2879-GEO: Sustainable Urban Transport Investment Program
ENGINEERING, PROCUREMENT, CONSTRUCTION MANAGEMENT
AND SUPERVISION OF THE MODERNIZATION OF TBILISI-RUSTAVI
SECTION (SECTION 2) OF THE TBILISI-RED BRIDGE (AZERBAIJANI BORDER) ROAD

DRAFT IEE FOR SECTION 2

29th August 2013

Joint Venture of

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1. INTRODUCTION

1.1 Background

1. The Government of Georgia will sign a loan agreement of USD 73,0 million with the Asian Development Bank (ADB) under a MFF to implement Tbilisi~Rustavi Urban road link (Section 2). The modernization of road section-2 of 6.8 km from Phonichala to Rustavi forms a part of Tbilisi-Rustavi Highway with a total length of 17.4 km is one of the components /sub-projects(Tbilisi~Rustavi Urban road link(Section 2) and Anaklia Coastal Improvement (Phase 2) identified for construction. The Municipal Development Fund of Georgia (MDFG) is the project executing, implementing and disbursing agency. The MDFG is the Employer and acts on behalf of the municipality and the Road Department of Georgia. The objective of the Project is to develop an efficient, affordable, and environmentally sustainable transportation system that forms a part of the south-east route of the country.

2. The project will focus on the improvement of the existing transport services linking Rustavi to Tbilisi. The Project targeted measures and specific facilities such as provision of interchanges, underpass, bridge road widening, bus stops, retaining wall, footbridge included to ensure a quick, safe and reliable bus services and guarantee proper physical connection with Tbilisi and Rustavi at the entrance of the city. The Program was developed as the Government's response to the transportation problems in urban areas, which include large traffic volumes between Tbilisi and Rustavi route causing increasing delays.

1.2 Objectives

3. This Initial Environmental Examination (IEE) has been prepared for Section-2, as part of the ADB supports (ADB Loan 2879-GEO) in undertaking the Detailed design of the Engineering, Procurement, Construction Management and Supervision of the Tbilisi~Rustavi Urban link (Section 2) of 6.8 km. The objective of the study is to help the Government prepare and implement an efficient, safe and sustainable transport network, in accordance with international environmental safeguards.

4. In addition, the IEE aims to identify the likely impacts, both positive and negative, and assess the impacts on the environment of the proposed intervention undertaken by the MDF. The basic objective is to ensure that nobody is made worse off as a result of such development. The overall aim is to ensure that the proposed project is environmentally sound and sustainable following the international requirements laid out in United Nations Framework Convention on Climate Change to which Georgia is a signatory (Ref: Short List of the Ratified Conventions in Section 1.2.4 of Volume-II).

1.3 Methodology for IEE

5. This IEE follows the methodology outlined in the ADB Guidelines; ADB Safeguard Policy Statement, June 2009 (SPS 2009) and environmental Laws of the Government of Georgia. The experiences of other studies in preparing IEE documentation for transport sector have also been reviewed. This IEE is prepared based on review of detailed design, collection of primary, secondary data and information, field visit, discussions with the MDF and Environment Department, and stakeholder consultations.

6. This report covers the description of existing environmental conditions, assessment of environmental impacts of proposed road project, recommended management and mitigation measures and monitoring of selected parameters. The environmental impact was considered for activities during pre-construction, construction and operation phases of the Project. The scope of the IEE covers the natural and human

environment, their interaction and any induced change brought about by the road construction/reconstruction activities.

7. Further, various environmental activities were carried out at the project feasibility and planning stages. Sector experts conducted both office studies and field investigations and on-site assessment of the environmental condition. A full set of the required environmental and social information has been collected. The National Environmental Agency took samples of surface water, soil and ambient air and analysed them. The design team checked the background noise and radiation along the entire alignment for the proposed route. Emission impacts of the traffic were analysed using licensed software "Ecolog–Magistral". Noise and vibration modelling was executed by DOHWA engineering team.

