-central part of Caucasus, is the most uneven from the climatic and landscape point of view, among Caucasian countries. Georgia covers both Caucasian mountain systems (southern slopes of Great Caucasus as well as northern part of Lesser Caucasus). At the same time, all types of Caucasian landscapes are represented here. Humid sub-tropic landscapes with predominance of autochthonous Colchic fauna and flora are in the western part of the country.

Zoogeographic Characteristics of the of the Project Area

The Samtredia-Grigoleti Highway corridor is entirely situated within the limits of the Colchic region of Caucasus district of the Circumboreal sub-zone. The most part of this region is lying in the Western Georgia. Its conditional borders are: from the west - Black Sea; from the south-east - Meskheti mountain ridge; from the east – Surami ridge and southern offspur of Great Caucasus; and from the north-east - the western part of Great Caucasus mountain ridge. Typical "Colchic" landscapes unify foothill and lowland subtropical forests

with plenty of evergreen plants. Colchic communities are attached to the region with mild climate (usually positive January temperature) and high level of annual precipitation (1,000mm and more).

One can outline, throughout territory of Georgia two areas with important landscape differences. The first - Caucasus district, including Colchic and Caucasus regions, unify forest landscapes with plenty of autochthonous animals and representatives of European fauna. The second - the Mediterranean sub-zone is composed with two other types of biological communities. There are Anterior Asia district with highlands of Lesser Caucasus (landscapes very similar to those in Turkey and the most part of Middle East) and arid, semi-dessert landscapes in Kura district with many elements of Turanian fauna (this region, also is genetically connected with biological communities typical for countries of Central Asia). Significant part of Georgian territory (northern slopes of Trialeti ridge and part of southern slopes of Great Caucasus in East Georgia) are covered with forest areas with communities including elements of Colchic, East-European, Middle East and Turanian fauna.

From the viewpoint of zoogeography, the entire Caucasus is located in the Holarctic or Palaearctic kingdom or zone, depending on the terminology used by experts in zoogeographic zoning. The zoning of the World Geographic Atlas of 1964 published in Moscow[1] is used in the report. According to Vereshchagin's map (1964), the Caucasus includes several zoogeographic sub-zones. In the north of the region there are two districts of the Kazakhstan-Mongolian province of the Central Asian sub-zone. The middle of the Caucasus is mountains of the Greater and Lesser Caucasus and Talish that belong to the Caucasus district of the Circumboreal sub-zone isolated from the main part of the sub-zone by steppes. The Circumboreal sub-zone is sometimes referred to as the sub-zone of Western Eurasia, which in principle does not change its characteristics and boundaries in the Caucasus (World of Geography 1984). Southern boundaries of the Caucasus Ecoregion lie within the Anterior Asia district of the Mediterranean province and Kura district (almost entire Azerbaijan) of the Iran-Turan province. Both these provinces belong to the Mediterranean sub-zone. Thus, three zoogeographic sub-zones and four zoogeographic provinces neighbor in the Caucasus. The Caucasus is a home to species typical for all the three sub-zones resulting in the rich diversity of flora and fauna.

The area of the Project, lying along the old motor road Kutaisi- Batumi, is, actually, on lesser importance from the standpoint of the animal biodiversity conservation, because of long and hard transformation of the natural landscapes. Fauna of the Project area is strongly degraded in result of long time usage for agriculture, irrigation and because of dense human population

[1] We refer to the zoning presented in the World Physical-Geographic Atlas (1964) first of all because one of the map authors was N.K. Vereshchagin, author of *The Mammals of the Caucasus; a History of the Evolution of the Fauna* (1959), a fundamental monograph also including a detailed map of the Caucasus zoogeographic zoning based on theriology data.

2.5.1. Landscape (habitats) of the Project area

The natural type of the vegetation within the Project area is an Imeretian-oak forest with the evergreen underbrush. The Samtredia-Grigoleti Highway corridor is located in the narrow strip of this landscape. From south it is bordering with hilly foothills, covered with Colchic hemihyleas (an extra-humid, evergreen, subtropical forest). From the north, the construction corridor is bordering with accumulative lowland plain, covered with swamped alder-forest with included sphagnum-mires and reed-bogs. According to map of Dr. N. Beruchashvili all these landscapes are united into one sub-type of landscapes – "Colchic Lowland landscapes with swamp alder forests and sphagnum bogs, and foothill landscapes with hornbeam-oak forests alternating with beech-chestnut, oak-Zelkova and polydominant forests with evergreen understory"

It should be noted that natural vegetation cover, within the area of construction, is destroyed almost totally. Largest part of the land is converted to treeless arable lands and pastures. Small remnants of forest are under the press of the fuel-wood harvesting, cattle and pig grazing, and penetration of the invasion species of plants. The wind-braking tree-strips mainly consists of exotic tree-species and local bushes, like blackberry, greenbrier (*Smilax sp*.) etc.

Fig 38. Map 1 – **Landscapes (ecosystems) of the Project area**

1 - Accumulative lowland plain, covered with swamped alder-forest with included sphagnum-mires and reed-bogs.

2 - Accumulative lowland plain, covered with Imeretian-oak forest with the evergreen underbrush.

7 - Hilly foothills, covered with Colchic hemihyleas (an extra-humid, evergreen, subtropical forest).

48 –Accumulative lowland plain, covered with sphagnum-reed mires

Dark-gray areas – cities; **light-gray** areas - villages

2.5.2. Ecosystems, species complexes and species in need of conservation crossed by the Samtredia-Grigoleti Highway corridor.

Ranges of separate animal species and areas of distribution of species complexes often coincide with borders of biotopes or landscapes. Landscapes are mosaic scattered within each of physical-geographic or zoogeographical regions. Best systems of division of landscapes of the Caucasus, and in particular of the Georgia, are given By Ketskhoveli (1957, 1973), Gulisashvili et al. (1975), Sokolov and Tembotov (1989). However we can accept here the simplified scheme, more appropriate from zoological point of view.

The main types of ecosystems along the Samtredia-Grigoleti Highway corridor are the following:

Industrial and urban areas. Sometimes, nests of birds or significant associations of bats can be found in old industrial buildings - mainly abandoned storehouses, cellars, attics etc. In such a case, it is needed to undertake special measures, to prevent a mass death of them, especially, if these species are protected by law (e.g. are included in the Red Data List). We had not recorded such associations or nesting places of protected species in abandoned buildings, inspected close to the RoW of future highway during the short field-survey (6-10 November).

Rural landscapes cover largest part of the territory crossed by the Samtredia-Grigoleti Highway corridor route. Cultivated lands are feeding place for many animals, especially for birds - nesting in a forest and the passengers on flyway. As rule, here are established not diverse and numerous, but constant animals complexes. Of certain importance are wild animals complexes established on pastures and meadows, which are being mown. Mainly these are connected with species complexes in the surrounding natural landscapes, but have a reduced numbers of populations. Many protected species occur there.

The projected road passes mainly through agricultural lands and residential areas.

- The fields of maize (corn) and pasturelands, both on the drained lands, are spread along the whole length of the construction corridor. Pastures and arable lands are important feeding place of bird-of-prey. Especially importance of these for soaring raptor birds is increasing during the spring and autumn passages (migration) as stop-over sites and place with plenty thermals, up-rising air currents, generated by sun-heated land surface. Birds use all possible structures for perching (as roosts), thus the lighting pylons of the Samtredia-Grigoleti Highway will be constantly used by birds.
- Homestead lands covered with orchards and filbert-tree plantations are located in a few places e.g. at the villages Tabanati, Khidmagala. Dense human population and regular works in yards and gardens reduced number of rare and endangered species in this area. No protected by law species observed during the field trip.

- The old tea-bush gardens, shown on the topographic maps are converted in the pastures already. Therefore, animal populations on such sites are scarce. No significant populations of the protected by law species are known on this grounds.
- The last two km the corridor runs exactly on the old motor road through the degraded pasturelands. This site of the corridor is located along the banks of Khidmagala fish-ponds. The fish-ponds are well known stop-over-site of migratory birds and place of wintering of part of them.

Wetlands (swamped meadows and mires) - are crossed by the Samtredia-Grigoleti Highway corridor in a few places. All wetlands contain some rare and endemic vertebrate and invertebrate species and are inhabit with very vulnerable community of animals. They are important for many species as shelter, feeding place, stopover sites during migration and wintering.

The most important parts of this ecosystem are (from East to West):

- Mires at the Loghoba River (between 3 and 4 km)- swamped area and pond with partly opened water surface
- Wetland at the Narionali Lakes, and the lakes of itself. These mires are not designated as a Wetland of International Importance (as a Ramsar Site).
- Khidmagala fishponds – partly dried, partly eutrophicated, and partly with open-water surface artificial water-bodies.

Others wetland are fragments of floodplains of the rivers and channels crossed by the RoW and small mires that are scattered along the Highway route.

The Pichori-Paliastomi wetland (south from the river Rioni, including lakes Paliastomi and Imnati, and surrounding mires up to limits of swamped forest at the road Samtredia-Batumi) can be considered as a remote environmental receptor. It can be affected during construction and operation of the highway. This area is a part of the Kolkheti National Park established in 1999. Within this area lies the former Kolkheti State Nature Reserve (500 ha), established in 1947, today included into the National Park as a Strict Nature Protection Zone.

Georgia had acceded to the Ramsar Convention (date from the time of accession - 30 May 1996). This area is included in the Ramsar List of Wetlands of International Importance as site N°893 “Wetlands of Central Kolkheti”. This site covers 33,710 ha of terrestrial area and about 22,000 of marine water. Generally, Kolkheti National Park is covered by the Ramsar Site, but the shapes of both (the Ramsar site and National Park) are not congruent and their borders are not coincident in many places. The Ramsar site N°893 is largest Ramsar site in Georgia.

This area is rich with relics and endemic species of tertiary period. The area is of importance as place of aggregation of birds during migration. The wetland habitats provide stopover site for dozen wader and waterfowl species and serves as a feeding ground for

many raptor birds. The wetlands in the National Park are indeed an important site for wintering birds. This area supports complex of animals of lowland wetlands extremely vulnerable to any contamination and pollution. The most western population of the Marsh turtle (*Emys orbicularis)* exists in this area.

The construction corridor lies along the south border of the National Park on distance between 220 meters (at Grigoleti) up to 7.7 Km (in vicinities of Kvemo Chibati village). The shortest distance between Ramsar site border and the RoW is about 1400 m at the village of Akhalsopeli along the river Uskubani channel and about 3.5 km at the Khidmagala fishponds. The Highway passes across of a lot of small rivers, irrigation channels and drainage ditches. All water in this area is running to the Paliostomi Lake trough the wetland. That is why any accident with the vehicle loaded with environmentally dangerous stuff will harm this wetland. It should be noted that the construction and normal operation of the highway directly along the southern borders of the National park will have certain slow the negative impact on the fauna and ecosystem within the protected area.

River bank ecosystems, usually differing from surrounding landscapes by the higher humidity, less developed soil layer, sometimes – the higher density of shelters, more developed bush vegetation and less covered with agricultural landscapes. These ecosystems usually form narrow belts along rivers up to several hundred meters wide. Generally, they are quite diverse in regard of species composition of plants and animals. They are important for many species as shelter and feeding place. Animal community of these ecosystems can be affected if large part of the vegetation will be destroyed.

The rivers crossed by the project from East to West are: Ochopa, Laghoba, Tskhenistskali, Rioni, Khevistskali, Pichori, Oragvisgele, Mtredistskali, Lesis Tskali, Tskal-Tsitela, Sviana, Uskubani and their tributaries, Karavis-Gele. The projected highway is running close to the river Supsa (about 100 m). Moreover the highway crosses many channels and drainage ditches, among them the largest are channels Shavistskali, Natekhis Arkhi, Tskal-Tsitela Arkhi and runs close to Didi Arkhi.

Especially, the impact would be significant in places where the construction corridor runs along the water-beds: Rioni River, channel Didi-Arkhi, river Supsa. The floodplain of the Rioni River will be affected in case of vehicle accident on the site from Samtredia to the bridge on the Rioni River. Other floodplains will be affected during construction works and exploitation of the highway.

Freshwater ecosystems. Attention must be paid to fish, association of amphibians and invertebrate species. Such ecosystems are sensitive to the impact of the Samtredia-Grigoleti Highway corridor construction and operation. These ecosystems can be affected during construction work in case of fuel leakages and turbidity increasing during work within floodplain and river crossing by trucks. The Samtredia-Grigoleti Highway corridor crosses more than 13 rivers and different streams (see above) and a lot of channels.

According to peculiarities of a structure of the fauna, all habitats within the Construction Corridor could be united in following ecosystems' complexes:

Pasturelands and maize (corn) fields and pasturelands on drained lands on Colchic Lowland (from vicinities of Samtredia to Grigoleti village) are important as the feeding place of the migrating birds, especially, of soaring raptor birds during migration.

Small sites of semi-natural biotopes – wetlands, floodplain forests, old wind-breaking tree-strips and meadows are scattered within the area. They are also of importance for migratory birds, bats and other mammals.

Wetlands are important for many species as shelters, feeding places, stopover sites during migration and wintering. The most important site of wetland ecosystem is the Narionali Lakes and Khidmagala fishponds. These areas supports specific complex of terrestrial vertebrate and invertebrate animals and serves as a feeding area and stop-over-site during passage for many birds' species.

2.5.3. General Characteristics of Animal Species` Composition, According to Taxonomic Groups.

Mammals.

108 species of mammals occur in Georgia. These species are associated in 64 genera of 28 families that belong to 7 orders. From this amount 4 species, probably, do not meet any more in wild nature of Georgia. Seven species were acclimatized in Georgia or have penetrated after acclimatization on adjacent territories (Bukhnikashvili, Kandaurov 1997, 2002; Gurielidze, 1997). The Samtredia-Grigoleti Highway corridor crosses ranges of distribution of about 55 terrestrial mammal species. Some more species are also recorded within the administrative districts of Lanchkhuti and Abasha, but, nowadays, occurring of these species within the Construction Corridor is unlikely. There are not key-habitats of the endangered mammals within the Construction Corridor itself. Populations or some individuals of the protected by law species can be affected during construction and operation of the Samtredia-Grigoleti Highway, or in results of vehicle accidents within the zone of impact on the remote ecological receptors. These species are as follows: Otter (*Lutra lutra),* several species of bats and, in case of leakage of big amount of oil or fuel in the rivers Rioni, Supsa, three species of dolphins (Common bottlenose dolphin (*Tursiops truncatus*), Short-beaked common dolphin (*Delphinus delphis*), Harbour Porpoise (*Phocoena phocoena*). Parts of populations or some individuals of the protected by law species can be affected during construction and operation in results of vehicle accidents within the construction zone (the feeding strategy of some medium-sized carnivore species, picking up dead animals from the road, leads in increased mortality).

The penetration of some individuals of Brown Bear *(Ursus actors)* cannot be excluded. There are not data on distribution within the studied area of such invasive species as are Raccoon-Like Dog (*Nyctereutes procyonoides*) and Common Raccoon (*Procyon lotor*), but their presence on this territory cannot be excluded, too.

As regards terrestrial mammals within the Construction Corridor of the Samtredia-Grigoleti Highway - bats (*Chiroptera*) are most vulnerable species. Bats are extremely restricted in finding shelters for breeding colonies. They frequently form large colonies in manmade structures and/or tree holes along the roads. Such colonies will most likely be destroyed in case of roads widening and during cleanup activities. In addition, an oil spill could destroy the food resource of the maternal colony, which will substantially reduce number of young. One species of Chiroptera, which are found along the Construction corridor, are included in the Georgian Red Data list and in the IUCN Red List under the category vulnerable (The Atlas of European Mammals, 1999; The Red List of Threatened Animals IUCN, 1994, 2003). Evaluation of highway construction and operation related impact requires survey of summer nursing and maternal colonies and winter roosts. All bats that occur in Georgia are included in the Appendix II of Bonn Convention and protected under EUROBATS Agreement. 13 species of bats are recorded in the project area.

Table 2.5.1. Bat species occurring along the Samtredia-Grigoleti Highway corridor route

N	***Species - Latin name***	**Common English name**	**Georgian name**	**Inhabiting**	
				Tree Hollows	**Buildings**
1	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	დიდი ცხვირნალა		+
2	*Myotis blythii*	Lesser Mouse-eared Bat	ყურწვეტა მღამიობი		+
3	*Myotis mystacinus*	Whiskered Bat	ულვაშა მღამიობი		+
4	*Myotis daubentonii*	Daubenton's bat	წყლის მღამიობი		
5	*Pipistrellus pipistrellus*	Common Pipistrelle	ჯუჯა ღამორი		+
6	*Pipistrellus pygmaeus*	Pygmy Pipistrelle	პაცია ღამორი		+
7	*Pipistrellus nathusii*	Nathusius's Pipistrelle	ტყის ღამორი	+	
8	*Pipistrellus kuhlii*	Kuhl's Pipistrelle	კულის ღამორი		+
9	*Nyctalus noctula*	Common Noctule Bat	მელამურა	+	
10	*Nyctalus lasiopterus*	Greater Noctule Bat	გიგანტური მელამურა	+	
11	*Nyctalus leisleri*	Leisler’s Noctule Bat	მცირე მელამურა	+	

N	*Species - Latin name*	Common English	Georgian name	Inhabiting	
12	*Barbastella barbastellus*	Western Barbastelle	ევროპული მაჩქათელა	+	
13	*Eptesicus serotinus*	Serotine Bat	მეგვიანე		+

During the field trip (6-11 of November, 2012) the large trees with hollows (the potential bats roosts) and strips of trees - linear structures of landscape, which are important for bats movement to feeding areas, were found within the limits of the construction corridor or in close proximity of it in the 22 points of observation (see Table 2):

Table 2.5.2. Observation points, where large trees and strips of trees were found

Point #	Latitude	Longitude	Old trees
17	42.150120° N	42.349551° E	Solitary poplar-tree
27	42.132665° N	42.306819° E	Solitary tree in RoW; Tree-strip across the RoW
31	42.127033° N	42.293852° E	Solitary poplar-tree in RoW; Tree-strip across the RoW - beside the river and road
35	42.122267° N	42.280336° E	Two tree-strips across the RoW, small alder forest
36	42.119233° N	42.268561° E	Tree-strip across the RoW
38	42.092462° N	42.074046° E	A few solitary trees in RoW and beside the river
40	42.089551° N	42.104484° E	The poplar tree-strip across the RoW
41	42.092308° N	42.124998° E	Large sycamore tree within the RoW, and solitary poplar-tree farther within the construction corridor
42	42.106238° N	42.244194° E	Two tree-strips on both sides of road across the RoW
43	42.108591° N	42.248666° E	Alder forest and solitary large trees on both banks of the Rioni River
45	42.033820° N	41.743250° E	Solitary tree in RoW
52	42.049748° N	41.797070° E	The poplar tree-strip across the RoW within the construction corridor
54	42.052986° N	41.802875° E	Small alder forest
57	42.082913° N	41.906035° E	Solitary trees in RoW
63	42.094317° N	41.981337° E	Tree-strip and large solitary tree within the RoW
64	42.102971° N	42.022183° E	Tree-strip across the RoW
65	42.103753° N	42.039557° E	Tree-strip and large solitary tree within the RoW
68	42.101085° N	42.052644° E	Tree-strip across the RoW
70	42.097950° N	42.060861° E	Tree-strip across the RoW
72	42.099033° N	42.195928° E	Tree-strip across the RoW
73	42.099594° N	42.201489° E	Large sycamore tree within the RoW; poplar tree-strip across the RoW
74	42.099917° N	42.204575° E	Sycamore and poplar tree-strip across the RoW and solitary tree in RoW

All these trees, as well as other trees, possibly growing within the construction corridor in not observed by us places, should be inspected on the presence of bats colonies, before start of the clearing works within the Right-of-Way.

It should be noted that the project area lies within the ranges of distribution of some species, which are of community interest. There are game species and species attractive for tourists. Also within the work area occur some species, which are most threatened by the roads. Among them are seven mammals of middle and large size, which are listed in the Table 3.

Table 2.5.3. Mammal species occurring within the work area

Point #	ლათინური დასახელება/ Latin name	ინგლისური დასახელება/ English name	ქართული დასახელება/ Georgian name	Status of presence	IUCN and RDL
1	*Myocastor coypus*	Coypu	ნუტრია	Resident	
2	*Canis aureus*	Jackal	ტურა	Resident	
3	*Lutra lutra*	Common Otter	ცავი	Resident	VU
4	*Meles meles*	Badger	მაჩვი	Resident	
5	*Felis silvestris*	Wild Cat	ტყის კატა	Resident	
Presumed species					
6	*Capreolus capreolus*	Roe-deer	ევროპული შველი	Autumn &Winter visitor	
7	*Canis lupus*	Wolf	მგელი	Autumn &Winter visitor	

Wolf appeared in the forest at Narionali Lakes in last years, locals say. The feeding strategy of the other species (picking up dead animals from the road) leads in mortality of medium-sized carnivores on roads. Most dangerous site of the road is between the 2.8 km and 4.5 km, 8.7 km and 9.2 km, 9.6 km and 13.7.