8. Sensitive environmental and social receptors were analysed in the project area and the results of the analysis were considered in design and planning of mitigation measures. The land acquisition and resettlement issues are submitted as a separate document – Resettlement Action Plan. Mitigation measures were integrated within the Environmental Management and Monitoring Plan

9. The IEE document is structured as main text and annexes. The main body of the text provides concise and logical description of the environmental condition, sensitive receptors, potential environmental impacts and relevant mitigation measures, integrated in the Environmental Management Plan (EMP). The annexes provide more detailed information regarding particular issues, like: the report of the he National Environmental Agency on the environmental pollution (water, soil and ambient air), the results of traffic pollution modelling.

10. However, the data from the following disciplines were also reviewed and incorporated in to the IEE study.

- Engineering
- Hydrology
- Ground water
- Public Health
- Land Acquisition and Resettlement

11. Thanks should be acknowledged to the MDF, concerned agencies, field level personnel, and local people who assisted in the studies.

12. (3) The design project envisages cutting of trees (the amount is round 4000). The vegetation mainly comprises a green belt along the highway, trees in orchards and riparian vegetation. Detailed botanical studies showed that no sensitive floodplain forests, wetland habitats or red data species are under the impact. There are also rare, endangered and vulnerable species in the project area, including the silver berry *Elaeagnus angustifolia* (rare species), the Turkish Pine *Pinus eldarica* (endangered species), etc. The results of the botanical studies conducted prior to the construction need to be verified and detailed figures and descriptions, required for calculation of compensation planting will be added when the RoW is finally rectified.

2. DESCRIPTION OF THE PROJECT

2.1 Overview

13. The proposed Project is an Investment Program under MDF for the SUTIP-P1. The interventions considered under this Tranche include creation of New road on the Mtkvari river side, road widening for development of 4 or 6 lanes from existing 2 lanes, pavement strengthening, drainage improvement, construction of new bridges and underpasses, retaining walls, interchanges, overpass for easy crossing of the local people. The length of 17.4 km is divided into 2 Packages. As such, Package-I which had completed is Section-1(Sta. 0+000~4+000) and Sectin-3(Sta.10+800~ 17+400) and Package-II is Section-2 (Sta. 4+000~10+800). This IEE is developed for 6.8km length Section-2 from Phonichala to Rustavi.

14. In addition, the project's special focus will also be given to the improvement of the express bus services linking Rustavi to Tbilisi, with specific facilities such as bus stops, road marking, footbridge or underpass will be developed to ensure a quick, safe and reliable bus services and guarantee proper physical connection with metro network at the entrance of the city.

2.2 Selection of alignment for section 2

15. With the objective of rendering effective accomplishment to the Project in the process of being arranged and avoiding the public complaint of residents living in section2, MDF divided the project area into 3 sections. As a result of this, economic analysis for section 2 had been carried out by the consultant with 3 alternative alignments. According to economic analysis and MDF's direction, MDF decided that the Alternative-3 was selected for Section 2 as a result of comparison of economic analysis of the three alternative option of Tbilisi~Rustavi Highway project Section II dated April 11, 2013.

16. On comprehensively judging with construction cost, resettlement issues and environment issues , the result of economic analysis, Alternative-3 is applicable as optimum alignment of the Section 2.
The construction cost of Alternative-3 is a little expensive than other alternatives, but it will be reduced through comparison of construction method about retaining wall, underpass and etc.
In case of Alternative-1 & 2, Resettlement problem to be caused by crossing residential area (the first section and second section of Ponichala) will make progress of the Project impossible, and will also cause significant delay of Resettlement action plan and implementation.

Fig.2.1 Alternatives for section 2 alignment

2.3 Type and Category of the Project

17. In general, this is a road upgrading project from 2 lanes to 4 lanes. However, particularly for section 2, new 4 lane road will be constructed following new alignment. This reconstruction is to meet Georgian National standard(SST Gzebi 2009) and TEM standard(Trans-European North-south Motorway) within the existing right-of-way (RoW) and categorized by ADB as Environment Category B since some adverse issues of lesser degree are involved with it for environmental assessment and therefore, an IEE is prepared.

2.4 Need for Project

18. Georgia's geographical location positions the country at the center of both East-West (the Black and Caspian Seas) and North-South (between Russia and Turkey) transit routes. Trade with neighbouring countries is an important feature of the Georgian economy and estimated to be worth more than US$2 billion. The Government of Georgia (which assumed office after the Rose Revolution in 2002) made it a key priority to rehabilitate transport, energy and rural infrastructure, which had deteriorated significantly since 1990. Recognizing the importance of infrastructure to the sustainable economic development of the country, the Government has managed to substantially increase investments in these sectors.

19. One of the Government's priorities has been to develop Georgia's competitiveness as a transit country by improving its East-West Transport Corridor and this is recognized in the National Development Plan. In the years 2003-2004 Louis Berger and Trans project Roads Survey and Design Institute of Georgia prepared a TACIS funded study on Rehabilitation of Caucasian Roads. This provided a significant amount of data for the existing roads and an improvement strategy with additional by-pass options to relieve traffic volumes and congestion in the urban areas through which the existing main highway still passed.

20. By now, the construction of some sections (Tbilisi-Agaiani, Agaiani-Igoeti, Igoeti-Gori) of the Eurasian corridor (E-60 highway) highway is accomplished and the construction of Kobuleti bypass is underway. At the same time, the modernization projects of other sections of the road are being developed.

21. International road Tbilisi–Red Bridge (Azerbaijan border) is an integral part of TRACECA Transport Corridor. The road links Georgia with Azerbaijan as well as with Europe and Asia. The modernization of Tbilisi-Red Bridge (Azerbaijani border) road allows transporting the passengers and various goods to Baku, the capital of Azerbaijan through the improved and modern road. This road will also make Tbilisi and Georgian Black Sea resorts and ports more accessible to the population of Azerbaijan. Tbilisi-Rustavi design freeway envisaged by the present project is a part of Tbilisi-Red Bridge road.

22. The design Tbilisi-Rustavi section of Tbilisi-Red Bridge (Azerbaijani border highway) road links the capital of Georgia with the major industrial and administrative center Rustavi and the district center Gardabani. Rustavi with its population of 120 thousand people is the main satellite city of Tbilisi megalopolis. Thus, the travel between Rustavi and Tbilisi is intense. This is natural if considering that many Rustavi inhabitants commute on daily basis towards Tbilisi to work or study. The existing 2-lane highway (one in each direction) has not enough capacity to carry the whole traffic entering or exiting Tbilisi at peak hours.

23. According to the data of the Road Department of the Ministry of Regional Development and Infrastructure of Georgia (hereinafter referred to as "The RD"), the given section of the design road is overloaded, with the traffic intensity exceeding 14,000 vehicles a day, while the maximum carrying

capacity of the existing road is 7,000 vehicles a day. The overloaded traffic often causes traffic jams creating major discomfort for the passengers. In addition, the increased amount of fuel used leads to the increased proportion of emission of products of combustion in the atmospheric air and deterioration of the atmospheric air quality in the adjacent settled areas.

24. Technical parameters of the existing road do not meet safety requirements, resulting in frequent accidents leading to injuries and human toll as well as economic loss. Sharp increase in the traffic intensity in terms of improper conditions of the road infrastructure often leads to car accidents. In this context, the Georgian Government has decided to improve the capacity of Tbilisi-Rustavi link by upgrading the road into a freeway.