Sites of the Samtredia-Grigoleti Highway Construction Corridor those are most important from mammals' biodiversity preservation standpoint:

- Rioni River banks on both side of the river (between 9 and 10 km of the Construction Corridor)
- Narionali Lakes (between 10 and 15 km)
- Mires at the Loghoba River (between 3 and 4 km)
- Wind-breaking tree-strip at the 26.4-26.6 km near Lanchkhuti – for bats

Birds.

There are approximately 390 bird species recorded for Georgian avifauna. (Abuladze, 1997, Boehme Et Al., 1987; Zhordania R.G., 1979). About 220 species breed regularly or incidentally in Georgia, others appear in the country during migrations or in wintertime (Abuladze 1997). Some species can be assumed as potentially being under impact of the construction and operation of the highway, namely raptors.

Based on all available data and taking into account the viewpoint of bird conservation, it can be concluded that breeding avifauna of the project area can be classified as a poor by breeding species and is presented in general by common, widely distributed and numerous bird species. The dominate group of breeding birds are small passerines. Noteworthy is a fact that this area contains a breeding sites of Common Buzzard (*Buteo buteo*) and Black Kite (*Milvus migrans*). Probably, the White-tailed Eagle (*Haliaeetus albicilla)* is a rare year-round resident and, possibly breeder in National Park.

Territory of Georgia is important to Western Palaearctic birds' migration. Diversity of the bird species and numbers of each species greatly increase in spring and in autumn during seasonal transit migrations and in winter. The area has an importance for a various species of birds-of-prey, passerines, waders, waterfowl, herons, egrets, gulls, terns, as well as for the Common Quail and the Black Stork, etc. as a stopover site on passage and as wintering habitat.

The south-eastern coast of the Black Sea is one of the most important sites of Western Palaearctic birds' migration. Area includes the south-western part of the Colchic Lowland, seacoast, coastal lowland from Paliastomi Lake and left bank of Rioni River, in north, to Chorokhi River Valley, in south, foothills and pre-mountain area of the western slopes of the Meskheti Ridge. This area is of importance for a variety species as a stop-over site on passage and wintering habitat, but especially – for birds-of-prey. Hundred of thousands of individual migratory raptors is concentrating here in autumn. This area is the compound part of well-known "International Bird Area" for raptors "Arkhavi-Borchka" in the north-eastern Turkey.

Also, Georgia is an important wintering area for waterfowl, waders, some passerines and for birds-of-prey. Significance of Georgian wintering places is increasing when unfavorable weather conditions take place in regions northward from Main Caucasus Ridge (Azov Sea, south of Russia, Front-Caucasian area).

Birds, raptors (e.g. buzzard, Black kite) and owls, are using the roads as feeding grounds, and this makes them susceptible to being struck by cars.

Sites of the Samtredia-Grigoleti Highway Construction Corridor those are most important from mammals' biodiversity preservation standpoint:

- Rioni River banks on both side of the river (between 9 and 10 km of the Construction Corridor)
- Wetland at the Narionali Lakes, and the lakes of itself (between 10 and 15 km)
- Khidmagala fishponds at the Grigoleti village

Reptiles.

54 species of reptiles were ever recorded for Georgia (Bakradze & Chkhikvadze, 1992; Tarkhnishvili et al., 2002). The major part of reptile species is restricted in their distribution in the south-eastern part of Georgia, and can not be affected by the construction. 11-14 reptiles occur along the proposed Samtredia-Grigoleti Highway. Two rare species (*Elaphe longissima* and *Vipera kaznakovi*) are among them. Importance of populations that are found throughout the Construction Corridor differs between the species. Within the project area occur two regional endemic species, found exclusively in the Caucasus (*Darevskia derjugini, Vipera kaznakovi*).

Areas of high diversity of reptilian fauna were not found along the proposed Samtredia-Grigoleti Highway construction corridor. Sites of the Highway construction corridor that can be considered as potentially important for reptilian fauna are those which can support numerous associations of Marsh turtle (*Emys orbicularis*). Possible impacts of the Samtredia-Grigoleti Highway construction on the reptile populations will be low, the impact of highway operation – unknown at the moment. Importance of populations that are found throughout the construction corridor differs between the species, but no one can be suffered on the species or population level in result of power line construction of operation in proper way.

The pre-construction survey in summer is needed to find places with the numerous associations of Marsh turtle (*Emys orbicularis*), aggregations of rock lizards (*Darevskia sp*.).

Amphibians.

There are 12 species of amphibians found in Georgia (Tarkhnishvili, 1995, 1996). Four species of them are distributed within the Construction Corridor. There are not amphibian species protected by Georgian legislation recorded within the area of the proposed Highway construction corridor.

All amphibian species are in need of stagnant, or of very slowly current, fresh water – pools and oxbows on the floodplain and in the forest (e.g. on the forest roads). They can be killed in large numbers if fuel or lubricants oil will leak into the water bodies, where they spawn, during breeding season. But, none of amphibians will be extirpated as a species. Seasonally, during the spring migration to reproduction sites, summer migration to feeding

grounds and autumn migration to wintering places many amphibians die on the roads. The massive presence of frogs on the road makes a certain danger to traffic safety. *Rana ridibunda* - species which should be taken into consideration as potentially problematic in above mentioned.

Sites of the construction corridor those can be considered as potentially important for amphibian fauna are all swamped alder forest with dense undergrowth along the rivers, irrigation (drainage) channels, all scattered along the RoW wetlands, where can be supposed numerous association of amphibians – Marsh frog and Tree frog.

Freshwater Fish

The present ichthyofauna of Georgia comprises 167 species, 109 genera, 57 families, 25 orders and 3 classes. Among them 61 are freshwater inhabitants, 76 living in marine water and 30 species are anadromous (Ninua N., Japoshvili B., 2008). Ichthyofauna of the lower reaches of the Rioni River is rich. 35 fish species occurs in Rioni, downstream from the Samtredia City, and in its tributaries and standing water bodies along the highway route, and 21 species in river Supsa. Among them six sturgeon species and one salmon are anadromous, eight species are noted in the Red Data List. The reduced number of fish species can be found in the tributaries of these two rivers.

Fish are less sensitive to the impact of the Samtredia-Grigoleti Highway construction and its operation. Fish can be affected during construction work in case of fuel leakages and turbidity increasing during work within floodplain and river crossing by trucks, especially, during spawning period and during period when young fishes (fry) of anadromous fish species are migrating to the sea back. As well, in case if, in result of construction, an access to spawning places, feeding grounds or wintering pits will be restricted for fish.

Spawning areas of anadromous species are situated upstream the Construction Corridor, but during migration in the river any disturbance and change of water conditions in those rivers would be very adverse for sturgeon and salmon population in Georgia. The salmon migration in the river lasts from March till July, with peak during April-June, thus works on the river Supsa banks should be not executed during above noted period.

Only the floodplain of rivers Rioni, Laghoba, Tskhenistskali, Khevistskali and Supsa could be affected during construction of the bridges. In all these rivers in this place occurs 15 - 30 species of fish. Among them 8-9 species can be considered as those having for locals any significance as subject of substitution fishing or as a game fish species.

Which species and in which numbers spawns within the zone of impact (upstream and downstream) is unknown and needs involving of the ichthyologist in the pre-construction

surveys. The ichthyologist should undertake the pre-construction survey to find exactly locations of spawning grounds of protected and commercial fish and recommend appropriate schedule of river crossing works.

Table 2.5.4. Fish species occurring within Project Area

#	Latin name	English name	Georgian name	Status	Rioni and Tskhenis-tskali rivers	Supsa River mouth
1	*Acipenser sturio*	Baltic Sturgeon	ატლანთიური ზუთხი	**CR**	**+**	**?**
2	*Acipenser nudiventris*	Fringebarbel sturgeon	ჯარღალა/ფორეჯი	**EN**	**+**	**-**
3	*Acipenser stellatus*	Starry sturgeon	ტარაღანა	**EN**	**+**	**-**
4	*Acipenser gueldenstaedtii. colchicus*	Colchic Sturgeon	რუსული ზუთხი	**EN**	**+**	**+**
5	*Acipenser persicus*	Persian sturgeon	სპარსული ზუთხი	**EN**	**+**	**-**
6	*Huso huso*	Beluga	სვია	**EN**	**+**	**-**
7	*Anguilla anguilla*	European eel	გველთევზა		**+**	**+**
8	*Alosa caspia palaeostomi*	Paliastomi shad	ქაშაყი		**+**	**+**
9	*Rhodeus colchicus*	Colchic Bitterling	ტაფელა	Endemic	**+**	**+**
10	*Barbus escherichii*	Barb	კოლხური წვერა		**+**	**-**
11	*Capoeta sieboldii*	Colchic Khramulya	კოლხური ხრამული	**VU** Endemic	**+**	**+**
12	*Carassius carassius*	Crucian carp	ჩვეულებრივი კარჩხანა		**+**	**?**
13	*Cyprinus carpio*	Common carp	კობრი		**+**	**?**
14	*Gobio lepidolaemus caucasica*	Gudgeon	ციმორი		**+**	**+**
15	*Abramis brama*	Common bream	კაპარჭინა		**+**	**+**
16	*Blicca bjoerkna*	Silver bream	ბლიკა		**+**	**-**
17	*Alburnoides bipunctatus fasciats*	South minnow	აღმოსავლური ფრიტა		**+**	**+**
18	*Alburnus alburnus*	Bleak	თეთრულა		**+**	**?**
19	*Chalcalburnus chalcoides derjugini*	Shemaya of Batumi	შამაია		**+**	**+**
20	*Aspius aspius*	Asp	წითელტუჩა ჭერეხი		**+**	**+**
21	*Chondrostoma*	Colchic nase	კოლხური ტობი	Endemic	**+**	**+**

#	Latin name	English name	Georgian name	Status	Rioni and Tskhenis-tskali rivers	Supsa River mouth
	colchicum					
22	*Squalius cephalus = Leuciscus cephalus orientalis*	European Chub	კავკასიური ქაშაპი		+	+
23	*Rutilus rutilus*	Roach	ნაფოტა		+	-
24	*Scardinius erythrophthalmus*	Rudd	ფარფლწითელა		+	-
26	*Vimba vimba*	Vimba	მცირე ვიმბა		+	+
27	*Phoxinus phoxinus colchicus*	Eurasian minnow	კვირჩხალა		-	+
28	*Tinca tinca*	Tench	გუწუ		+	+
29	*Cobitis satunini*	Loache	გველანა	Endemic	+	+
30	*Barbatula angorae*	Angora loach	ანგორას გაჭალა		+	+
31	*Silurus glanis*	European catfish	ლოქო		+	+
32	*Salmo trutta labrax*	Black Sea salmon	შავი ზღვის ორაგული	**EN**	**?**	+
33	*Gambusia affinis holbrooki*	Mosquito fish	გამბუზია		+	**?**
34	*Perca fluviatilis*	River perch	ქორჭილა		+	-
35	*Neogobius constructor*	Ravine goby	კავკასიური მდინარის ღორჯო	Endemic	+	+
36	*Neogobius gymnotrachelus*	Caspian goad goby	კასპიური ღორჯო		+	+
37	*Neogobius fluviatilis*	Monkey Goby	მექვიშია ღორჯო		+	
					35	**21**

Invertebrates.

Invertebrates, and in particular insects, a new group included in the Red Data Books in last decades. Thousands of invertebrates species occurs in Georgia and most of them are very poorly studied. There is only fragmentary bibliography on most of them. Conservation status of the most of species can be characterized as DD (Data deficient), except narrow-ranged forms, which are a priori threatened. Numerous (hundreds of species) invertebrate animals - endemics of Caucasus, species included in the Red Lists or important for human health or economy - require extra surveys, first of all, as indicators of general status of ecosystems. The specialist-input is also necessary to evaluate highway-related effects on invertebrates.

It is supposed that invertebrate species hardly could be affected by the construction of the Samtredia-Grigoleti Highway corridor on a population level or on a species level. The extent and power of the impact factors of the Samtredia-Grigoleti Highway construction and operation, such as vehicle emissions or pH change in neighbor water pools, etc are not evaluated. That's why we do not describe here invertebrate species occurring within the area of interests. Invertebrate species listed in the Red Data List of Georgia will be noted below in the Table #6. One of the most vulnerable species of redlisted invertebrates is Colchis crayfish (*Astacus colchicus).* The wellbeing of this species is depended on clear water.

Endemics to Caucasus within the project area

The Caucasus has high concentration of endemic species, exceeding those in the vast majority of non-tropical regions. The total number of regional endemic species varies between 20-30% for fish, amphibians, reptiles, and mammals (Tarkhnishvili & Kikodze, 1986; Chatwin et al., 1986) and is possibly even higher for some groups of invertebrates. Largely, this is explained by presence of Pliocene forest refugia in the western Caucasus, where many species currently absent from the rest of the Planet survived both sharp decrease of humidity 5 millions of years before present and the Ice Age (Tarkhnishvili, 1996, 2004; Tarkhnishvili et al., 2000, 2001).

21 vertebrate taxa, considered endemic to the Caucasus, are listed in the IUCN Red Data Book under categories DD, LR (nt), VU, EN, and CR. Those include eight mammals, one bird, ten reptiles, and two amphibians. There are at least five mammals, one bird, 17 reptiles, 18 fish and hundreds of invertebrates (insects, snails, crustaceans) endemic to the Caucasus but not included in either national or international Red Lists.

The Samtredia-Grigoleti Highway corridor lies at the foothills of the Western Lesser Caucasus. The Western Lesser Caucasus, with its extremely high humidity level and landscapes similar to the North American temperate rainforests, has the highest diversity of forest plants and animals throughout the ecoregion and harbors a high proportion of the regional endemics, including Pliocene relict species. Those include 11 endemic species of insectivores and rodents, 1 bird, 11 to 14 reptiles, 3 amphibians, and 4 of the Caucasian endemic fish. This is nearly 50% of the vertebrate species endemic to the Caucasus ecoregion. The list of the Caucasian endemics found in the Western Lesser Caucasus includes 12 species enumerated in the IUCN Red List.

Conservation of the endemic animal complex of the Western Lesser Caucasus is of special importance for the World Biodiversity Heritage.

Among the vertebrate species ten species, which are endemic to Caucasus, can be found within the area of Project. Below, in the Table 5, one can see their names (scientific and common) and preferred biotopes for these species, and their range of occurrence within the area under consideration.

Table 2.5.5. Species endemic to the Caucasus occurring on the Project Area

N	Common name	Latin name	Georgian name	Biotopes and range of occurrence
	MAMMALS			
1	Pontic mouse	*Apodemus ponticus*	პონტოს ტყის თაგვი	fields and orchards – entire area
2	Caucasian mole	*Talpa caucasica*	კავკასიური თხუნელა	fields and orchards – entire area
3	Caucasian White-Toothed Shrew	*Crocidura gueldenstaedtii*	გრძელკუდა კბილთეთრა	fields and orchards – entire area
	BIRDS			
4	Armenian gull	*Larus armenicus*	სომხური თოლია	Vagrant, everywhere
	REPTILES			
5	Caucasian viper	*Vipera kaznakovi*	კავკასიური გველგესლა	?
6	Large-headed ring snake	*Natrix megalocephala*	დიდთავა ანკარა	Wetlands
7	Artvin lizard	*Darevskia derjugini*	ართვინური ხვლიკი	?
	FISH			
8	Colchic nase	*Chondrostoma colchicum*	კოლხური ტობი	All watercourses and water bodies
9	Colchic khramulya	*Varicorhinus sieboldii*	კოლხური ხრამული	Rivers and large channels
10	Ravine goby	*Neogobius constructor*	კავკასიური მდინარის ღორჯო	Rivers and large channels
	INVERTEBRATES			
11	Banded Agrion	*Calopteryx mingrelica*	სამეგრელოს ტურფა	Wetlands
12	Shamyl's Ghost Moth	*Phassus schamyl*	კავკასიური წმინდადგახვიარა	fields and orchards – entire area
13	Caucasian Festoon	*Allancastria caucasica*	კავკასიური ზარინთია	fields and orchards – entire area
14	Colchic crayfish	*Astacus colchicus*	კოლხური ფართოფეხა კიბო	All watercourses and water bodies

Red Data List of Georgia.

48 redlisted terrestrial species are recorded within the Samtredia-Grigoleti Highway corridor. According to Criteria of Georgian Red List four mammals are Vulnerable (VU) and one Endangered (EN), among 22 birds two are Critical Endangered (CR), seven - Endangered (EN) and 13 - Vulnerable (VU), one reptile is Endangered and one amphibian – Vulnerable. The amphibian redlisted species are not fixed there. Among nine fish species one is Critical Endangered (CR), six are Endangered (EN) and two - Vulnerable (VU). Eleven invertebrates, among which three species are Endangered and seven - Vulnerable (VU) species, and one (*Brahmaea ledereri*) is Regional Extinct, are recorded within Project Area. Aquatic species – freshwater and marine fish and marine mammals should be recognized as remote ecological receptors, mainly situated downstream of rivers from the Construction Corridor and in the sea. Two dolphin species (one EN and one VU) and 9 fish are among redlisted animals. See **Table 6.**

Among the five mammals there are three (one bat - Western barbastelle, Harvest Mouse and Otter) that use the part of the work area as a home ranges and feeding grounds. Otter could be affected during works into the riverbeds and on lakes, when turbidity of water and level of disturbance on the feeding places will increase. Bat can be suffered if some roosts in the trees with hollows will be destroyed during the clearing works (tree cutting before the construction.

The Project area is of importance for two-three redlisted bird species. Two bird species could be considered as a potential breeder within this area (Barn Owl and Bearded Parrotbill), and other species are regular or rare passage migrants during passage. For many others not protected by law birds this area is a flyway and stop-over site during passage.

One redlisted reptile – Caucasian viper is suspected for this area. It can be found on small hillocks on clearings within the forest and in open habitats.

Table 2.5.6. Animals, included in the Red Data List of Georgia (2006), which can be found within the work area.