25. After the further sections of the road are designed and constructed, the capital of Georgia will be linked to Azerbaijan and its capital Baku through the modern road meeting the international standards. This road will be used to comfortably transport the cargo and passengers to Tbilisi and Black Sea ports. The design road is also very much important for the social-economic development of the population of Kvemo Kartli region, particularly for the population and industries in the city of Rustavi and Gardabani region.

2.5 Location

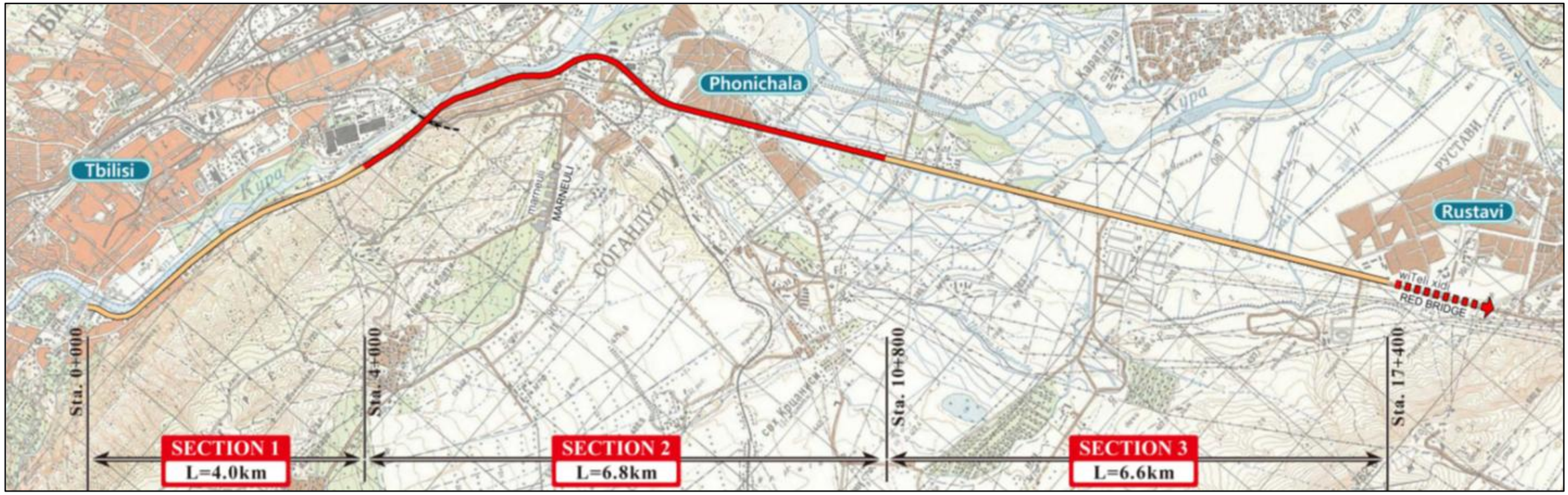
26. Tbilisi-Rustavi road is located in Tbilisi and Gardabani district. The length of the design Tbilisi-Rustavi road(Section 2) is 6.8km. Generally, the aim of the project was to lay the road along the route recommended by analysing economic analysis.

27. Section 2: Phonichala - Rustavi has 6.8km long length of road alignment on the Project. Tbilisi-Ponichala section of the project alignment is entirety located in Gardabani district, 5km of the Project road coincides with the alignment of the existing road and 3.8km of the Project road is newly constructed along Mtkvari river. Radii of horizontal and vertical curves, longitudinal and transverse slopes, super elevations correspond to highway parameters according to TEM Standard and SST Gzebi. The width of each lane is 3.5m or 3.75m in consideration of each section depending on residential area, river side and non-residential area. The central barrier has 4m width on river side and 6m width on connecting area to Section 1 and Section 3. Sidewalk will be installed for entire Section 2 excluding connection area to Section 3 and parallel road and sidewalk will be installed for river side area. Type of pavement is considered with asphalt concrete. The Project is to construct two underpass crossing E60 road at 4+620 on IC and passing under existing railway at 4+985 as well as retaining wall about 1.6km along the Mtkvari river. The new road also includes one overpass bridge at 7+515, two bridges on IC from Sta. 8+300 and Sta. 9+840. Construction of the infrastructure will entail acquisition of additional private land and will affect private structures and businesses somewhat. Besides, construction of the road will require replacement of the existing utilities and communication infrastructures either.

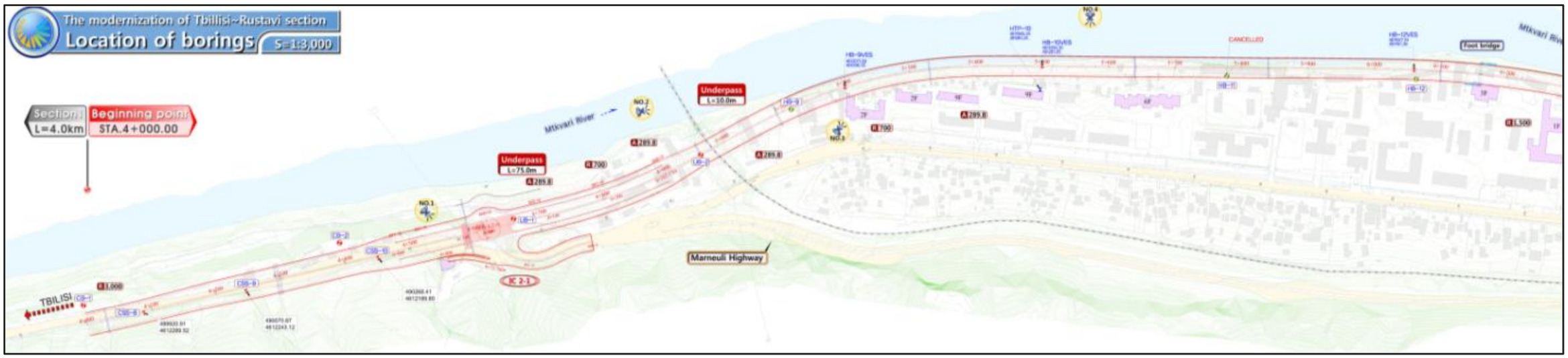
Table 2.1. Description of Section-2

Item	Length	Lane/ Width of cross section	Structures	Remark
Section 2	6.8 Km	4~6 lanes/ 28.5~49.5m	Interchange : 3 places Bridge : 3 places Underpass : 2 places Footbridge : 4 places	

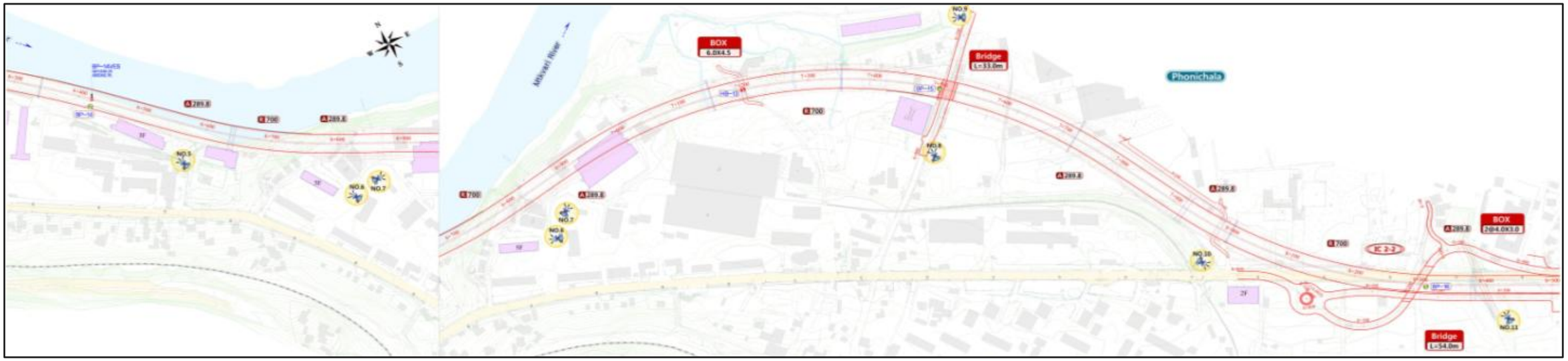
Map of the entire Tbilisi – Rustavi Section of the Highway