National status according to the Criteria of Red Data List of Georgia: RE – Regional Extinct, CR - Critical Endangered, EN - Endangered and VU - Vulnerable

#	***Latin name***	**English name**	**ქართული დასახელება/Georgian name**	**National status**
		Mammals	ძუძუმწოვრები	
1	*Barbastella barbastellus*	Western barbastelle	ევროპული მაჩქათელა	**VU**
2	*Micromys minutus*	Harvest Mouse	პაწია თაგვი	**VU**
3	*Lutra lutra*	Otter	წავი	**VU**
4	*Tursiops truncatus*	Common bottlenose	აფალინა	**EN**

#	*Latin name*	English name	ქართული დასახელება/Georgian name	National status
		dolphin		
5	*Phocoena phocoena*	Harbour Porpoise	ზღვის ღორი	**VU**
		Birds	ფრინველები	
1	*Podiceps grisegena*	Red-necked Grebe	რუხლოყელა მურტალა	**VU**
2	*Pelecanus crispus*	Dalmatian Pelican	ქოჩორა	**EN**
3	*Ciconia ciconia*	White Stork	ლაკლაკი	**VU**
4	*Ciconia nigra*	Black Stork	ყარყატი	**VU**
5	*Tadorna ferruginea*	Rudy Duck	წიტელი იხვი	**VU**
6	*Melanitta fusca*	White-winged Scoter	გარიელი	**EN**
7	*Haliaeetus albicilla*	White-tailed Eagle	თეტრკუდა ფსოვი	**EN**
8	*Accipiter brevipes*	Levant Sparrowhawk	ქორცქვითა	**VU**
9	*Buteo rufinus*	Long-legged Buzzard	ველის კაკაჩა	**VU**
10	*Aquila heliaca*	Imperial Eagle	ბეგობის არწივი	**VU**
11	*Aquila clanga*	Greater Spotted Eagle	დიდი მყივანი არწივი	**VU**
12	*Aquila chrysaetos*	Golden Eagle	მთის არწივი	**VU**
13	*Neophron percnopterus*	Egyptian Vulture	ფასკუნჯი	**VU**
14	*Aegypius monachus*	Black Vulture	სვავი	**EN**
15	*Gyps fulvus*	Griffon Vulture	ორბი	**VU**
16	*Falco cherrug*	Saker Falcon	გავაზი	**CR**
17	*Falco vespertinus*	Red-footed Falcon	თვალშავა	**EN**
18	*Falco naumanni*	Lesser Kestrel	მცირე კირკიტა	**CR**
19	*Tyto alba*	Barn Owl	ბუხრინჭა	**EN**
20	*Grus grus*	Common Crane	ღუხი წერო	**EN**
21	*Burhinus oedicnemus*	Eurasian Thick-knee	თვალჭკეტია	**VU**
22	*Panurus biarmicus*	Bearded Parrotbill	ულვაშა წივწივა	**VU**
		Reptiles	ქვეწარმავლები	
1	*Vipera kaznakovi*	Caucasian viper	კავკასიური გველგესლა	**EN**
		Fish	ძვლიანი თევზები	
1	*Huso huso*	Beluga/ Giant	სვია	**EN**

#	***Latin name***	**English name**	**ქართული დასახელება/Georgian name**	**National status**
		Sturgeon		
2	*Acipenser sturio*	Atlantic Sturgeon	ატლანთიური ზუთხი	**CR**
3	*Acipenser nudiventris*	Fringebarbel sturgeon	ჯარღალა/ფორეჯი	**EN**
4	*Acipenser stellatus*	Starred Sturgeon	ტარაღანა	**EN**
5	*Acipenser gueldenstaedti*	Colchic Sturgeon	რუსული ზუთხი	**EN**
6	*Acipenser persicus*	Persian Sturgeon	სპარსული ზუთხი	**EN**
7	*Salmo fario labrax*	Black Sea Salmon	შავიზღვის ორაგული	**EN**
8	*Capoeta (Varicorhinus) sieboldii*	Colchic Khramulya	კოლხური ხრამული	**VU**
9	*Neogobius fluviatilis*	Monkey Goby	მექვიშია ღორჯო	**VU**
		Invertebrates	უხერხემლოები	
1	*Phassus schamyl*	Schamyl's Ghost Moth	კავკასიური წმინდადგახვიარა	**EN**
2	*Brahmaea ledereri*	Lederer's Brahmaea	კოლხური ბრამეა	**RE**
3	*Deilephila nerii*	Oleander Sphinx	ოლეანდრის სფინქსი	**EN**
4	*Callimorpha dominula*	Tiger Moth	დათუნელა ჰერა	**VU**
5	*Axiopoena maura*	Cave Transcaspian Tiger Moth	მღვის ამიერკავკასიური დათუნელა	**EN**
6	*Allancastria caucasica*	Caucasian Festoon	კავკასიური ზარინთია	**VU**
7	*Xylocopa violaceae*	Violet Carpenter bee	იისფერი ქსილოკოპა	**VU**
8	*Onychogomphus assimilis*	Dark princertail	მსგავსი ნემსიყლაპია	**VU**
9	*Calopteryx mingrelica*	Banded Agrion	სამეგრელოს ტურფა	**VU**
10	*Astacus colchicus*	Colchis crayfish	კოლხური ფართოფეხა კიბო	**VU**
11	*Dolomedes plantarius*	Fen raft spider	ტივის ობობა	**VU**

Section 4. Protected Areas and significant ecological phenomena on the project area.

Protected areas

The Georgian Law "On the Protected Areas System (7 March 1996) gave the legal basis for the establishment, management, control, territorial and functional organization of the protected territories, and commercial activities within their boundaries. For the conservation of natural heredity and sustainable social-economic development of the Georgia it was decided to establish new system of protected areas.

In 1998, the Parliament of Georgia adopted the Law on Establishment and Management of Kolkheti Protected Territories (in force -1999) - law on Kolkheti National Park, Kobuleti Nature Reserve and Kobuleti Managed Reserve. This law envisages the protection and rehabilitation of natural and modified wetlands of the Kolkheti wetlands.

The Kolkheti National Park was established on the Kolkheti lowland and part of the Black Sea marine area between mouth of rivers Inguri and Rioni as a part of Georgia's Integrated Coastal Management Programme in 1999 (with total area of 45447 ha and land area of 29704 ha in 2010). The Kolkheti State Nature Reserve (500 ha), established in 1947, was included into the National Park in its Strict Nature Protection Zone. The park consist of three parts: most northern Churia wetland (between rivers Churia and Khobistskali), Nabada wetland (between rivers Khobistskali and Rioni), and Pichori-Paliastomi wetland (south from the river Rioni, including lakes Paliastomi and Imnati, and surrounding mires up to limits of swamped forest at the road Samtredia-Batumi). Only this last one (Pichori-Paliastomi) can be considered as a remote environmental receptor. It can be affected during construction and operation of the highway.

This area represents rich with relics and endemic species of tertiary period - humid Colchic region. Seacoast and shallow marine area is not less important for biodiversity conservation than inland freshwater wetlands. 15,742 ha of marine water is included in the National park due to it significance for fish and waterbirds, especially as feeding ground of all species of sturgeons occurring in the Black and Azov Seas. This is only protected area in the World which dedicated to conservation of unique landscape of Kolkheti Lowland – Colchic swamped polydominant forest and alder forests, and peat bogs at the sea shore. This landscape covers about 15,000 ha within border of National Park. Nearly 10,000 ha are covered by hydromorphic lowland landscapes of deltas and floodplains with wetlands, swamped grasslands and salt marshes. The Colchic polydominant forest remained only within borders of the National Park, and even in the Park, it experienced hard anthropogenic pressure. Illegal logging for fuel wood is still one of major threat for biodiversity in this area.

Georgia had acceded to the Ramsar Convention (date from the time of accession - 30 May 1996) and included in the Ramsar List of Wetlands of International Importance this area as

site N°893 “Wetlands of Central Kolkheti”. This site covers 33,710 ha of terrestrial area and about 22,000 of marine water. Generally, Kolkheti National Park is covered by the Ramsar Site, but the shapes of both (the Ramsar site and National Park) are not congruent and their borders are not coincident in many places. The Ramsar site N°893 is largest Ramsar site in Georgia.

The area is of importance as place of aggregation of birds during migration. The wetland habitats provide stopover site for dozen wader and waterfowl species and serves as a feeding ground for many raptor birds. The National Park is indeed an important site for wintering birds. This area supports complex of animals of lowland wetlands extremely vulnerable to any contamination and pollution. Sensitive populations of smooth newt (*Triturus vulgaris*) occur in the area. The most western population of the Marsh turtle (*Emys orbicularis)* exists in this area. The wetland ecosystems of the Kolkheti National park are attractive and interesting for visitors of various categories. Tourists’ infrastructure of the protected area is quite developed. There is favorable situation for bird watching.

The construction corridor lies along the south border of the protected area on distance between 200 meters (at Grigoleti) up to 7.7 Km (in vicinities of town Lanchkhuti). It passes across of a lot of small rivers, irrigation channels and drainage ditches. All water in this area is running to the protected area. That is why any accident with the vehicle loaded with environmentally dangerous stuff will harm the protected area. It should be noted that the construction and normal operation of the highway directly along the southern borders of the National park will have certain the negative impact on the fauna and ecosystem within the protected area. The input of nitrogen from runoff waters from road and the vehicle exhaust fumes will deteriorate the nutrient conditions in the bog, while the peat bogs are very sensitive to changes in nutrient supply.

The Samtredia-Grigoleti Highway is running apart of borders of the Katsoburi Managed Reserve, Kobuleti Nature Reserve, Kobuleti Managed Reserve, Kintrishi State Nature Reserve and Mtirala national Park, thus description of fauna of these protected areas will be surplus in the given report.

Bird migration routes across project area

Bird migration and nomadic movements take place in Georgia during the whole year. However, there are sharply seen two migratory periods – spring and autumn passage. The important Euro-African and Euro-Asian migratory fly-ways of many bird species cross the territory of Georgia, from their nesting sites to the wintering areas and back. Not less than 215 species, or more than half of bird species of Georgia, are migratory birds, which are absent in the winter. The fly-ways of migratory birds’ on the territory of Georgia are linked with natural “guiding” lines – with the outlines of the Black Sea coast line, valleys of the large rivers (Rioni, Mtkvari and with their tributaries), mountain ranges, mainly with the

Greater Caucasus Chain and its spurs, and less with the Surami ridge and with ranges of the Lesser Caucasus. There are known primary, secondary and additional flyways, as well as concentration places of migratory flocks, so-called “migratory bottle-necks” and stop-over sites (places of their stay for the resting). The “bottle-necks” are situated on the passes in mountains (e.g. passes of the Great Caucasus) and in valleys of large rivers – Mtkvari, Rioni, Tergi (Terek), Alazani, and in valleys of some tributaries of them. The most important bottle-neck is located in south-western part of Kolkhida Lowland.

The general flyway within the project area goes perpendicularly across of the Samtredia-Grigoleti Highway, and follows the Black Sea coastline.

Spring (second decade of March – first decade of May). General direction of the migration is from the South to the North. There are using all suitable valleys of the rivers and the coast of the Black Sea. Part of the flocks flies above the sea surface in few kilometers off the coastline. Transit migrants are dominating. Their species composition and numbers vary to a great extent, sometimes in a very short time.

One can see four waves of the birds’ migration on the territory of Georgia in the spring - form the beginning of March till the middle of March, in second half of March, from the first week of April till the third week of April, from the end of April till the second week of May.

From bird safety standpoint the first wave (1-20 March) and second wave (second half of March) are noticeable. In this time many cranes, birds-of-prey, waterfowls and ravens (*Corvidae*) are migrating. These species are sensitive to accidents on linear obstacles (e.g. wires) and to electrocution when perching. Third wave – (7-10 April till 1 May) is the most intensive migration wave. More than half of the spring migrants migrate in this time. The last fourth wave (May) is of less importance for the Samtredia-Grigoleti Highway corridor project, because this is a time of migration of small birds (cuckoo, oriole, swift and some species of small passerines). Arrivals of the migrant birds, which are nesting in Georgia, continue from 5-10 May to 20-25 May, with peak between 10 and 20 May. The most important factors of intensification of spring migration are the meteorological conditions on the plains of the North Caucasus and the existence in Transcaucasia. The soaring birds (e.g. large birds of prey) are in need of the good warmed grounds, of places with the ascending flows of air. The migration of some species of ducks, geese, waders, and cranes have place at night.

Autumn (September – end of October). General direction of the migration is from the North to the South. The birds’ flocks cross the Main Caucasus Ridge through the passes in the gorges of the main rivers and go down to the intermountain plains. They do not follow to the bends of these riverbeds. The main part of the birds flies along the coastline of the Black Sea and above the sea. Birds gather in large flocks in the Kolkhida/Colkhic Lowlands.

Transit migrants are dominating; their species composition and numbers vary to a great extent, sometimes in a very short time.

Autumn passage is longer and more active than the spring passage. The first autumn migrants appear even at the beginning of August. The autumn passage ends at the turn of November. There are shown three waves of the autumn migration - at the beginning of September, from the second week of September till the first week of October, and at the end of October. The most numerous groups are passerines (*Passeriformes*), waders (*Charadriformes*), birds-o-prey (*Falconiformes*), geese (*Anseriformes*), pigeons (*Columbiformes*).

The cold snaps on Russia territory, as well as also weather conditions (direction and force of winds, intensity and character of precipitation, height and density of the cloudiness) in some regions of Georgia and in adjacent regions of Russia and Turkey influence the intensity of the autumn passage.

The migration is going in the daytime and in the night. Four peaks are noted in diurnal activity of the migrants. Among species sensitive to accidents on linear obstacles (e.g. wires) are migrating at dusk some waterfowls and birds-of-prey, and some species of ducks, geese, and cranes flying at night. The Quail is sensitive to road lighting. Flock of Quails, migrating in dusk and at night, can land on the road surface under lamps, and will be killed by cars.

Winter (December – February). This period is characterized by poor species structure, by limited territorial distribution of large aggregations of birds, by high numbers of some wintering species' and by essential fluctuations of birds number from year to year. At the later period of the winter (the last weeks of February) it is noted increasing of the diurnal activity of all species and some revival of activity in the movements of both flocks of wintering species and resident breeders. The territory of Georgia is of important significance for wintering birds. More than 130 species are wintering there and more than 40 of them are gathered in numerous flocks. Birds are distributed irregularly in the places of wintering. Mostly, they prefer the open and semi-open areas on the plains in the regions with generally warm and snowless winters. The most important wintering area is Colchic Lowland, at coastal lowlands, in flood-plains of large rivers of Black Sea basin and of their inflows.

Number of birds changes during the wintering season, reaching maximum usually in the middle of 1st – the beginning of 2nd decades of February. The greatest aggregation of wintering birds occurs on Colchic Lowland, where up to 60 % of birds from the total of those wintering in Georgia are recorded during the some years. Seaside lowlands also play the important role as wintering habitat, here are recorded up to 10-25% of the birds wintering in Georgia in different years. Up to 15-20 % of birds, wintering in Georgia, are recorded in open landscape of Eastern Georgia.

Number of the migrants varies noticeably from year to year. Unfortunately, the available data, does not allow defining an exact number of the birds, which are flying during the seasonal migrations through the territory of Georgia. General estimations of the number of the migratory and wintering birds: about 250 bird species - from 25 up to 40 millions of individuals, (depends of the weather conditions) migrate along the Black Sea coast.

Sometimes, Khidmagala fishponds and Narionali lakes are holding large association of waders and waterfowl and simultaneously with big number of bird-of-prey feeding on these.

Results of the Field Survey on 06-10 November 2012

Zoological Description of the road section 1 (Lot 1; Km 0 – 11.5).

In result of cameral work with maps and satellite images were select 10 areas of interest along the Highway construction corridor, 4 of which are falling withing section 1 (Lot 1; Km 0 – 11.5). The sites were recognized as the places potentially important for biodiversity preservation. These areas were inspected by zoologist during field survey 6-10 November, 2012.
Below is given brief list of these **Preselected Areas of Interest**.

- Site #1 Laghoba river crossing and swamp in the river floodplain.
- Site #2 Alder forest at the road between villages Gaunatskari and Kvishanchala
- Site #3 Rioni River crossing
- Site #4 Narionali lakes with surrounding wetlands

During the field survey not only the preselected areas but additional areas have been studied. All these areas, where studies have been carried out are further entitled as **Surveyed Areas a**nd within each Survey Area particular sites used for survey are referred as **Observation Points**.

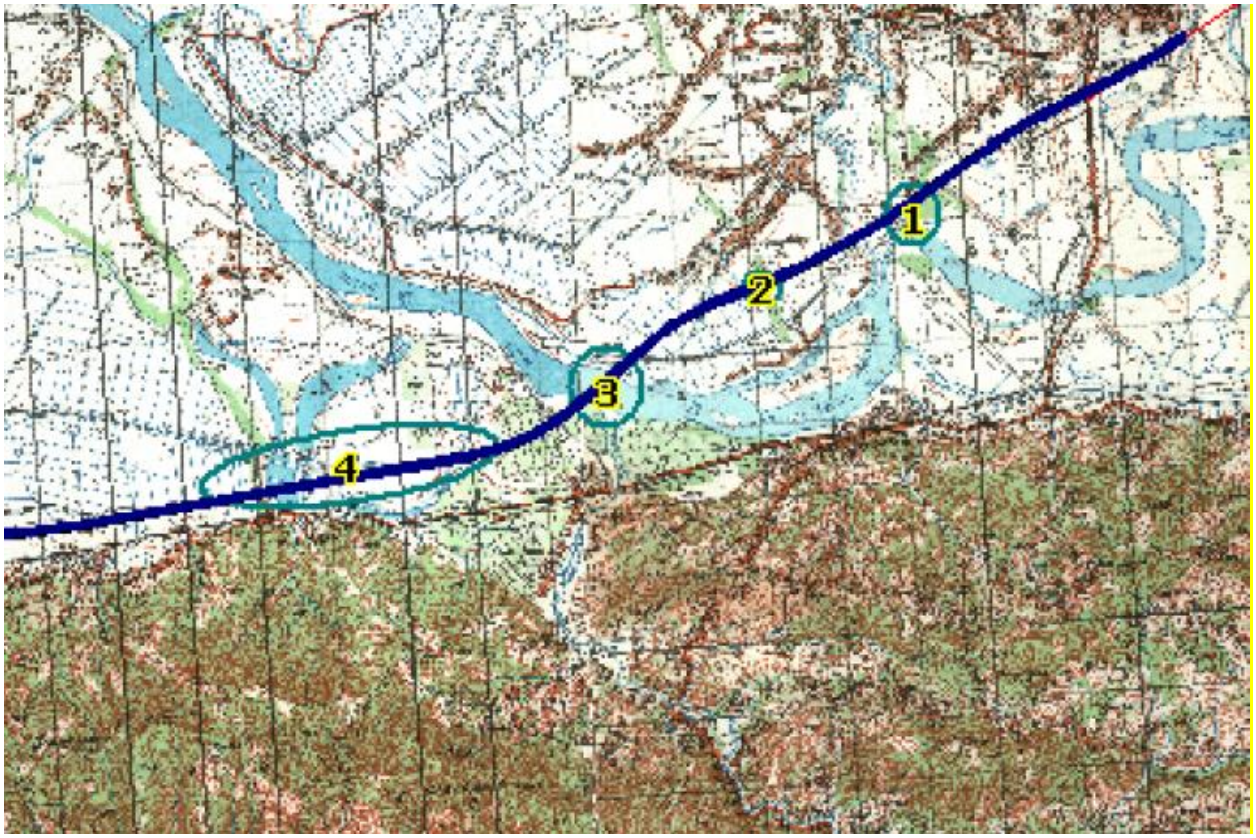


Fig 39. Preselected sites for Zoological Survey

Surveyed Area 1: The beginning point of the proposed Samterdia-Grigoleti Highway, left-hand bank of the river Ochopa. This Survey Area was not among the Preselected Areas of Interest and has been surveyed in addition. Observation Points: 17, 18, 19, 21 and 22
Brief description of the area: One large solitary poplar-tree within the maize fields and bushes within the river floodplain.

Animals: Jackdaws, goldfinches, greenfinchs, a siskin, buntings, crows, migrating flocks of starling (*Sturnus vulgaris*). Marsh frogs (*Rana ridibunda*); no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.


Fig 40. Surveyed Area 1; Observation Points 17 da 21

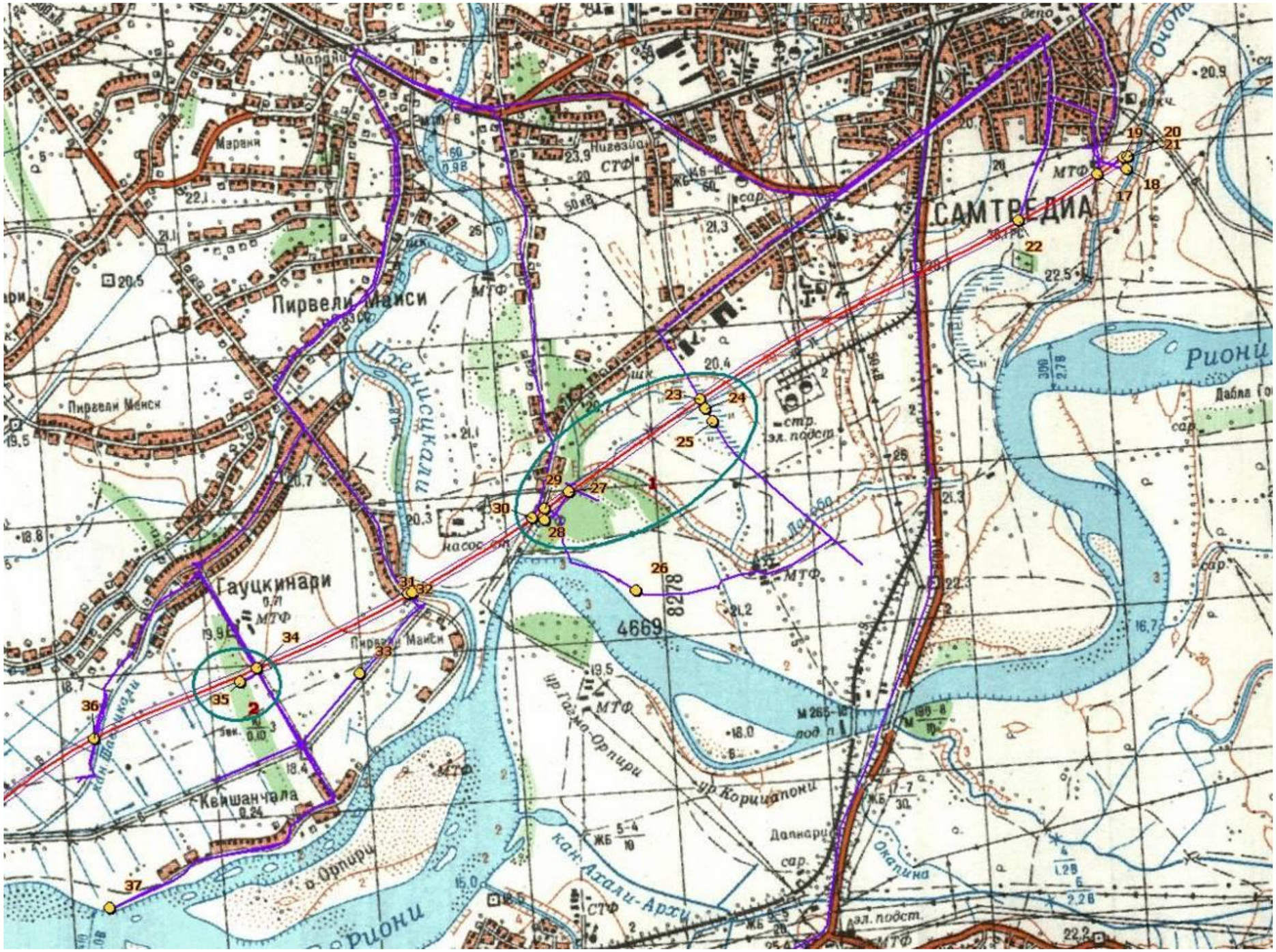


Fig 41. Surveyed Areas 1 – 5: Surveyed Area 1; Observation Points 17 - 22 ; **/ Surveyed Area 2** (within Preselected Area of Interest 1) Observation Points 23 – 25; **/ Surveyed Area 3;** (within Preselected Area of Interest 1) Observation Points 26 – 30; / **Surveyed Area 3;** (within Preselected Area of Interest 1); Observation Points 26 – 30; / **Surveyed Area 4;** Observation Points 31 - 32 ; **Surveyed Area 5** (within Preselected Area of Interest 2); Observation Points 33 – 37;

Preselected Area of Interest №1 Laghoba river crossing and swamp in the river floodplain.