Plan No.1 of Tbilisi – Rustavi Highwaysection 2 (Sta. 4+000~6+300)



Plan No.2 of Tbilisi – Rustavi Highway section 2 (Sta. 6+300~8+500)



Plan No.3 of Tbilisi – Rustavi Highway section 2 (Sta. 8+500~10+800)

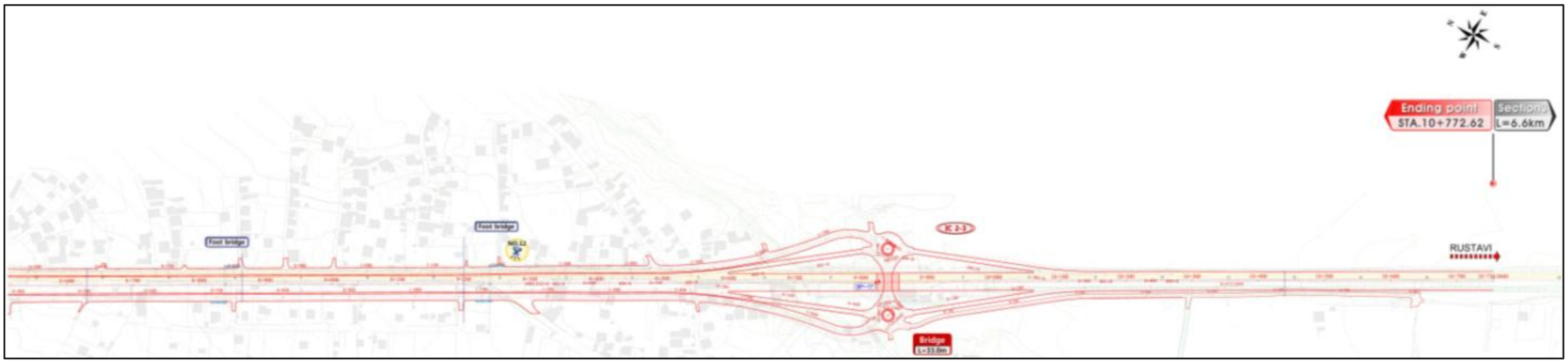


Fig.2.2 **Map of the entire Tbilisi – Rustavi Section of the Highway** ***and Plan of Section 2***

2.6 Proposed Schedule for Implementation

28. Construction of the Project is scheduled for implementation over a period of 17 months, starting in January 2014.

2.7 Design Criteria and Parameters

Application of standard

29. The Georgian norms "SST Gzebi:2009, TEM standard and AASHTO standard were applied during preparation of the design documentation for Modernization of Tbilisi~Rustavi section (Section 2) of the Tbilisi~Redbridge(Azebaijani Boarder) road as well as such other design-construction norms.

30. Design for road – TEM Standard (Trans-European North-south Motorway)

Design for Bridges and overpasses – AASHTO Standard

Traffic safety conditions – Georgian National Standard(SST Gzebi 2009)

31. Application of various norms and standards is caused by the fact the Georgian National Standards are not comprehensive and do not include all required norms and regulations and still under elaboration.