Surveyed Area 2; Observation Points 23, 24, 25

Brief description of the area: eastern part. left-hand bank of the river Loghoba, swamped area, thicket of False indigo (*Amorpha fruticosa*); bushes within the river floodplain..

Animals: Millerbird, buntings, crows. Marsh frogs (*Rana ridibunda*); this area supports populations of Jackal, Wild cat, Coypu, Brown hare, Quail, and waders – locals says. No evidence of presence of Common Otter (*Lutra lutra*); according to habitat the Marsh Turtle (*Emys orbicularis*) can be found there.

Fig 42. Surveyed Area 2 (within Preselected Area of Interest 1)

Surveyed Area 3; (within Preselected Area of Interest 1) Observation Points 26 – 30;

Brief description of the area: western part of River Loghoba crossing area, wind-breaking strip (point#27) and solitary trees within the RoW, within the maize fields

Animals: Tracks of Caucasian mole (*Talpa caucasica*); chaffinch, blackbird, house sparrow, mountain sparrow, flying buzzard, crows, Marsh frogs (*Rana ridibunda*) and Tree frog (*Hyla arborea*) no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.

On the right-hand bank of the river Rioni, at the observation point #26, footprints of following mammals were recorded: Dog, Coypu, Wild cat; Jackal, and Water vole. Three adult Black cormorant (*Phalacrocorax carbo*) were seen in the middle of river stream.

Fig 43. Surveyed Area 3 (within Preselected Area of Interest 1)

Surveyed Area 4; Observation Points 31 - 32 ; This area was not included in a list of Preseleceted Areas of Interest. Decision on need of site assessment has been taken during the survey.

Brief description of the area: River Tskhenistskali crossing area, large solitary poplar-tree within the RoW; pastureland on the left-hand bank and maize field on the right-hand banks of the river.

Animals: chaffinch, blackbird, house sparrow and Tree frog (*Hyla arborea*) no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.

Fig 44. Surveyed Area 4; Observation Points 31 – 32; Not included in a list of Preseleceted Areas of Interest.

Preselected Area of Interest #2 – Alder forest at the road between villages Gaunatskari and Kvishanchala

Surveyed Area 5 (within Preselected Area of Interest 2); Observation Points 33 – 37;

Brief description of the area: right-hand bank of Rioni River at the river crossing point. Channel Shavitskali (point#36) crossing point and wind-breaking strip (point#34-35) within the maize fields. Crossing with Baku-Supsa pipeline corridor (point #33) and right-hand bank of the Rioni River in about 1 Km of crossing point.

Animals: chaffinch, blackbird, flying buzzard, crows, Marsh frogs (*Rana ridibunda*) and Tree frog (*Hyla arborea*) no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.

Fig 45. Surveyed Area 6, Preselected Area of Interest No 3, Observation Points 42 – 44; r. Rioni crossing;

Preselected Area of Interest No 3. Rioni River crossing

Surveyed Area 6, Preselected Area of Interest No 3, Observation Points 42 - 44

Brief description of the area: River Rioni crossing on the right-hand bank of Rioni River. River Khevistskali mouth. Floodplain of rivers covered with degraded riparian alder forest, old wind-breaking tree-strip. Pasture.

Animals: crows, Marsh frogs (*Rana ridibunda*); no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.

Preselected Area of Interest No 4 Narionali lakes with surrounding wetlands

Surveyed Area 14, Preselected Area of Interest No 4

Brief description of the area: Narionali Lakes and surrounding fields. Wind-breaking strips (points# 72 and73) and solitary trees (point #75) and small swamped alder forest (point #76).

Fig 46. Surveyed Area 14, Preselected Area of Interest No 4,– Narionali Lakes and surrounding fields.

Animals: Black bird, Chaffinch, Great Tit (*Parus major*); Winter Wren (*Troglodytes troglodytes*); European Robin (*Erithacus rubecula*); Gray heron - 1, Buzzards – 1, Harrier - 1, Black kite - 1, Little grebe -1; Redshank (*Tringa totanus*) – 2, Marsh frogs (*Rana ridibunda*) in plenty; no evidence of presence of Common Otter (*Lutra lutra*) and of Marsh Turtle (*Emys orbicularis*) was found.

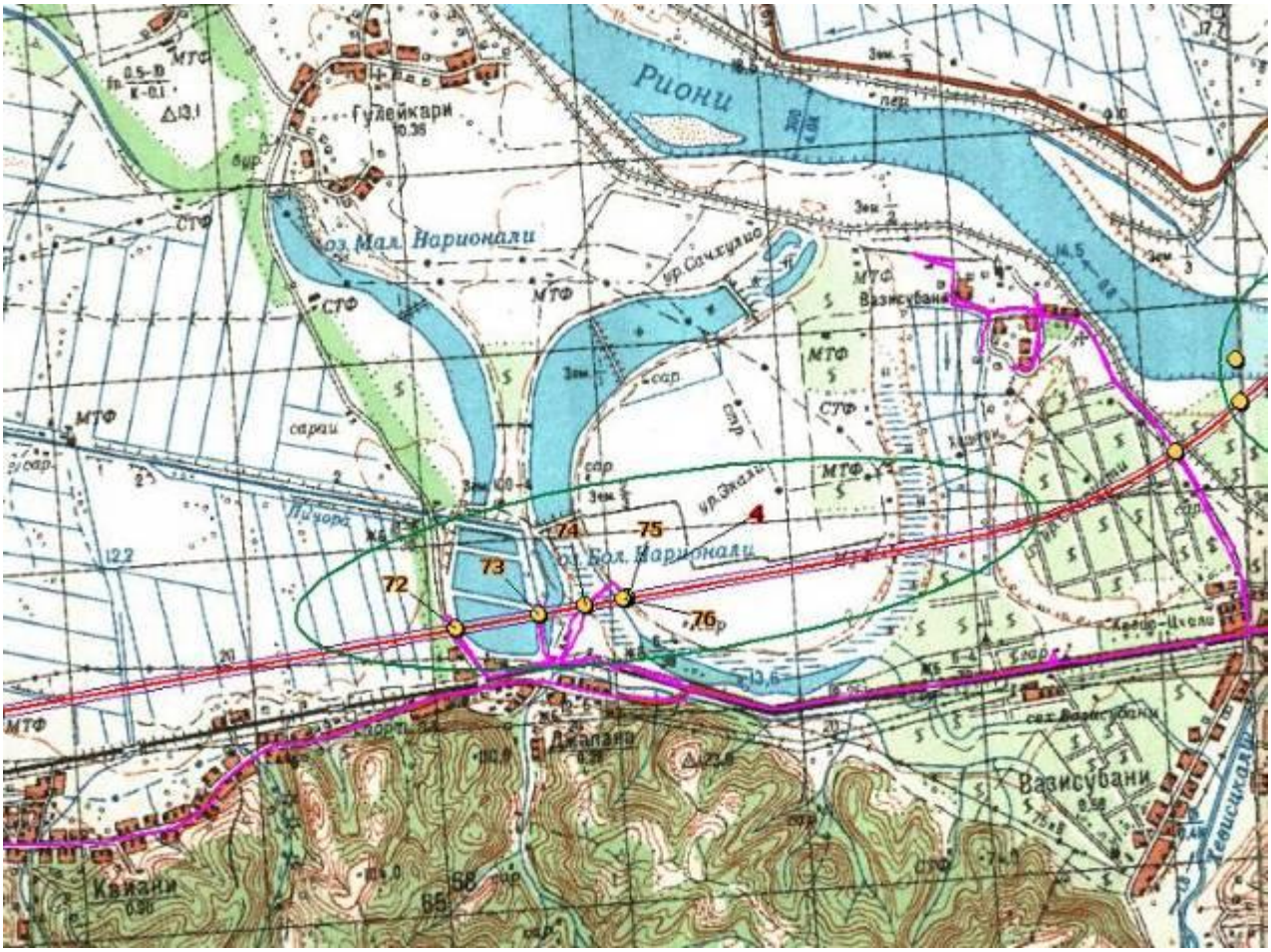


Fig 47. Surveyed Area 14, Preselected Area of Interest No 4,– Narionali Lakes and surrounding fields. Wind-breaking strips (points# 72 and73) and solitary trees (point #75) and small swamped alder forest (point #76).

2.5.4. Recommendation and conclusion

2.5.4.1. "Hot spots" –areas requiring special attention

There are areas, more or less sensitive to the Samtredia-Grigoleti Highway impact, along the Construction Corridor as well, as a sensitive species or groups of species, spread in the project area. Basing on the analysis of information presented in this report, and other issues, we can define several sensitive sites and faunistic complexes, which can be damaged during highway construction.

The following sites are sensitive to the Samtredia-Grigoleti Highway **construction and residual impacts**

1. All river and channel crossings;

    - Impact factor: pollution of the water by the oil or fuel (diesel) and by litter or waste products. Ecological receptors are all groups of water-dwelling animals (hydrobiontes), especially endemics and protected by law – Colchis crayfish, larva of dragonflies and fish (freshwater and anadromous).
    - Water turbidity increasing during river crossing process. Ecological receptors are all groups of hydrobiontes, especially fish (freshwater and anadromous) during spawning time and downstream-migrant fish fries(especially for sturgeons and Black Sea salmon).

2. Narionali Lakes

    - Pollution of the water by the oil or fuel. Ecological receptors are all animals and the ecosystem as a whole,
    - The effluent waters from the road-bed – water pollution and litter transport to the ponds. Ecological receptors are all groups of hydrobionts, especially, fish in fish farm, because the produced fish will lose consumer value.
    - Animals' disturbance on the key-sites. This is especially significant in case of disturbance of migratory bird species during autumn migration and wintering, and in case of Otter home range fragmentation.
    - Illegal hunting and the vandalism acts - by members of the construction crews or by poachers. Ecological receptors, mainly, birds and fish, but not only. Especially unfavorable this will be during autumn passage and wintering, and in lesser extent – during spring passage.

Impact factors:

- Destroying of shelters and nests during the preconstruction clearings (cutting trees etc). Ecological receptors birds (mainly not protected by law passerines) and bats.
- Animals' disturbance on the key-sites on breeding (nesting) places during breeding season (some birds will abandon their nests, even with nestlings).
- A limitation of opportunities of animals to move and feed within their home ranges. Ecological receptors are bats (in case of destroying of linear structures of landscape – e.g. wind-breaking tree strips etc), middle mammalian species(e.g. badger, jackals, otter etc) and amphibian species (newts, toads and frogs)

- Mortality of animals on roads. Ecological receptors are middle mammalian species (e.g. martin, jackals, otter etc), some large birds, which are using the roads as a place where they pick up food and using the lighting pylons for perching and rest, as well as, the amphibians (newts, toads and frogs) that are migrating twice a year from water bodies (spawning and wintering places) to terrestrial habitats, to the feeding places in forest and fields, during the rest part of the year.

2.5.4.2. Recommendations

It is necessary to carry out the detailed pre-construction survey in the field along exactly chosen route of the projected highway to define all objects those are sensitive to impact of the Samtredia-Grigoleti Highway construction and operation.

Generally one can propose following:

- Neither of breeding (nesting) area on beforehand definite distance should not be damaged or disturb without survey by experts and allowances of MOEPNR. In order to mark on the country all locations of breeding areas and nesting areas of the threatened species it is in need to carry out the detailed account (in Mart-June) before they will be disturbed or destroyed. That should be included into detailed program of the construction.
- Implementation of measures preventing release of oil products (fuel, lubricants) into water, e.g. refueling of equipment should be allowed only outside the floodplains
- For birds, constructing artificial nesting platforms for raptors if any nest will be disturbed during construction.
- Restore disrupted linear structures of the landscape (wind-breaking tree-strips, riparian forest and shrubs along the rivers and channels etc) essential for wellbeing of bat species population in the region.

It is requested to take into account phenological peculiarities of sensitive species (such as breeding season, nursing time, migrations and wintering, especially hibernation) to mitigate the temporary impacts of construction works.

- Diversity of the bird species and numbers of each species greatly increase in spring and in autumn during seasonal transit migrations and in winter. Taking this into account it is strongly recommended to carry out building process of the roads in the sensitive areas (Narionali Lakes and Khidmagala fish ponds) during July-August or during end of October - December.

- The ichthyologist should undertake the pre-construction survey to find exactly locations of spawning grounds of protected and commercial fish and recommend appropriate schedule of river crossing works:
    a) The Black Sea salmon (*Salmo fario labrax* is going for spawning in the river Supsa since the March till July. Therefore, any river-crossing work on the river should be scheduled on August-February
    b) The sturgeons are going to spawning area in May-July. Changes in water velocity in Rioni and Supsa in this time will be very unfavorable for all sturgeon species, as well as, movement of heavy tracks within river stream canal on shallow water, as well river-crossing works should be scheduled on August-February.

Residual impacts during operation of the road can be mitigated using the best world practices of the construction to minimize impact of it.

The proposed mitigation measures should include:

- additional field studies to confirm presence or absence of home ranges of threatened species (including bats and birds) exactly within the Construction Corridor, and to find out the accurate routes of seasonal movements of mammals (Otter, bats) and amphibian to prevent home ranges and translocation ways fragmentation.
- construction of culverts, modified for use by animals, and special under ground passages for amphibians in places of they concentration during seasonal dispersal to resolve problems of animals mortality on the road and increase the traffic safety (Jedrzejewski W., et al, 2009; Limpens H.J.G.A., Twisk P. and Veenbaas G., 2005.)
- Usage of bat boxes to compensate the felled trees with nursing colonies and/or wintering associations of bats, if any of such tree will be cut
- If the external lighting system will have wires between lamp poles (not an underground cable) then conductors should be equipped with so-called “bird diverters” placed on the wires. These are shiny metal objects that spin in the wind and catch birds’ attention and cause them to avoid the wire. Other mitigation measures that may be appropriate may be found in the Avian Power Line Interaction Committee’s Suggested Practices for Avian Protection on Power Lines (APLIC, 2006).

2.5.4.3. Conclusion

Fast the entire the area of Project is in fact on lesser importance from the standpoint of the animal biodiversity conservation, because of long and hard transformation of the natural landscapes and dense human population in the area. Dense human population and regular works in yards and fields reduced number of rare and endangered species in Highway construction corridor. Cattle and pigs are grazing everywhere. The trees were felled in the past and tree cutting is ongoing in all forested areas.

Based on the review of available data, it can be stated that there are no problems related to conservation of animal biodiversity, which cannot be resolved and/or mitigated at a reasonable cost. Actually, there are not many threatened and endangered species protected by law of Georgia. No one of them could be considered as being in critical situation on species or on population level because of the Project activity. No one of the protected areas will be directly affected by the Project activities.

Enumerated above in this report the Sensitive sites are results of observation in the field, unfortunately, in not very appropriate time for zoological examination of territory – first week of November. It could not be excluded that additional study in the due time will show other sensitive sites in addition to listed in the report.

However, it is unlikely that any species, protected by the law or by the international obligations of Georgian State (Conventions), or valuable population of such species will be damaged by the Highway construction, or by operation of it, on the significant level, and thus will become threatened of impact of the project.

Although the impact area of construction and operation of the Highway is situated within quite transformed landscapes, possibility of some impact of the fauna could not be excluded and additional studies in the zone of construction (Pre-construction survey stage) and post-construction monitoring in the corridor of construction is needed to assess real value of potential risks and to plan adequate mitigation measures.

2.5.4.4. Monitoring

It is needed to monitor during construction process and during operation of the Samtredia-Grigoleti Highway:

General

- Solid Waste Management on construction sites and camp facilities - to ensure compliance with relevant regulations
- Water Quality downstream - to ensure compliance with Water Pollution Control Regulation and to monitor any changes downstream of construction corridor.

- Effluent of wastewater treatment facilities - to ensure compliance with Water Pollution Control Regulation and to monitor any changes in the water ecosystem of Rioni downstream and Kolkheti National Park wetlands
- Environmental Monitoring Coordination within construction area - to ensure compliance with contracts and commitments

Zoological

- Bird mortality on road surface and on lighting facilities (electric lines etc.), especially during migration - to record the accidents involving birds
- Animals mortality on the road - to record the traffic accidents involving animals
- Wildlife disturbance on key-sites, e.g. breeding places (birds, bats, mammals) on all construction sites - to ensure compliance with contracts and commitments
- Wildlife (mammals and amphibians) - usage of underpasses across roads (if any will be build) - to ensure proper use of the facilities and prevent poaching on places of its, to check and improve the effectiveness of this measure.
- Take censuses of the local population of Common Otter - to check the adverse impacts on the local populations of the species within the Impact zone of the Project
- Breeding birds (waterfowl and raptors) within the Impact Area - to check effect of project

2.6. Archaeological Potential of Samtredia-Grigoleti Highway Construction Corridor

Background

The construction corridor of Samtredia-Grigoleti Highway belongs to historical Kolkheti and its end part lies in the Rioni River floodplain. The archaeological sites described below are found in the areas adjacent to the Highway, mainly in the Rioni –Supsa interfluve. This section was a historical part of Guria Province and one of the most important areas of Kolkheti. The recent archaeological findings show the importance of this micro-region in the origin and development of Kolkheti culture.

General Overview of Kolkheti Culture

Archaeological excavations and prospecting have revealed dozens of archaeological sites dating back to the 3rd-1st millennia B.C. in Kolkheti Lowland, downstream the Enguri, Rioni, Supsa and Choloki rivers. These sites include remnants of ancient settlements on hills, in the lowlands and under peat, burials, bronze items, treasure and various items of different periods.

The coastal area of Kolkheti contains centers of bronze and iron metallurgy of Late Bronze Age and Early Iron Age (14th – 8th centuries B.C) where ore was mined, smelted and metal items were made and moulded.

The archaeological culture of the 14th-8th centuries B.C. is known as the advanced magnificent bronze culture of Kolkheti. This culture is characterized by various metal work tools and weapons, specific type of pottery, beam-type wood architecture. The geo-climatic conditions of Kolkheti Lowland account for the development of specific types of settlements. Due to the high humidity and swamps the residential and service buildings were built on special compacted area surrounded by earth fill. The archaeological excavations allowed us to identify the types of wooden residential buildings and methods of construction. The types of buildings are log-houses, timber frame houses daubed with clay as well as wooden houses on stilts.

Later due to the development of crafts, production of goods, trade, relations with other countries the Kingdom of Colchis was established in the aforementioned area in about 6th century B.C with cities of Phasis, Dioskuria, Vani, Gyenos (Ochamchire), Eshera, Sairkhe, Pichvnari, etc.

The palaces, temples, fortifications, public buildings and burials excavated in the sites of the aforementioned cities evidence the existence of a sophisticated state and class society. Together with the common citizen's graves, the noblemen's burials containing a lot of valuable items (such as gold and silver jewelry, pottery, weapons, insignia, coins. etc.) were discovered in Kolkheti. The existence of local coins, the so called "Kolkhuri

Tetri" is the evidence of the statehood. The areas where Kolkhuri Tetri coins were discovered are located in the districts of West Georgia.