32. Construction of 4-lane (excluding 0.9km from Sta.4+000~4+900) is envisaged in the design.

Technical parameters adopted for the section 2 is as follows:

- Design speed : 120 km/hr;
- Maximum longitudinal slope : -3.98%;
- Minimum change ratio of vertical curve of Crest(m/%); K=150
- Minimum change ratio of vertical curve of Sag(m/%); K=85
- Cross slope – 2%;

Roadway

33. Width of roadway adopted in the design for Section 2 is 28.5-49.5m.
Width of dividing strip is adopted 4.0-6.0 m.
Width of paved shoulders is 0.5m~3.0 m.
Fill slope adopted is 1:1.5.
Cut slope adopted is 1:1.0

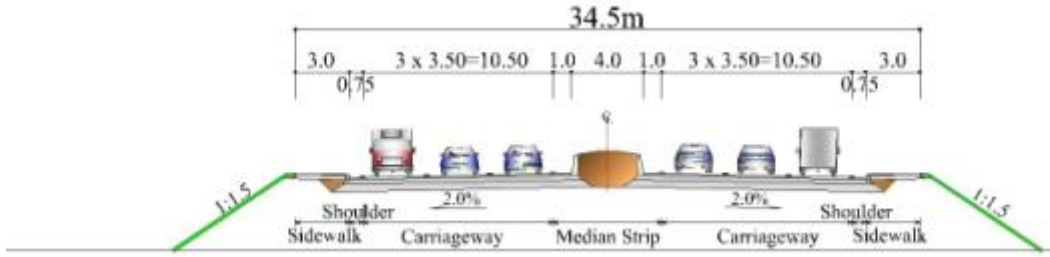
34. Volumes of earthworks are calculated according to the design cross profile.

35. Widths of main lanes, paved shoulders and roadside are shown on the cross-sections, however widths of acceleration-deceleration lanes to be constructed at junctions and interchanges are not shown (see in a separate Table).

36. Typical cross section with 4 types are shown as below.

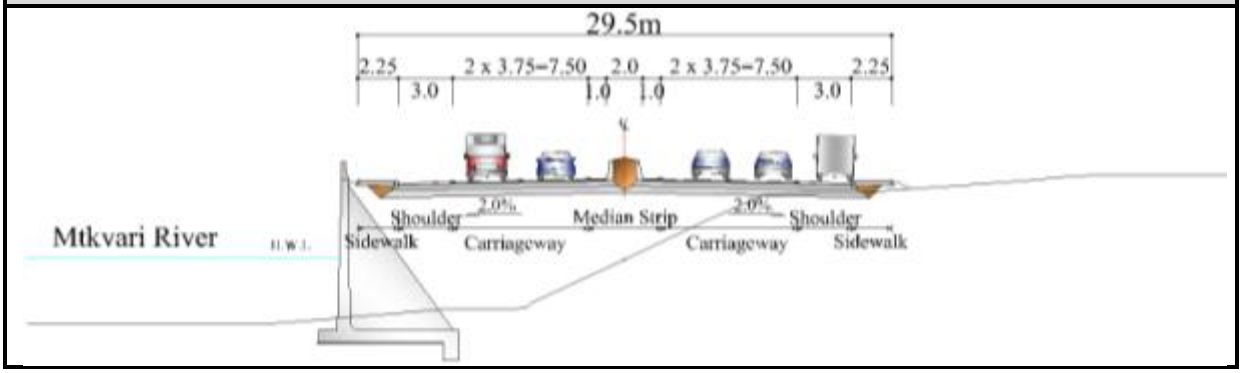
37. Beginning section connecting to Section 1 is composed to 6 lanes of width 36m

Beginning Section (6 lanes), STA.4+400~5+000(L=0.4Km)