The latest archaeological findings allow experts to maintain that in the 6th-2nd centuries B.C. there were highly developed schools of jewelers and goldsmiths in some cities of Kolkheti (Vani, Sairkhe, Pichvnari). Using the most complex and sophisticated techniques (hammering, forging, brazing, granulation, impression) the goldsmiths created outstanding works of art, including earrings, buckles, diadems, temple rings, pendants, rings, beads, etc.

The Greek and Roman authors describe the extraction and treatment of gold in Colchis and call Colchis "a country abundant in gold". The myth of the Argonauts describes Colchis (Kolkheti) as the country where the Golden Fleece was held. One of the most distinguished ancient geographers and historians, Strabo (the 1st century B.C. – the 1st century A.D.) states that the country where the Argonauts traveled to get the Golden Fleece was Colchis. He also describes the ancient technique of gold extraction.

The List of Archaeological Sites in the Construction Corridor of Samtredia-Grigoleti Highway according to the Literary Sources

In the villages along Samtredia-Grigoleti Highway and in the adjacent areas all types of archaeological monuments typical of Kolkheti culture were discovered during the excavations and prospecting. These archaeological sites include settlements under peat dated back to the 3rd millennium B.C., settlements with the remnants of the 13th-10th centuries B.C wooden architecture, remnants of the 8th-7th centuries B.C. dune settlements and the 6th-5th centuries B.C. lowland settlements, burial grounds, including the 4th-3rd centuries B.C. dolium burials, etc. The lowland settlements deserve special attention. These are settlements built in a bit elevated areas of lowlands. Their cross sections contain dried gypsum layers. Most of such settlements are located within a range of 100-500m from settlement hills. One such site was discovered in **Gvimbalauri Village**.

In the section between Japana and Grigoleti the archaeological sites were discovered and studied in the late 20th century when Bako-Supsa oil pipeline was laid.

Unfortunately, the archaeological references listing and describing the aforementioned sites do not specify their location. Therefore, in this report we present the locations of the sites by villages (as it is shown in the archaeological references).

Japana Village

1. The ruins of the antique period settlement in the oil pipeline corridor;
2. The medieval architectural complex – keep, rampart, and 3 church ruins, located in the village;
3. Patara Jikheti (Little Jikheti) Church – middle centuries.

Fig 48. Archaeological articats found in Imereti

Annex 3

Analysis Report

Considerations and interpretations of Test Report #– 73 (2012)

National Environmental Agency

Department of Environmental Pollution Monitoring

Laboratory of Atmospheric Air, Water and Soil Analyses

Floor 8, David Agmashenebeli Avenue 150, Tbilisi 0112, Georgia

Analysis Report No. ...73...

Numbers of registered samples: #716-720 (water); #1, #2, #3, #4, #5 (soil)

Number of Protocol pages: 13

Client: Non-entrepreneurial Entity WORLD EXPERIENCE FOR GEORGIA

Client's address: Apt. 3, Building 17, Block 7, Vazha-Pshavela Avenue, Tbilisi

Tel: (+99532) 599 16 22 21

Fax:

ID No.:

E-mail:

Etiquettes provided by the Client: #1, #2, #3, #4, #5

Sample description and identification (matrix, form): Surface water, atmospheric air, soil

Used method/device: Ion-chromatographic, spectrophotometric, atomic-absorption, titrimetric, weight, mobile apparatuses

Sample receiving date: CR: 30.11.2012

Date of analysis: 30.11.2012 – 13.12.2012

Date of issue: 19.12.2012

The Report is drafted based on Sanitary Rules 2.1.4.000-00; N297/N of August 16, 2001: "Sanitary rules and norms to protect surface waters against pollution", Decree N297/N of August 16, 2001 of the Minister of Labor, Health and Social Affairs of Georgia.

 # 716 (#1)

The Rioni - Samtredia (N42^{0}07’35,1’’ E$_O$ 42^{0}18’00,4’’)

#	Measured parameters	Unit of measurement	Measurement results	Maximum Permissible Concentration	Method used
1	pH		7. 96	6-9	Mobile apparatus – pH 330i/340i
2	Diluted oxygen	mg/l	7.7	4 – 6	Mobile apparatus - Oxi330i/340i
3	Diluted oxygen	%	68		Mobile apparatus - Oxi330i/340i
4	Turbulence	NTU	32.4		Mobile apparatus - Turb. HI 98703
5	Hydrocarbonates	mg.eqv/l	100.04		Titrimetric
6	Ammonium nitrogen	mg/l	0.179	0.39	Spectrophotometric
7	Nitrate nitrogen	mg/l	0.865	10.0	Ion-chromatographic
8	Nitrite nitrogen	mg/l	0.125	0.2	Ion-chromatographic
9	Chlorides	mg/l	7.8	350	Ion-chromatographic
10	TDS	mg/l	169.0		Weight
11	TPH	μgr/l	*	300	

* The results of the analysis are given in Annex.

 # 717 (#2)

The Tskhenistskali - Samtredia (N42^{0}07’37,3’’ E$_O$ 42^{0}17’49,6’’)

#	Measured parameters	Unit of measurement	Measurement results	Maximum Permissible Concentration	Method used
1	pH		7.93	6-9	Mobile apparatus – pH 330i/340i
2	Diluted oxygen	mg/l	6.7	4 – 6	Mobile apparatus - Oxi330i/340i
3	Diluted oxygen	%	61		Mobile apparatus - Oxi330i/340i
4	Turbulence	NTU	61.4		Mobile apparatus - Turb. HI 98703
5	Hydrocarbonates	mg.eqv/l	97.60		Titrimetric
6	Ammonium nitrogen	mg/l	0.257	0.39	Spectrophotometric
7	Nitrate nitrogen	mg/l	0.886	10.0	Ion-chromatographic
8	Nitrite nitrogen	mg/l	0.227	0.2	Ion-chromatographic
9	Chlorides	mg/l	5.2	350	Ion-chromatographic
10	TDS	mg/l	163.0		Weight
11	TPH	μgr/l	*	300	

* The results of the analysis are given in Annex.

 # 718 (#3) **The Rioni - Vazisubani (**N42^{0}06'50,1'' E$_O$ 42^{0}14'18,8'')

#	Measured parameters	Unit of measurement	Measurement results	Maximum Permissible Concentration	Method used
1	pH		7.95	6-9	Mobile apparatus – pH 330i/340i
2	Diluted oxygen	mg/l	7.4	4 – 6	Mobile apparatus - Oxi330i/340i
3	Diluted oxygen	%	66		Mobile apparatus - Oxi330i/340i
4	Turbulence	NTU	61.5		Mobile apparatus - Turb. HI 98703
5	Hydrocarbonates	mg.eqv/l	104.68		Titrimetric
6	Ammonium nitrogen	mg/l	0.280	0.39	Spectrophotometric
7	Nitrate nitrogen	mg/l	2.423	10.0	Ion-chromatographic
8	Nitrite nitrogen	mg/l	0.271	0.2	Ion-chromatographic
9	Chlorides	mg/l	7.4	350	Ion-chromatographic
10	TDS	mg/l	210.0		Weight
11	TPH	μgr/l	*	300	

* The results of the analysis are given in Annex.

 # 719 (#4) **The Channel - Gurkaneti (**N42^{0}05'40,6'' E$_O$ 42^{0}04'33,6'')

#	Measured parameters	Unit of measurement	Measurement results	Maximum Permissible Concentration	Method used
1	pH		7.42	6-9	Mobile apparatus – pH 330i/340i
2	Diluted oxygen	mg/l	6.3	4 – 6	Mobile apparatus - Oxi330i/340i
3	Diluted oxygen	%	60		Mobile apparatus - Oxi330i/340i
4	Turbulence	NTU	81.4		Mobile apparatus - Turb. HI 98703
5	Hydrocarbonates	mg.eqv/l	146.4		Titrimetric
6	Ammonium nitrogen	mg/l	0.443	0.39	Spectrophotometric
7	Nitrate nitrogen	mg/l	2.983	10.0	Ion-chromatographic
8	Nitrite nitrogen	mg/l	0.108	0.2	Ion-chromatographic
9	Chlorides	mg/l	11.5	350	Ion-chromatographic
10	TDS	mg/l	170.0		Weight
11	TPH	μgr/l	*	300	

* The results of the analysis are given in Annex.

 # 720 (#5)

The Channel (N42^{0}05’47,3’’ E$_O$ 42^{0}03’37,0’’)

#	Measured parameters	Unit of measurement	Measurement results	Maximum Permissible Concentration	Method used
1	pH		7.78	6-9	Mobile apparatus – pH 330i/340i
2	Diluted oxygen	mg/l	6.2	4 – 6	Mobile apparatus - Oxi330i/340i
3	Diluted oxygen	%	58		Mobile apparatus - Oxi330i/340i
4	Turbulence	NTU	55.5		Mobile apparatus - Turb. HI 98703
5	Hydrocarbonates	mg.eqv/l	136.64		Titrimetric
6	Ammonium nitrogen	mg/l	0.365	0.39	Spectrophotometric
7	Nitrate nitrogen	mg/l	3.746	10.0	Ion-chromatographic
8	Nitrite nitrogen	mg/l	0.187	0.2	Ion-chromatographic
9	Chlorides	mg/l	10.6	350	Ion-chromatographic
10	TDS	mg/l	279.0		Weight
11	TPH	μgr/l	*	300	

* The results of the analysis are given in Annex.

Information about the concentration of polluting substances in the atmospheric air
Non-entrepreneurial Entity WORLD EXPERIENCE FOR Georgia

Date of measurement	№	Place of measurement	Site coordinates	Concentration, mg/m^3			
				Dust	CO	NO_2	SO_2
28-30.11 2012	№ 1	Samtredia	N 42^{0}07'35,1'' E$_O$ 42^{0}18'00,4''	0.002	0.90	0.006	<0.1
	№ 2	Samtredia	N 42^{0}07'37,3'' E$_O$ 42^{0}17'49,6''	0.002	0.87	0.005	<0.1
	№ 3	Samtredia Vazisubani	N 42^{0}06'50,1'' E$_O$ 42^{0}14'18,8''	0.003	0.97	0.007	<0.1
	№ 4	Samtredia Gurkneti	N 42^{0}05'40,6'' E$_O$ 42^{0}04'33,6''	0.004	1.27	0.120	<0.1
	№5	Samtredia	N 42^{0}05'47,3'' E$_O$ 42^{0}03'37,0''	0.005	1.08	0.005	<0.1
	Maximum Permissible Concentration			0.5	5	0.2	0.5

Results of soil analysis

#	Description	Samtredia, bank of Rioni #1	Samtredia, bank of Tskhenistskali #2	Vazisubani #3	Gurkneti #4	Lanchkhuti #5
		N42^{0}07’35,1’’ E$_O$ 42^{0}18’00,4’’	N42^{0}07’37,3’’ E$_O$ 42^{0}17’49,6’’	N42^{0}06’50,1’’ E$_O$ 42^{0}14’18,8’’	N42^{0}05’40,6’’ E$_O$ 42^{0}04’33,6’’	N42^{0}05’47,3’’ E$_O$ 42^{0}03’37,0’’
1	Lead - Pb, mkg/g	4.8	4.3	1.62	3.7	4.01
2	Zinc - Zn, mkg/g	32.96	24.82	14.06	27.6	25.6
3	Copper – Cu,mkg/g	9.2	8.1	4.6	7.7	7.9
4	Nickel- Ni, mkg/g	20.1	14.62	8.34	8.20	17.6

Type of analysis: A - accredited, N - Non-accredited, *C* - Pre-international accreditation period, subcontractual - accreditation, subcontractual - accreditation; subcontractual - non-accreditation; used method: IC-ion chromatograph, Titrimetric, UV/VIS-spectrophotometer, atomic-absorptive, weight, mobile devices.

Note: The results of the analyses can be appealed within 14 days of receiving the protocol.

Analysis Report drafted by**:** **Elina Bakradze,**

Head of the Laboratory of Atmospheric Air, Water and Soil Analyses

Protocol examined by: **Gulchina Kuchava,** Quality Manager

Analysis Report approved by: **Marine Arabidze,** Head of Department

Fig 49. Sampling

Annex 4.

4. Air pollution and background radiation

4.1 Air Quality: Baseline, Project Impacts and Mitigation

Air Quality

Before the breakdown of the Soviet Union, the State Hydro meteorological Services were responsible for regularly measuring the concentrations (3 times daily) of the basic air pollutants: particulate matter, SO2, NO2 and CO, as well as some specific pollutants from local stationary sources. These measurements were carried out in Georgia until 1991 in 11 large cities at 33 measuring sites. Over time, however, their scope has slowly been reduced. Reliable measurements of air quality after 1994 are not currently available. In most cities the maximum allowable concentrations (MAC) are exceeded. Table below gives the ratio of the measured concentrations at the municipal measurement stations to the maximum allowable values for four cities: Tbilisi, Kutaisi, Batumi and Rustavi.

Air Quality in Tbilisi

Pollutant	WHO air quality guidelines	EC limit value	Georgian MAC	Averages measured over five-year periods		
				1984-1988	1989-1993	1994-1998
Particulate matter, $\mu g/m^3$	50.0	150.0	150.0	400.0	350.0	300.0
SO_2, $\mu g/m^3$	60.0	50.0	50.0	120.0	90.0	140.0
NO_x, $\mu g/m^3$	40.0	..	40.0	45.0	50.0	40.0
CO, mg/m^3	1.0	..	3.0	4.2	4.0	3.2
Phenol, $\mu g/m^3$	..	..	3.0	4.4	7.0	4.4
Formaldehyde, $\mu g/m^3$	..	..	3.0	12.0	12.5	12.0

Source : UNEP-GRID. Tbilisi Environmental Atlas. Tbilisi, 1999.

Air pollution is not measured in rural areas. There are also no monitoring stations that would comply with the requirements of the Cooperative Program for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). However, for the sections of the highway located in rural areas (Zestafoni – Kutaisi; Kutaisi West – Samtredia) it is expected that air quality would be good owing to the current relatively limited scale of industry and road traffic in Georgia. In the vicinity of Zestafoni and Kutaisi the baseline contamination patterns should be worse.

Exceedances of maximum allowable concentrations (MAC) of selected air pollutants in selected cities

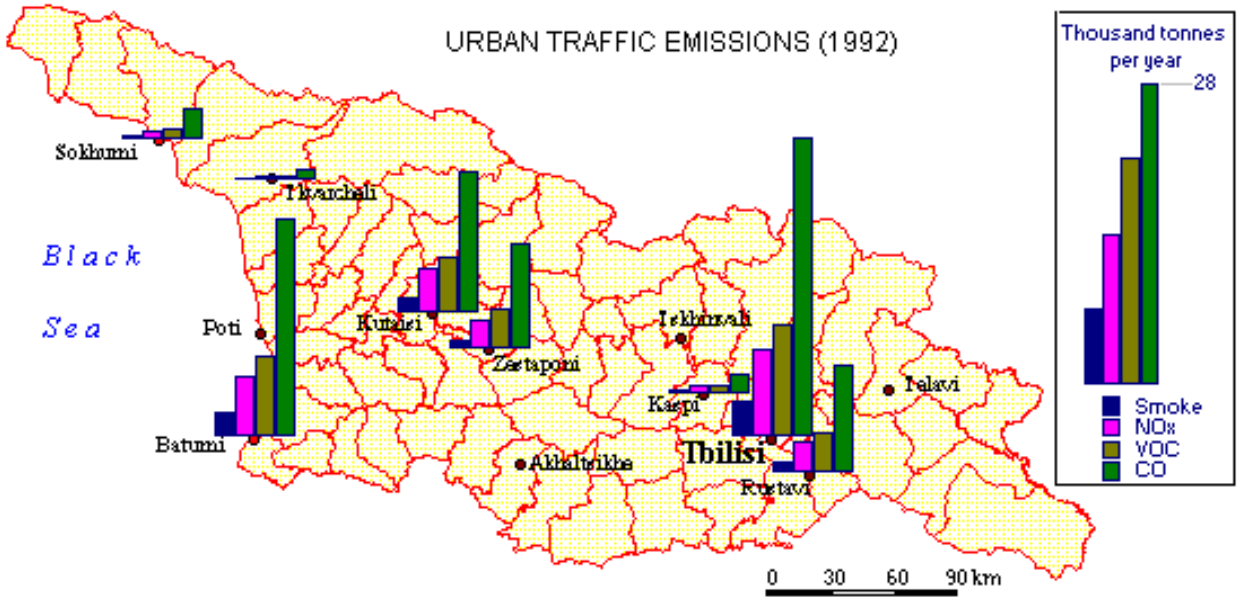
City / pollutant	Exceeded level coefficient		
	1997	1998	1999
Tbilisi			
Particulate matter	2.0	2.0	2.0
SO_2	3.4	3.8	3.5
NO_x	=1.0	=1.0	=1.0
CO	1.3	=1.0	=1.0
Phenol	1.6	1.3	1.6
Formaldehyde	5.0	4.0	4.0
Kutaisi			
Particulate matter	4.0	4.0	4.0
SO_2	1.6	1.2	1.2
NO_x	1.7	1.5	1.2
CO	=1.0	=1.0	=1.0
H_2S	=1.0	=1.0	=1.0
Batumi			
Particulate matter	1.3	1.3	1.3
SO_2	3.2	2.8	3.0
NO_x	1.5	1.5	1.2
CO	=1.0	=1.0	=1.0
H_2S	=1.0	=1.0	=1.0
Rustavi			
Particulate matter	=1.0	2.0	2.0
SO_2	6.0	8.0	8.5
NO_x	2.3	1.7	1.7
CO	=1.0	=1.0	=1.0
Phenol	2.2	2.0	2.0
NH_3	4.9	4.2	4.4
H_2S	=1.0	=1.0	=1.0

Source: Ministry of Environment and Natural Resources Protection, 2001.

Air Emissions

Road traffic is the major source of air pollution in Georgia, followed by the energy sector and industry. Traffic intensity is high in larger cities and, in extreme cases, it amounts to 60,000 vehicles per day (e.g. in Tbilisi).

Georgia has about 3000 stationary sources of air pollution in its main industrial sectors such as energy, iron and steel, chemical and petrochemical, timber and paper, and food. At present, however, few are working at full capacity. The total emission of selected air pollutants is presented in table below. These data are obtained with the use of the CORINAIR methodology, on the basis of emission indicators and activity indicators (mainly in the form of energy consumption or production rate) for different sectors. They include the following stationary sources: power stations, fuel combustion in both industrial and non-industrial enterprises, and industrial processes. Mobile sources include road transport, railway transport, air transport, marine transport and "other" mobile sources.



1000 tons

Pollutants	1999	2000	2001	Share of mobile source emissions (average of 1999-2001)
Particulate matter				
Total	**4.96**	**4.58**	**4.72**	
Stationary sources	3.47	3.11	3.24	
Mobile sources	1.49	1.47	1.48	31%
SO_2				
Total	**6.52**	**6.14**	**6.35**	
Stationary sources	4.16	3.81	4.01	
Mobile sources	2.36	2.33	2.34	37%
NO_x				
Total	**26.79**	**26.04**	**27.7**	
Stationary sources	4.74	4.24	5.03	
Mobile sources	22.05	21.8	22.67	83%
NMVOC				
Total	**28.74**	**27.74**	**28.85**	
Stationary sources	3.26	2.93	3.05	
Mobile sources	25.48	24.81	25.8	89%
NH_3				
Total	**0.04**	**0.03**	*	
Stationary sources	0.04	0.03	*	
Mobile sources	*	*	*	*
CO				
Total	**163.84**	**162.26**	**163.22**	
Stationary sources	4.06	3.76	3.91	
Mobile sources	159.78	158.5	159.31	98%
N_2O				
Total	**0.96**	**0.84**	**0.86**	
Stationary sources	0.93	0.81	0.83	
Mobile sources	0.03	0.03	0.03	3%
CH_4				
Total	**0.73**	**0.62**	**0.64**	
Stationary sources	0.42	0.31	0.32	
Mobile sources	0.31	0.31	0.32	47%
CO_2				
Total	**3235**	**3127**	**3253**	
Stationary sources	1472.0	1371.0	1427.0	
Mobile sources	1763.0	1756.0	1826.0	56%

Source: Ministry of Environment and Natural Resources Protection and State Statistical Department, 2002.
Note: * no data available.

The existing air quality should be examined so that any potential for impact on air quality associated with releases to atmosphere from increased traffic can be assessed in an additive context. However, in general the baseline data indicates that levels of measured pollutants are high only in large cities. The air quality along the motorway route except Tbilisi, Rustavi, (partially Zestaphoni and Kutaisi) is currently very good. These findings are unsurprising given the current extent of industrial activity and road transport currently within Georgia.

Baseline pollution according to available data

According to the data of 2009 (source: Monitoring and Prognosis centre of the MoE; September 2009) ambient air pollution in Kutaisi is significant:

- Dust – average monthly concentration is reported to be 0.6mg/m^3, which exceeds MAC (for average daily concentrations) 4 times
- Sifur Dioxide (SO_2) – average monthly concentration is 0.15mg/m^3, which exceeds MAC 3 times
- Nitrogen Dioxide (NO_2) – average monthly concentration is 0.11mg/m^3, which exceeds MAC 2.8 times
- Nitrogen Oxide (NO) - – average monthly concentration is 0.078mg/m^3, which exceeds MAC 1.3 times

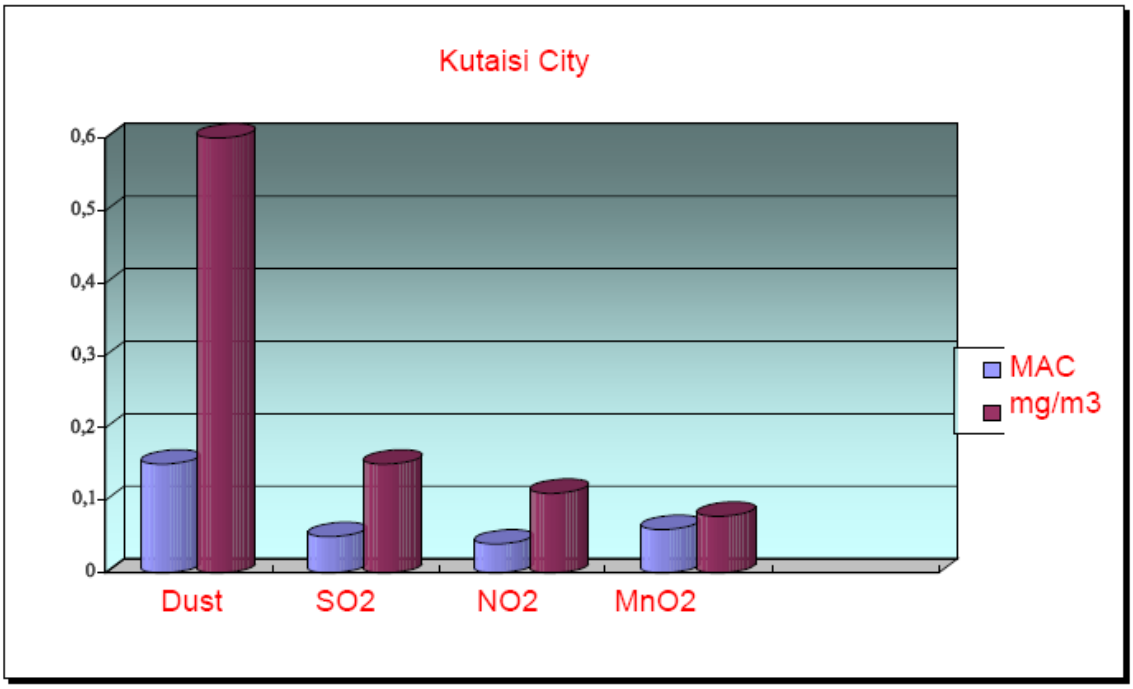


Fig. 4.1 Average Concentrations for September 2009

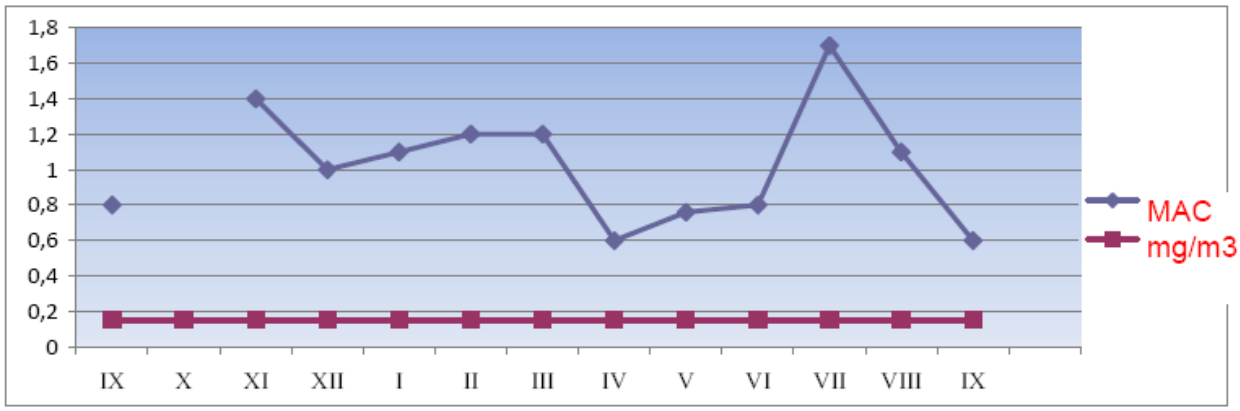


Fig. 4.2 Dust Concentrations (Average Montly for 2008 – 2009)

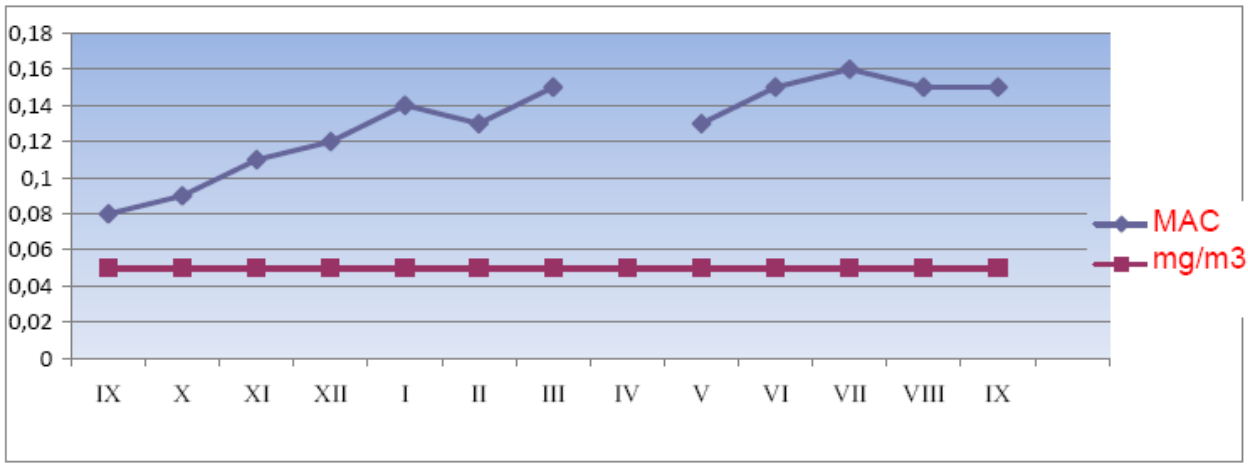


Fig. 4.3 SO_2 Concentrations (average monthly for 2008 – 2009)

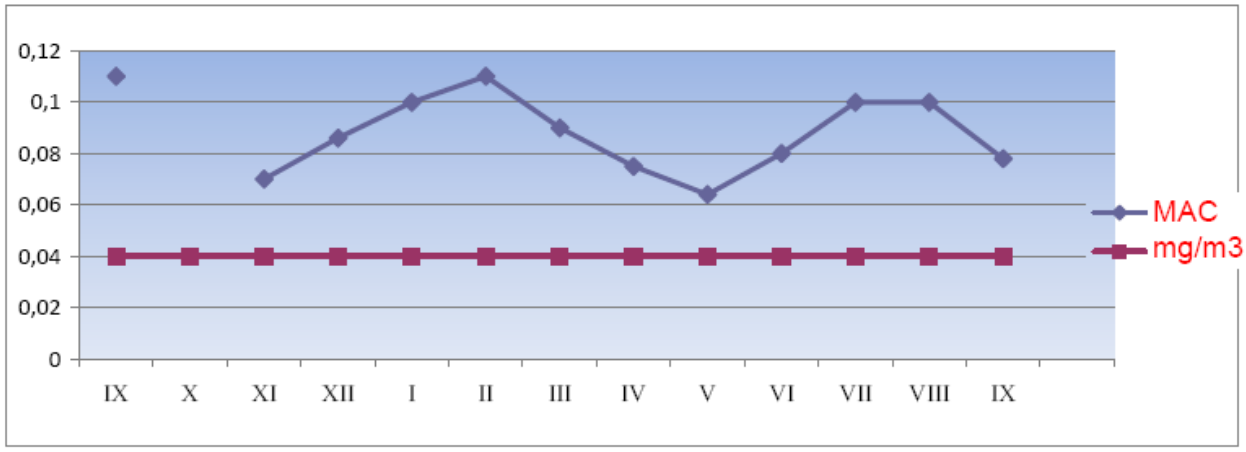


Fig. 4.4 NO_2 Concentrations (average monthly for 2008 – 2009)

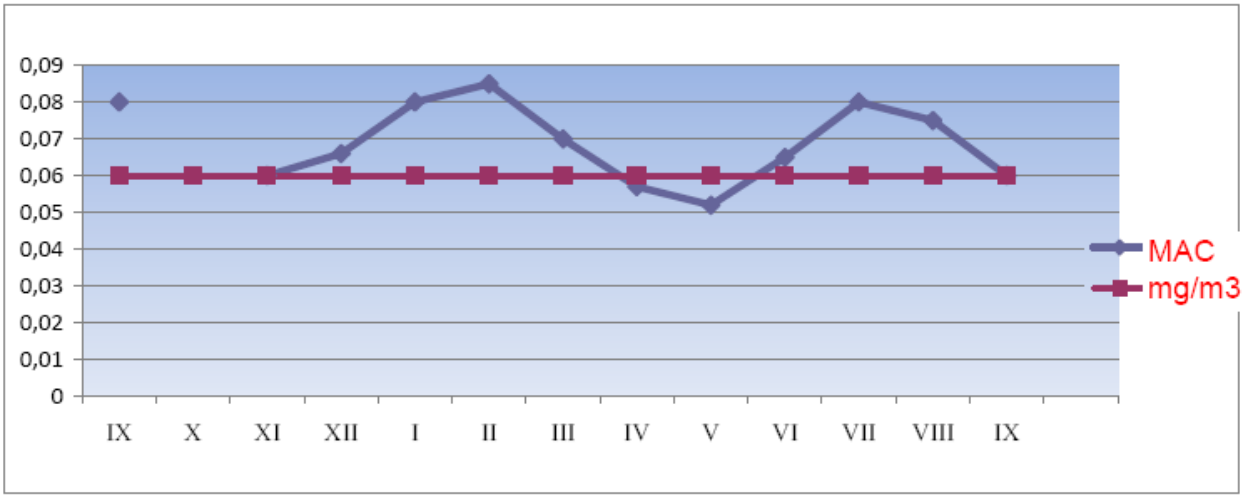


Fig. 4.5 NO Concentrations (average monthly for 2008 – 2009)

4.2. Radiation background

Existing radiation background was measured using in 23 december, 2012 device produced in Russia –“СРП 6801” . Measurement was done along the way “corridor” and main line.

Fig. 4.1. Instrument – “СРП 6801”

According to measured data, radiation background was between 5-12 microrentgen/h, which is permissible.

Annex 5.

Noise Factor: Baseline, Project Impacts and Mitigation

Introduction. Regulatory Requirements

The Scientific Research Institute of Environmental Protection until its dissolution was responsible for the monitoring and management of noise, but there is no systematic nationwide monitoring of noise, because of limited resources. Noise is measured as a response to complaints by the public.

From 1999 to 2002, noise was measured in five sites in Tbilisi. The noise level at 7.5 m above the curb ranged from 71dB to 80 dB. Railroad noise 25 m from the track was 65 dB during the day and 63dB at night. Noise was also measured in 1999-2001 in Rustavi (73-75 dB), Poti (72-74 dB), Telavi (70dB) and Gori (72 dB). According to European standards, the maximum noise level for urban areas is 65 dB during the day and 55 dB at night. These sporadic measurements indicate that traffic noise has reached disturbing levels in the major cities, and the levels are expected to increase due to a rising trend in traffic density.

Therefore, there is no sufficient information to be sure that along the road section Zestafoni - Kutaisi noise level is within the standards, although the expectations are that no real problems should arise in that regard. However, at the detailed design and EIA stage there is a need to monitor noise levels near the settlements and consider preventive measures against noise in planning.

The current Georgian standards for the noise level are based on former soviet sanitary norms No. 3077-84 and specify different noise levels for different zones. The most relevant standards are the noise limits inside the residential building and outside it (at the wall) which are as follows:

Inside the residential buildings:

For Leq (7a.m. - 11p.m.) the indicative(equivalent) sound = 40dB(A), maximum level = 55dB(A)

For Leq (11p.m. - 7a.m.) the indicative(equivalent) sound = 30dB(A), maximum level = 45dB(A)

Outside the residential buildings (measured at the wall):

For Leq (7a.m. - 11p.m.) the indicative(equivalent) sound = 55dB(A), maximum level = 70dB(A)

For Leq (11p.m. - 7a.m.) the indicative(equivalent) sound = 45dB(A), maximum level = 60dB(A)

International Regulations

Federal Highway Administration: Exterior Noise Abatement Criteria

Table 5.1

Activity Category	Maximum 1 hour L_{eq}
Land where serenity and quiet are of extraordinary importance	57 dBA
Schools, churches, libraries, hospitals, residences, playgrounds, recriation areas	67 dBA (52dBA indoors)
Developed lands	72 dBa

5.1 Baseline Noise Measurement Data

Sampling Session 1 - 03. 2013

The baseline noise was measured using device produced in UK “PCE-EM882”. Measurements were undertaken in all identified points using the following methodology: data was taken from the device at each point in every 5 minutes during half an hour (total of 6 data) and average calculated for each point of noise. One device have been located at 5m distance from the edge of the existing road. Each minute one measurement has been carried out. The average of 30 measurements during 30 min is provided in the table below.

Figure 5.1 Noise measure instrument

Table 5.1. Noise Levels at Sampling Sites

Site №	time	Max. db	Aver. db
2 (5m from the road)	12.45	82	65
2 (25m from the road)	12.50	75	60
5 (5m from the road)	14.25	67	45

5.2 Modeling of Traffic Related Noise

Point-source propagation can be defined as follows: Sound level$_1$ – Sound level$_2$ = 20 log r_2/r_1. This means that for every doubling of distance, the sound level decreases by 6dBA ("inverse square law"). Line-source propagation occurs when there is a continuous stream of noise sources. The reinforcement by the line of point sources makes the propagation field either cylinder shaped or a half-cylinder shaped area. The line source propagation prediction model is as follows: Sound level1 – Sound level2 = 10 log r_2/r_1; The decrease in sound level for each doubling of distance from a line source is 3 dBA. When noise levels from a busy highway are considered, it is appropriate to utilize the highway as an infinite line source and consider a 3-dBA doubling of the distance-propagation rate.

In order to carry out semi-quantitative estimation of noise impacts related to existing and projected traffic, we used measured noise data – average and maximum values

provided in the table 6.1 . Based on comparison of the maximum and average levels of noise and existing traffic volume data, we can consider that current traffic is not high enough to apply linear source propogation (3-dBA law) but the attenuation figures are between the point source and linear source (between 3-dBA and 6-dBA values). Increase of the traffic volume will lead to reduction of intervals between the vehicles crossing the given crossection of the highway. Therefore, we assumed that according to the traffic volumes projected for the 2030, the traffic will be “dense enough” to apply 3-dBA law for the noise attenuation and maximum of currently observed average figures (68 dBA) could be taken as indicative figure for noise at a 5m distance from the road side..

The table 5.5. provides noise levels at different distances from the edge of the road as predicted by “3dBA-law” .

Table 5.5 Predicted level of Baseline Noise

Distance from the Edge of the Road m	Predicted Noise Level Average Value - dBa	Predicted Noise Level Maximum Value - dBa
5	68	85
10	65	82
20	62	79
40	59	76
80	56	73
160	53	70
320	50	67

5.3 Modeling of Noise Related to Construction Activities

Evaluation of construction related noise relies upon known information on the noise produced by various equipment and activities at individual stages of construction. For example noise levels produced at 50 ft (15.24m) as provided by the U.S. Department of Transportation, FHWA, CADOT, and SBAG 1993; and Country Sanitation Districts of Los Angeles County 1994 are about:

Table 5.6 a

Source of Noise	Equivalent noise level, dBA

1. Construction machinery and mechanisms	
Backhoes	84 - 85
Bulldozers	84 - 85
Graders	91 - 92
Compressors	80 - 88
Jackhammers	85 - 98
Pile Drivers	96 - 107

According to other sources (U.S. Environmental Protection Agency, 1972,):

Table 5.6 b

Source of Noise	Equivalent noise level, dBA
Construction machinery and mechanisms	
Compacters (rollers)	72 - 75
Front loaders	72 - 83
Backhoes	72 - 92
Tractors	78 - 95
Scrapers, graders	80 - 95
Pavers	85 - 88
Trucks	83 - 93
Compressors	75 - 88
crane, movable	75 - 85
Jackhammers and rock drills	82 - 98
Vibrator	70 - 82
Saws	72 - 82

Noise generated by mobile sources naturally attenuates at a certain distance. Attenuation follows logarithmic pattern. In case of construction related noise, point source propagation model should be applied. Point-source propagation can be defined as follows: Sound $level_1$ – Sound $level_2$ = 20 log r_2/r_1. This means that for every doubling of distance, the sound level decreases by 6dBA (“inverse square law”).

Table 5.6 c

Distance from the Edge	Predicted Noise Level	Predicted Noise Level

of the Road m	Average Value - dBa	Maximum Value - dBa
5	80	90
10	74	84
20	68	78
40	62	72
80	56	66
160	50	60
320	44	54

5.4 Resume

Baseline Conditions

Baseline and predicted noise level in the area alongside the highway is not significant. In fact without applying any abatement measures, the noise level is in compliance with the standard requirements for the apartment houses at the distance of – 40-50m from the highway.

Project Impact and Mitigation (Construction Phase).

As a result of rough estimation of construction related noise, we can assume that the noise impact will not exceed radius of 160m. This means that settlements will not be affected. Neither ecologically sensitive areas will be disturbed by the noise nuisance. Temporary and slight increase of the noise level near the construction ground within the 300m radius is acceptable impact. However, mitigation of this impact is possible by engine maintenance practice and avoidance of engine work in non-operational mode. The only limitation that could be recommended is to minimize the night-time works near Kutaisii. The night-works at other sites could be carried out without limitation.

Project Impact and Mitigation (Operation Phase).

Operation Phase - Traffic related noise will not affect areas outside of 160m from the highway. Noise level is acceptable within the 80m zone radius. The impact is not expected to be high even in 2030, when the traffic intensity is expected to increase significantly as compared with the current situation. Actually, the implementation of the

project will lead to decrease of the noise related impact on the settlements, so far as the most densely populated areas, like Samtredia and Kutaisi cities will be bypassed.

The only two sections, where the noise impact may need to be mitigated by special means is the point fo the studied route near the village Akhalsopeli between KM 19 and KM 21 of the Highway (two 400m length subsections). We propose to construct noise barriers at this subsection of the highway. However, currently preparation of the Resettlement Action Plan (RAP) is under way. During the RAP several houses in this critical zone will be revealed that require demolishing. About 9 houses in total will be destroyed and the residents will be compensated for residential houses and relocation expenses. These houses are exactly those, which fall within the noise impact zone. After the completion of the RAP it would be clearer if there are any not relocated residential houses, which are still within the zone of noise impact. The final configuration of noise impact zone and length and exact location of noise barriers still needs to be specified.

Annex 6.

Procedures for Extraction of Plant Species Included in Red List of Georgia from the Natural Environment and Procedures for Changing Category of Forestry Fund Land

Extraction of Plant Species Included in Red List of Georgia (Endangered) from the Natural Environment

The law of Georgia on the Red List of Georgia and Red Book identifies the exceptional cases, when plants included in Red List of Georgia could be extracted from the environment, namely:

According to Article 24 – "Extraction of Endangered Wild Plants or their Parts (from the Natural Environment)":

Extraction of endangered wild plants or their parts (from the natural environment) is allowed only in the below exceptional cases:

a) Restoration and propagation in natural conditions (cultivation);
b) Cultivation in dendrological and botanical gardens and parks;
c) For economic purposes to cultivate in artificial conditions (only if the wild plant is cultivated artificially);
d) For scientific purposes;
e) If the damage of the endangered wild plant or its parts is caused by entomic pests and phyto diseases and their presence in natural environment poses the threat of spreading entomic pests/phyto diseases and the extraction from the natural environment is the only means against entomic pests/phyto diseases – in this case the basis of the review of the issue of the extraction (from the natural environment) of the endangered wild plant or its parts by the ministry of the protection of the environment of Georgia is the summary presented to the ministry by the joint commission of public legal entity – Vasil Gulisashvili Institute of Forestry, public legal entity – Levan Kanchaveli Institute of Plant Protection and public legal entity – Tbilisi Botanical Garden and Botanical Institute. Upon the discussion of the summary the ministry is entitled to decide on the extraction of plants from the natural environment;
f) During the construction of object and infrastructure of special state significance – during the mentioned activities plant species included in the Red List are extracted from the natural environment only if the ministry of the protection of the environment of Georgia decides to extract plant species included in the Red List

from the natural environment. The ministry of the protection of the environment could be appealed to make the above decision by ministry determined by the law of Georgia on “the Structure, Incumbency and Rule of Conduct of the Government of Georgia”.

Change of Category of Forestry Land

The rule and procedures of the change of category of state forestry land are implemented according to the rule of conduct approved by the order of the minister of the protection of the environment and natural resources N5 (15th February, 2010) on “the Rule of Assigning Category of Special Purpose to State Forestry Land”.

The above mentioned rule regulates the issues of use of forests for special purpose within the state forestry territory. Territory of state forestry, which is issued into special purpose-specific use, is automatically assigned the category of special purpose of the state forestry.

The decision on the assignment of special forest use right within the state forestry fund as well as special tree felling was made by the ministry of the protection of the environment and natural resources upon agreement with other interested agencies, except for the cases as stipulated by Part 3, Article 33 of the Forest Code of Georgia (on the latter the decision is made by the Government of Georgia, while this part of the Forest Code implies the following: any change, which is aimed at the decrease of the state forest fund, should be well-grounded. In case of special tree felling on slopes of 35 degree or more inclination wood processing is possible only during the construction of object of especial state significance. Wood processing on slopes of inclination from 30 to 35 degree is allowed only after special research and if forest restoration measures are introduced parallel to wood processing). However, after the reorganization of the mentioned ministry this function was assigned to the ministry of energetics and natural resources, in the structure of which forestry agency was included. As respective changes on separation of incumbency have not yet been implemented in the legislation of Georgia, the below mentioned “ministry” and agency responsible for this specific issues presumably imply the ministry of energetics and natural resources.

Forest use with special purpose is implemented for the below purposes:

a) Construction, reconstruction (rehabilitation) or uninstallation of hydro systems, pipelines, roads, communications and power communications, channels;
b) During the implementation of anti-fire measures and elimination of results of flood and other extreme situations;

c) If a threat of restriction of functioning or damage to any infrastructure or its separate elements exists;
d) During fossil use;
e) During the reconstruction (rehabilitation) of monument of cultural heritage.

An entity interested in special forest use applies to the appropriate ministry. This ministry sends the application and supplemented documents to the bodies with the right of state forestry management for approval. In case of positive response the ministry sends the full documentation (in cases of activity determined by Sub-Paragraphs “a”, “d” and “e” indicated above) to the ministry of economics and sustainable development of Georgia and ministry of culture and protection of monuments of Georgia for approval and if positive response is given by these ministries, it starts the procedure of the review of the application and relative documentation. Only in cases stipulated by Sub-Paragraphs “b” and “c” the decision is based upon the proposal of the body with the right of state forestry management.

For the assignment of right of special forestry use within the state forestry the application should: in case of activities as stipulated by Sub-Paragraphs “a”, “d” and “e” comply with the requirements identified by Article 78 of the General Administrative Code of Georgia. It should also contain the list of supplemented documents:

1. The motivation of the necessity of special forestry use, its goal and term;
2. For private legal entities and individual entrepreneurs – statement from the register of entrepreneurs and non-profit (non-commercial) legal entities, for physical persons – copy of the personal ID card of Georgian citizen or passport, for public legal entity – authenticated copy of founding documents;
3. Precise measuring drawing of the area selected for special forestry use in UTM coordinate system. The drawing should be authenticated by the executor of the measuring drawing;
4. Copy of the document (if applicable), according to which and proceeding from the determined activity, the implementation of special forestry use is necessary or/and needed;
5. Rationale of the necessity of tree felling;
6. Information on the presence of the species protected by the Red List within the selected area.

In case of the activity identified by above given Sub-Paragraphs “b” and “c” the proposal of the body with forestry management right should be supplemented with the below:

1. Rationale of the necessity of the special forestry use;
2. Rationale of the necessity of tree felling;

3. Information on the presence of the species protected by the Red List within the selected area.

In case of the activity determined by Sub-Paragraph “c” additional information on the number of trees to be felled according to species should be provided, in case of the activity determined by Sub-Paragraph “d” – copy of license of fossil extraction, in case of the activity determined by Sub-Paragraph “e” – consent of the ministry of culture and protection of monuments.

In case of decision on special forestry use within the state forestry respective individual administrative-legal act of the minister is issued. On the bases of this act the body with the right of state forestry management signs special forestry use agreement with the stakeholder (except for cases identified by Sub-Paragraphs “b” and “d”) and delivers the territory selected for special forestry use with the act of delivery-acceptance. In case of the expiry of the term of the agreement (or termination) the forest user returns the territory selected for special forestry use to the incumbent body with the act of delivery-acceptance.

If wood processing is required during special forestry use, the trees to be felled are marked by the stakeholder and assigned by the body with the right of forestry management.

In cases stipulated by Sub-Paragraphs “b” and “c” and after the issuing of the above mentioned act the body with the right of forestry management implements the special forestry use and records the felled arborescent resources and passes them to the public legal entity of the ministry – forestry agency for further realization purpose and with the act of delivery-acceptance. If the special forestry user is the public legal entity of the ministry – forestry agency, it records the felled arborescent resource and implements its realization according to the rules as stipulated by the legislation.

Exclusion of Land from Forestry

Exclusion of land from forestry is conducted according to the resolution of the Government of Georgia (13th August, 2010) N240 on “the rule of identification of the state forestry boundary”.

The aim of the rule is to determine legal relationships connected with the identification of the boundaries of the state forestry and it does not spread over the legal relationships connected with the identification of borders of the protected areas of the state forestry.

The borders of state forestry are set by the Government of Georgia through sub-legal normative act, which was proposed in the form of draft resolution of the identification of

borders of state forestry by the ministry of the protection of the environment and natural resources of Georgia. However, after the reorganization of the mentioned ministry this function was assigned to the ministry of energetics and natural resources, in the structure of which forestry agency was included. As respective changes on separation of incumbency have not yet been implemented in the legislation of Georgia, the below mentioned “ministry” and agency responsible for this specific issues presumably imply the ministry of energetics and natural resources.

The below are entitled to raise the issue of the increase or decrease of the state forestry before the mentioned ministry:

a) Ministries identified by the law of Georgia on “the Structure, Incumbency and Rule of Conduct of the Government of Georgia”;
b) Government of the Autonomous Republics;
c) Tbilisi City Hall;
d) State assignee – Governor;
e) As well as the ministry based upon its own initiative.

The appeal should indicate the need (necessity) of increase or decrease of the state forestry, purpose and supplemented with cadaster measuring drawing (with digital version) of the respective area.

The ministry submits the presented documentation, according to the rule determined by the General Administrative Code of Georgia, for approval to the below agencies:

a) Ministry of economics and sustainable development of Georgia;
b) Ministry of culture and protection of monuments of Georgia;
c) If needed, to other interested administrative body.

After the receipt of consent from the above mentioned administrative bodies the ministry submits the prepared material to the Government of Georgia for decision making.

With the aim of precise identification of the contour of the new border of the state forestry the state body of forestry management facilitates:

a) Study of the existing information on the state forestry (plan-cartographic and cadaster material, land use plans, existing material of inventory (or forestry arrangement), topographic maps and other documentation which could be used for project preparation);
b) Request and study of the information related to the border of the adjacent owner (among these – information in Public Register);
c) Determination or/and specification of the border contour of the territory (line) based upon respective material;

d) Preparation of all the documentation required for the registration of state forestry in Public Register.

The ministry submits the mentioned documentation to the Government of Georgia for decision making.

After the decision on the identification of border of state forestry is made by the Government of Georgia the ministry submits the corresponding documentation to public legal entity – National Agency of Public Register of the ministry of justice of Georgia for registration purpose in the Public Register.

In addition, the ministry is entitled to appeal to the Government of Georgia on identification of borders of separate areas within the state forestry with the purpose of their further registration in the Public Register.

The border line of the state forestry (contour) should be determined via respective technologies (geo-informational system) and on the basis of ortho-photo-plan and other evidence (in state coordinate system – WGS-84/UTM).

Annex 7.

Waste Management Plan for Construction Camps and Equipment Yards

General Provisions

The below plan comprises all kinds of activities, which result in waste production, among these:

- Activities in normal exploitation conditions;
- Activities in abnormal exploitation conditions (i.e. during repair-construction works);
- Activities in case of emergency.

Goals and Objectives of the Plan

The below waste management plan sets the rules of collection, transporting, allocation, treatment and disposal of different waste in accordance with the provisions of the environmental norms and rules.

Systemic method is used in the process of waste management, namely, it comprises the following key principles:

- Timely measures to avoid waste;
- If possible, facilitation of waste treatment;
- The destruction of waste is the last option.

The waste management is conducted according to the below principles:

- Hierarchy principle in waste management;
- Proximity principle;
- Care commitment;
- Use of BATNEEC principles (the best known technique so far, which is not connected with excessive expenses);
- “The polluter pays” principle.

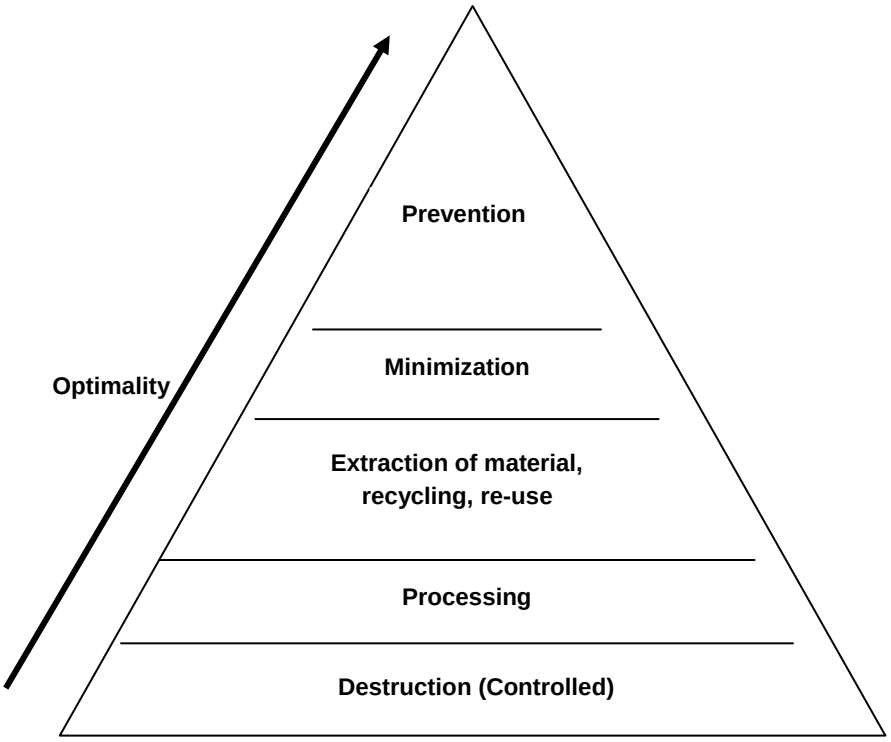
All of the above principles are discussed below.

Hierarchy Principle in Waste Management

Hierarchy principle in waste management illustrated in the below scheme implies the prioritization of various activities during waste management in terms of optimization.

Generally the best option is the prevention of waste, followed by the minimization of the amount and threat. In addition, it is accepted that re-use, restoration and recycling of waste is better and destruction is the last option.

Each waste flow should be processed according to the hierarchy. The selected technique should be the best in terms of threat and practicality.



Hierarchy in Waste Management

Proximity Principle

Proximity principle implies waste management be undertaken as near to the source of production as possible.

Care Commitment

The implementation of the “care commitment” program is facilitated for all types of waste.

The principle of “care commitment” implies that the person who produced or owns the waste is obliged to facilitate due management of the waste even after the waste is passed to the third party.

Care commitment system categorizes and sets the amount and character of the waste from “cradle to the grave” (i.e. from the production till the processing and final destruction including transportation).

The focus of the principle is on the fact that waste producer should select third party to whom the waste shall be passed with due diligence, evaluate the party’s capacity and control the party’s activities in terms of waste management.

Care commitment requirements are as follows:

- Waste, which is passed to the contractor or carrier for destruction, should have detailed written information on how the waste should be safely transported, processed and destroyed;
- The waste should be passed only to the permitted persons, i.e. registered waste carriers, licensed contractors, waste collectors of the local authorities or persons freed from the licensing obligation;
- Waste should be packaged as necessary, so that it will not spill or leak in the environment;
- All appropriate measures should be introduced, so that all persons who transport or destroy waste follow the requirements of law.

BATNEEC (the best known technique so far, which is not connected with excessive expenses) principle implies waste management be implemented using the best known technique, which is not connected with excessive expenses.

“The Polluter Pays” Principle

The principle implies that the person who causes the contamination of the environment should indemnify the expenses necessary to eliminate the results of the pollution.

The Main Goals of Waste management Process:

- Facilitation of the waste identification according to its categories and threats;
- Facilitation of the segregated collection of waste, compliance with the conditions of the temporary disposal to exclude the impact of the waste on the environment and human health;

- Facilitation of the transportation conditions of waste, which should exclude the emission or loss of waste as well as probability of accidents, damage to the environment and human health;
- The use of methods safe to the environment and human health during the treatment, processing or disposal of waste;
- Minimization of the amount of waste;
- Re-use of waste;
- Identification of personal responsibility for waste management;
- Facilitation of the records on industrial and household waste.

The implementation of the instructions given in the plan is compulsory to all employees.

General Requirements of Safe Waste Handling:

1. The staff involved in waste management (collection, storage, transportation, delivery/receipt) should be trained in occupational health care and safety issues;
2. The staff should be facilitated with special clothes, shoes and individual protection equipment. If required the staff clothes should be specially processed – especially after operations related to the hazardous waste;
3. The staff should be able to provide first aid in case of poisoning or trauma during waste related activities;
4. The people who have not undergone appropriate training, have no special clothes or have signs of sickness should not be allowed to work;
5. Allocation of waste exceeding the set norm in the area of waste collection is not allowed. Allocation of waste near spark or warmth sources is not allowed;
6. In case of allocation of different types of waste their compatibility should be considered;
7. Storage of external items, personal clothes, special clothes, individual protection equipment is not allowed in the areas of industrial waste collection. Eating in such areas is strictly prohibited;
8. Rules of personal hygiene should be strictly followed when working with industrial waste. Before eating and after completion of work hands should be washed with soap and warm water;
9. In case of poisoning signs the work should be terminated and the affected person should address the nearest medical point and inform the management of the structural unit;

10. The areas of collection of flammable waste should be facilitated with firefighting equipment. Smoking and use of open fire is strictly banned in the areas of allocation of such waste;
11. The staff should know the waste characteristics and firefighting rules. The fire extinguishing of burning flammable or fuel liquids is possible with fire extinguishers, sand or asbestos clothes;
12. Fire extinguishing of burning solvents with water is not allowed.

Responsibility for the Implementation of Measures Determined by the Plan

1. *Plant management is responsible for the following:*
    - Approval of waste inventory charter;
    - Facilitation with the equipment, resources and inventory required for waste management;
    - Protection of the environmental legislation of Georgia in the process of the management of waste produced as a result of the plant activities.
2. *Plant staff, who is involved in the waste management field, is responsible for the following:*
    - Non-fulfillment of waste collection, storage, transportation and other conditions as stipulated by the waste management plan;
    - Allocation of waste in non-sanctioned places;
    - Violation of norms, rules and records on waste production, processing, use and disposal;
    - Delivery of incomplete incorrect documentation (information) on waste management or refusal to deliver such information;
    - Delivery of waste without duly formalized documentation;
    - Non-fulfillment of the requirements of the waste management plan by the subordinate staff.

Procedures and Rules of Waste Management

This section describes the measures and rules, which should be met (prior to processing and/or destruction) for waste management purposes. Management measures are reviewed according to the below priorities.

Waste Classification

Further management of waste significantly depends on the classification of waste at the place of production. Segregation of waste by waste types, meeting the storage requirements and processing/destruction – all of the above requires appropriate classification of waste.

Waste categories should be identified, samples taken, checked, tested or analyzed in laboratory with the aim to facilitate the classification of waste according to EU standards and determine the below issues:

- Which category the waste belongs to – hazardous, non- hazardous or inert;
- How waste management should be implemented.

Person responsible for waste management should facilitate the below for waste classification:

- Use temporary inventory of waste, which should describe wide array of expected types of waste;
- If the specific type of waste is not included in the inventory, use other additional methodology to classify waste;
- If the general methodology of waste classification is not complete, waste samples should be taken and checked in laboratory to facilitate the classification of waste by the below table.

Provisions for Waste Classification

Waste Classification	Provisions
Inert	According to provisions of article 2 of EU directive 1999/31/EEC, inert waste is the waste which is not subject to significant physical, chemical or biological changes. Inert waste is not resolved, burn or show any other physical or chemical reaction; it does not decompose and negatively impact other matter, with which it interacts; it does not cause the pollution of the environment and damage human health. The contamination effect and eco-toxicity of such waste should be insignificant and will not pose threat to the surface and/or ground water quality.
Hazardous	Hazardous waste is the waste determined by article 1(4) of 91/689 directive and has the following potential characteristics: explosiveness, acidity, high degree of flammability or flammability, irritation causing, toxicity, carcinogenicity, corrosiveness, infectiousness, teratogenesis, mutagenicity; emits very toxic or toxic

	gases as a result of contact with air, water or acid; substances which could create other substances and eco-toxic substances as a result of destruction.
Non-hazardous	Waste which does not meet the above described provisions.
Waste water	Fresh water which was polluted as a result of project activities.

Inventory

After the classification of waste, which should determine the potential threat of the waste, the person responsible for waste management shall develop the inventory list comprising the below information:

- Waste flows and sources;
- Description and classification of waste flows, i.e. if the specific waste is hazardous or not;
- Storage rules, if applicable;
- Destruction methods and contractors;
- Quantitative characteristics of waste – annual, quarterly or monthly, whichever necessary.

Inventory records during annual or other changes are handled by the persons responsible for waste management. The copies of the waste inventory lists are delivered to the plant management. The records are updated only but those persons who have undergone special training in the issue of the use of waste inventory list.

Correct inventory of waste is necessary for the identification of the below issues:

- How the waste should be processed (if applicable);
- How the waste should be handled (i.e. need for personal protection equipment and like);
- How the waste should be stored (if applicable);
- Rule of final processing/destruction.

The aim of the inventory and further measures, among them – labeling, is to provide for the sufficient information and consequently safe final destruction of waste.

Waste Segregation and Collection

Special containers should be placed in the proximity of the waste producing unit.

Waste should be segregated and allocated in the appropriate container at the waste producing unit.

As a result of the activities at different units waste, which is the subject to registration, collection, temporary storage, carriage, treatment, processing or disposal, is produced and collected.

The method of separated collection of industrial and household waste according to waste categories and threat should be organized and introduced at the object.

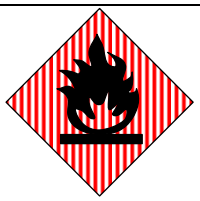
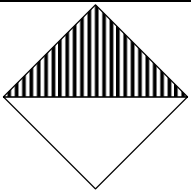
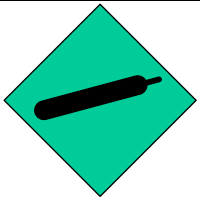
The below is the subject to segregated collection and storage:

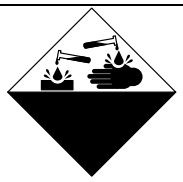
- Household waste;
- Industrial waste, the carriage of which is not banned on the household grounds (i.e. rubberized asbestos, rubber, plastic household items, wooden and paper waste, wood and sawdust waste, polyethylene pipes, sandpaper waste, etc.);
- Quicksilver containing substances and material;
- Lead containing waste;
- Chemical waste;
- Oily clothes, used respirator filters;
- Oil waste, among these – precipitator waste;
- Used industrial oils, lubricants;
- Material used during the liquidation of oil spills;
- Contaminated soil and sand;
- Metal scraps, welding electrode waste;
- Used rubber hoses, used tires;
- Used lead accumulator waste;
- Paint and paint barrel waste;
- Medical waste.

Labeling

Persons responsible for waste management are obliged to provide for marking of the waste containers in a way that the contents should be identified and described in detail. The above is necessary for the external staff to follow the safety rules of waste handling. Waste the type of which is not indicated shall be deemed hazardous and become the subject to the above described classification.

Appropriate labels should be applied to all containers (mugs, wheel boxes, barrels, etc.) so that it is clear which type of waste could be placed in the container. To avoid misunderstanding old labels should be removed.

 Explosive substances or material	 Toxic gas or substance	 Easily flammable gas and liquid	 Easily flammable solid substance
 Other hazardous substances and material	 Spontaneously igniting substance	 Non-toxic gas	 Hazardous if affected by water

 Infection threat	 Oxidant	 Corrosive substance	 Radioactive substance

Information and Warning Signs

 Smoking is banned	 Subject to processing	 For household waste	 Flammable

Fig. 7.1

Waste Storage

The waste should remain on place for minimal period of time and removed as soon as possible for further treatment and destruction.

Waste storage places should be put on the corresponding plan of the object. The waste should be stored in such conditions to avoid the below:

- Accidental leak or spill, surface or ground water contamination, breaking of container due to accidental crash, contact with the air due to utilization of secondary packaging and/or covers;
- Corrosion or depreciation of containers both due to the environment (through provision of shelter) and the waste itself; to provide the above mentioned containers should be proof to the specific waste which should be placed in it, i.e. automobile accumulators should be placed on plastic plates which are corrosion proof;
- Theft due to un-protected allocation of waste within the protected perimeter of the object.

Waste containers should correspond to the waste to be stored, its form, structure and threat. Only containers in good state of repair should be used. Covers should close or other type of covers used. Containers which react to the contents or could result in the leak of the dangerous substance should not be used. All hazardous waste should be strictly segregated from the other types of waste. Only one type of hazardous waste could be placed in a container. Solid and liquid waste should not mix.

The long term collection and storage of waste within the plant is allowed as temporary measure only if:

- Waste is used in the further technological cycle with their full utilization purpose;
- The user does not exist; etc.

Proceeding from the toxic and physical-chemical characteristics of waste and its components temporary storage is allowed in:

- Industrial or auxiliary storages (storage, store-room);
- Temporary non-stationary warehouse;
- Open areas.

The areas of temporary waste storage within the object are identified during the waste inventory process and should comply with the below requirements:

- The ground cover should be solid (concrete, asphalt-concrete or concrete tiles);
- The ground should be fenced and facilitated with ricks to avoid the spill of the harmful substances in rain sewerage or soil;
- The ground should be facilitated with comfortable access for auto-transport;
- The waste should be effectively protected against the impact of precipitations and wind (stalls, packaging, allocation of waste in containers, etc.).

During the temporary storage of waste in non-stationary warehouses and grounds the following conditions should be met: the possibility of waste disposal into the waste water or soil should be eliminated.

Hazardous waste could be stored in stationary warehouse. For this purpose a special warehouse area should be facilitated within the object. The area should be arranged according to the environmental requirements, namely:

- The floor and walls should be covered with ceramic tiles;
- The ceiling should be painted with moisture proof paint;
- The area should be equipped with the below:
    - ✓ Exhaust ventilation system;
    - ✓ Sink and tap for watering-washing of the area;

- ✓ Water intake drain;
- Iron lattices should be installed on the doors and windows;
- Racks and shelves should be installed for waste allocation;
- Waste could be allocated only in hermetic packaging, which should have appropriate labels.

Removal of hazardous waste from the plant and further management should be undertaken by organization with appropriate permit on this type of activity.

Waste Passing Rule

Passing of waste should be formalized through filling in the waste pass form. In each case the below information should be entered:

- Date and time of delivery;
- Description of waste with reference to amount;
- Information on waste producer;
- Information on waste carrier;
- Information on waste recipient;
- Signatures of the representatives of the producer, carrier and recipient.

The filled in form of waste pass should be present along with the carriage overheads from the waste production area or object to the designated place of destruction, that is treatment device of waste waters, landfill, etc.

Each form of waste pass should comprise the full description of waste, structure, production process, packaging, total amount of the passed waste and other relevant information.

Waste pass form should be filled in three copies. The formal procedure of waste pass is as follows:

- Waste pass form is signed by incumbent persons and sub-contractor, who conducts waste removal and carriage;
- The upper copy (first copy) stays at the object and is stored in the archive;
- The below two copies follow the waste till the place of processing, treatment or disposal;
- The carrier is obliged to make the responsible person sign the form at the waste recipient object. It should be indicated that the waste was received in the place of designation;
- After the above procedure the second copy is left at the recipient object;

- The carrier keeps the third copy in the office. Upon the next removal date the carrier should deliver the mentioned third copy to the area of waste production;
- The third copy stays at the waste production area and is stored along with the first copy;
- The photo copy of the third copy is made at the area of waste production. The photo copy is sent to the environmental division within the fulfillment of reporting obligations.

The filled forms of waste pass are stored throughout the entire validity term of the contract.

The responsible person is obliged not to issue and sign the waste pass form, if he/she has sound suspicion that the waste has not reached the designated area in accordance with the applicable rules.

Waste pass Form

Table 8.1

#	Information on waste producer	Information on waste carrier	Information on waste recipient	Waste composition	Rule/place of production	Packaging

#	Type of waste	Amount of waste	The period of waste collection	The number and name of automobile used for waste transportation	Driver's signature	Time of wate removal from the area of production	The time of waste reception at the place of waste reception	The waste producer's signature	Waste recipient's signature

Waste Producer Organization ——————————————————————————

Waste Recipient Organization ——————————————————————————

(It is filled in three copies, one stays with the waste producer, the second belongs to the driver and the third – to the waste recipient. After transportation the driver returns his/her copy to the waste producer).

Waste Transportation

Waste transportation should be conducted in full compliance with the sanitary, environmental and hazardous cargo carriage safety norms. All operations connected with waste loading/unloading and transportation should be maximally mechanized and hermetic.

The loss and dissipation of waste should be avoided during waste transportation. During the transportation of hazardous waste to the temporary storage the accompanying person should have the appropriate document – the request of removal of hazardous waste, which should be verified by plant management. The waste carrier facilitates the transport, loading and transportation of the hazardous waste to the designated area in accordance with sanitary, environmental and safety rules. Upon the completion of the operation the vehicle should be cleaned, washed and treated. The vehicle used for waste transportation should have appropriate warning sign.

Waste which is the subject to secondary processing should be removed from the plant territory by appropriate contractor company on the basis of a contract signed in advance.

Household waste is collected within the plant in special containers, while removal is conducted by the municipal cleaning service on the basis of a contract and according to the determined schedule.

The workers employed in the transportation (drivers and workers) should undergo appropriate training.

The below main risks are connected with cargo transportation:

- Automobile accidents;
- Dissipation or spill of cargo;
- Inappropriate loading of a vehicle.

To avoid the above mentioned the below should be facilitated:

1. The vehicle should be systematically checked in terms of technical state of repair and the traffic speed rules should be met;
2. The hermiticity of containers should be checked;
3. The cargo capacity of the vehicle should be considered during the loading in order to avoid over-loading of the vehicle;
4. Liquid impermeable capacious geo-membrane should be placed on the body of the vehicle. It should facilitate the detention of waste on the body of the vehicle in case of emergency spill.

If an accident still occurs despite the consideration of the above safety measures and the environment is contaminated, then the driver urgently contacts with the object administration, who implements the measures as stipulated by the emergency response plan and with the help of the rescue team.

Monitoring of Waste Management

During industrial waste collection, storage, transportation, use, treatment and disposal applicable ecological, sanitary-epidemiologic and safety norms and rules should be complied.

The registration of waste production, allocation, treatment and removal is conducted in special journal. The volume of the removed or utilized waste should be confirmed documentarily.

The person responsible for waste management should systematically control the below:

- The adequacy of the waste packaging;
- Presence of labeling on the packaging;
- The state of temporary waste allocation grounds;
- The amount of the collected waste and compliance with the applicable norms (visual control);
- Compliance with the procedure of the waste removal from the territory;
- Fulfillment of the requirements of ecological safety and safety technique.

Indicators of Effective Waste Management

As it has been already mentioned, different types of waste could be produced at the object. The applicable waste management rules should be complied to provide for appropriate waste management. The waste removal/disposal should be conducted according to the determined rule and following the applicable norms/rules of Georgia.

Potential Impact	• Pollution of the territory due to inappropriate waste management
Sources	• Packaging; • Other construction waste; • Waste collected during land works; • Fuel use and storage; • Repair of the equipment; • Household waste
Goal	• Facilitation of timely removal of waste according to the applicable rule; • Prevention of damage to the environment caused by waste
Activity/Control	• Facilitation of compliance with appropriate legislative and

	regulative requirements; • Arrangement of special place for temporary waste storage; • Throw of waste according to the applicable legislative requirements; • Separation of hazardous and non-hazardous waste; • Transportation of the household waste to the landfill; • Re-use of waste (if applicable); • The blocking of access and movement roads should be prevented
Effectiveness Indicator	• Absence of grievances; • Absence of waste collected during waste and technical servicing; • Absence of hazardous waste and spill traces (i.e. oil, fuel, etc.)
Monitoring	• Supervision over the allocation-removal procedures of waste; • Regular monitoring of waste collection-removal; • Due registration of records; • Grievance records, if needed – response
Corrective Activities/Reporting	• Corrective measures should be implemented as soon as a problem arises or a grievance is received; • The work managers account for every incompliance/violation of applicable norms; • If needed, the responsible person on the working place informs the management of the cases
Responsible Person	• Executor of works
Responsibility for Monitoring/Execution	• Plant management

Information on the Waste Produced during Object Exploitation

The following categories of waste are expected during object exploitation:

- Household waste;
- Office waste (paper, cartridges, bulbs, etc.);
- Packaging (wood, paper, etc.);
- Oil contaminated clothes, filters, absorption pillows;
- Oil contaminated soil;
- Polymer waste;
- Medical waste.

The amount of household waste produced during plant functioning is connected with the staff number. According to the preliminary data, up to 200 people shall be employed. Following the accepted norm, 0.70 m^3 of household waste is produced per employee annually. Proceeding from the above, the amount of household waste per year will be: 0.70 X 200 = 140 m^3. The installation of closed containers is planned for household waste at the object. The removal of this waste and disposal at the grounds will be conducted on the basis of the contract with the municipal cleaning service.

Oil contaminated mass as well as other hazardous waste shall be temporarily allocated within the plant in accordance with environmental and hygienic requirements and proceeding from the collection passed to the organization with appropriate environmental impact permit for further processing/disposal/treatment.

Wooden packaging material shall be passed to the local population for further re-use.

The management of waste produced at the object (classification, inventory, segregation, collection, storage, passing and transportation) and monitoring shall be conducted in accordance with the above principles, procedures and rule.

Annex 8

Inert material quarries in the designing territory area

The route of the design road must be divided into two provisional sections:

- The first section is Samtredia-Rioni crossing (0-9 km)
- Another section is Rioni crossing-Lanchkhuti (9-30 km).

The river Rioni will have impact on the supply of inert materials for construction activities and selection of the locations for the construction camps.

1. Inert material pits

a) There are sand and gravel pits across the river Rioni, at about 15-20 km adjacent to the west part of the design road, along the both banks of the bed of the river Tskhenistskali and across the river Abashistkali, west of Kolobani, Abasha region.

The pits across the river Tskhenistskali and in Abasha region are shown in Fig. 1.

Fig. 1. Sand and gravel pits across the rivers Tskhenistskali and Abashistkali

The largest of them is Chkhenishi pit (with presumable reserve of 2.000.000 m^3). No license is issued for this site at present.

A significant reserve is located on the right bank of the river Tskhenistskali, in particular, east of villages Samikao and Gulukheti (presumable reserve of 500.000 m^3).

No license is issued for Kolobani manifestation, either. The reserves here reach about 300.000 m^3.

Significant reserves are found across the river Abashistkali.

As for the manifestation across the river Rioni, there are licensed and non-licensed sites here with presumable reserves of 500.000 m^3 (Fig. 2).

Fig. 2. Sand and gravel pits across the river Rioni

Chkhenishi sand and gravel pit is located 8 km from the city of Samtredia, west of village Chkhenishi.

The genetic type of the pit is mechanical deposits.

The object is located on the terrace of the left floodplain of the river Tskhenistskali and is represented by alluvial deposits.

The productive stratum is represented by a mix of sand, gravel and block talus. The stratum on the surface outcrops as shingle, and the top rocks are presented as clays (0-0,6 m). Their lithlogical content is not uniform. The material is well treated and is represented by limestones and fragments of different volcanic rocks. The productive stratum is represented by a mix of sand, gravel and block talus. The stratum on the surface outcrops as shingle, and the top rocks are presented as limestones and fragments of different volcanic rocks.

The water-bearing horizons are sands and shingle. The level of ground water in these horizons is 1,05-1,8 m.

In a petrographic respect, the sand and gravel are represented by sedimentary erupted and metamorphic rocks.

The grain size is as follows:

- Fraction 0,14–0,63mm-10,0%
- Fraction 0,63–3mm- 8,9%;
- Fraction 3–10mm -6,0%;
- Fraction 10–20mm–11,4%;
- Fraction 20–40mm– 19,6%
- Fraction40–60mm–15,3%;
- Fraction 60–100mm–17,4%;
- Fraction 100mm –10,9%

Their chemical content is not studied.

Physical-mechanical properties are as follows:

For gravel:

- Volume weight -1280–1690 gr/cm3
- Density–2,71–2,77 gr/cm3
- Water absorption –0,29–2,31%;
- Content of over 0,14mm-sized particles - 0,01–0,1%;
- Weak rocks –0,0–9,7%;
- Content of plate and needle-like particles - 8,5–25,0%;

For gravel and detritus

- Volume weight - 1100–1550gr/cm3
- Dennsity–2,74–2,77 gr/cm3;
- Water absorption – 0,71–1,45%
- Dennsity–2,74–2,77 gr/cm3
- Water absorption –0,71–1,45%;
- Content of plate and needle-like particles - 4–37,5%;
- Content of weak masses0,0–7,5%;
- Content of over 0,14mm-sized particles – 0,04–0,1%;

With these physical-mechanical and other properties, the sand and gravel are usable for construction works.

Kolobani and Abashistskali manifestations have nearly the same properties.

The boulder and gravel across the river Rioni is well treated and has rounded shape. In a petrographic respect, the given material is presented by sandstones, limestone, porphyries, teschenites, granites, diabases, diorites, etc. Quartz and spar grains dominate in the sand fraction, followed by fine grains of fragmental material of the above-listed rocks.

The sand and gravel material is represented by the following percentages: diabases, porphyries, granites, quartz diorites – 35%, sandstones – 17%, grounds and diorites – 10%; limestones - 23%, basalts 10%, other rocks – 5%.

The sample treatment gave the following data:

1. Sand fraction with grains of up to 0–5 mm is 20–40 % of the total mass.
2. Gravel fraction of up to 5–70 mm – 44–72 %.
3. Boulder (block) fraction of over 70 mm – 4–10 %.
4. Clay fraction of less than 0,5 mm – 4 %.
5. Sieve-related loss – 10 – 14 %.

The physical-mechanical properties of the sand and gravel are as follows:

- Volume weight in the pillar – 1840–2100 kg/m^3.
- The same in the fill – 1643 –1702 kg/m^3.
- Loosening coefficient - 1,12–1,25 .
- Water absorption of the mixture 1,0 –1,4 (and 2,0 for gravel).
- Porosity 4– 45 %.
- Grade of brittleness - Dp-12.

The grade of sand and gravel meets the following standards:

8736–77 “Sand for building works” and sand meets the standard 8268–82 “Gravel for building works”.

The chemical content of the inert material (mixture) is as follows:

SiO_2 - 68,34 -68,06	CaO – 4,21 – 4,43
Al_2O_3 – 10,4 -10,88	MgO - 1,77 -1,99
Fe_2O_3 – 5,0 – 5,15	K_2O - 1,6 - 1,62
N_2O – 1,87 – 1,24	MnO – 026 -0,28
TiO_2 – 0,5 – 0,54	Moisture – 1,06 – 1,3

b) There are no sand and gravel manifestations across the rivers, within 40-50 km radius adjacent to the eastern area of the design road (Rioni crossing-Lanchkhuti). In the past, sand and gravel here was mostly delivered by a railway. In addition, they used to clastate rocks in the mountainous massifs and use them to build the roads.

Such a place is located in village Versachinati, 8 km from the village of Lesa, in the gorge of brook Natsara and on the left side of Shukruti-Aketi road. The locations of these objects are given in Fig. 3.

Fig. 3. Presumable pits of mountain rocks

According to the information provided by the locals, until 2005-2006, adjacent to village Versachinati, in the gorge of brook Natsara (Fig. 4) they extracted the ore based the relevant license. The fact of extraction was also proved by visual examination (See Fig. 1,2).

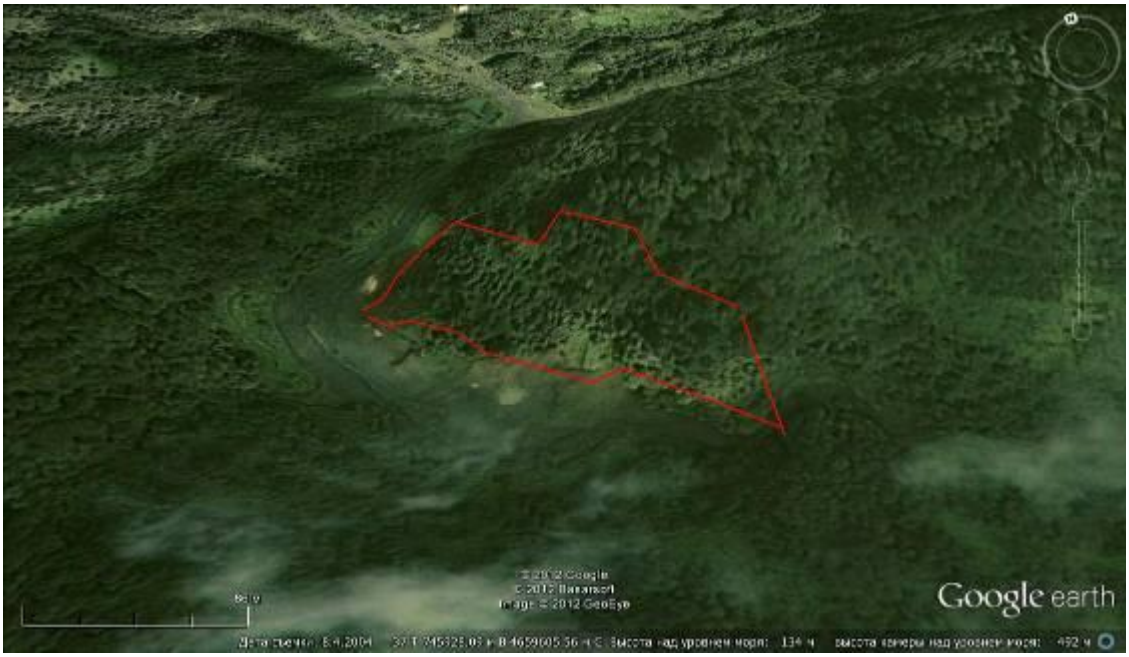


Fig. 4. Area of a former pit

The mountain rock is presumably represented by conglomerates.

Pic. 1. Former pit in village Versachinati

Pic. 2. Fragment of the former pit

A similar principle was used to find a former pit on the left side of Shukhuti-Aketi road (See Fig. 4 and Pic. 3).

Fig. 4. Former pits adjacent to village Shukhuti

Pic. 3. A site of an old pit adjacent to village Shukhuti

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Annex 10

List of Experts tooking part in preparing of EIA

Medgar Chelidze	Project Manager Eexpert in Environmental and Resettlement
Temur Kepuladze	Selecting locality for construction camps, waste managament units and quarries and environmental management
Zaza Lebanidze	Geology
Andrei Kandaurov	Ecology (Fauna)
Lali Akhalaia	Cultural inheritance
Mariam Kimeridze	Ecology (Flora)
Dato Chelidze	Ecology (Flora)
Baadur Ukleba	Hidrology
Gia Aladashvili	Social Environment; Analizing background radiation and noise
Varlam Changashvili	Modelling of Emissions