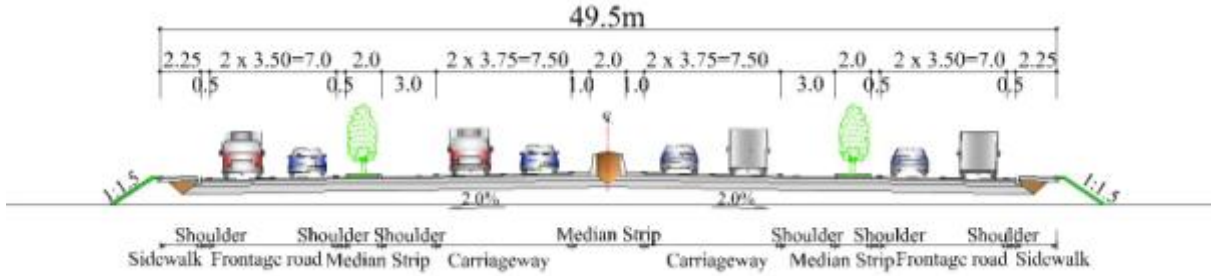
38. River side section is located close to the Mtkvari river.

River side (4 lanes), STA.4+400~8+400(L=4.0Km)



39. Frontage road is considered for residential peoples

Residential area (4 lanes), Frontage road(4 lanes), 8+400~10+100(1.7Km)



40. Ending section connecting to Section 3 is composed to 4 lanes of width 28.5m

Ending Section (4 lanes), STA.10+100~10+800(0.7Km)

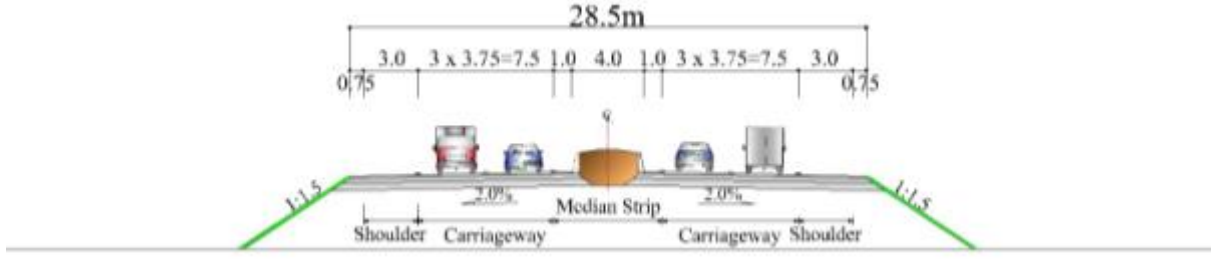


Fig. 2.3 Road Cross-Section

2.8 Road Pavement Structure

41. Road pavement structure is designed considering technical and economic parameters and based on the following data:

- Traffic flow;
- Reliability factor;
- Service life.

42. Both rigid and non-rigid pavement alternatives were studied whilst selecting the road pavement structure. Comparison of pavement alternatives identifies that rigid pavement has some advantages over non-rigid pavement. However, within the limits of Tbilisi application of non-rigid pavement has the advantage as in case laying of utilities is required, cutting out the rigid pavement and its re-paving shall be complicated. Considering the above-mentioned, non-rigid pavement was applied on the section 2.

Table 2.2 Non rigid Pavement Structure : Pavement layer and thickness.

No	Pavement Layers	Thickness of pavement layers, cm
1	Wearing course : Fine grained dense asphalt concrete hot mix	5
2	Binder course : Coarse grained porous asphalt concrete	10
3	Base : Crushed aggregates (0~40mm)	25
4	Sub-base : Sand and gravel mix	25

2.9 Engineering structures

Junctions and intersections

43. Construction of grade separate junctions and intersections is stipulated in the design:

44. To enhance accessibility while interchange design, the location of intersection facilities and types would be adapted in accordance with social condition of intersection point(obstacle and construction cost), geological condition and traffic condition as well appropriate connection around existing road.

45. The location of interchange is selected in consideration of connectivity with existing road and traffic condition on Section 2 and type of interchange is chosen to minimize confliction on geological condition and obstacles of Phonichala. In general 3 interchange is planned on Section 2.

Interchanges

46. Layout of interchange which is planned on project section is as follows;

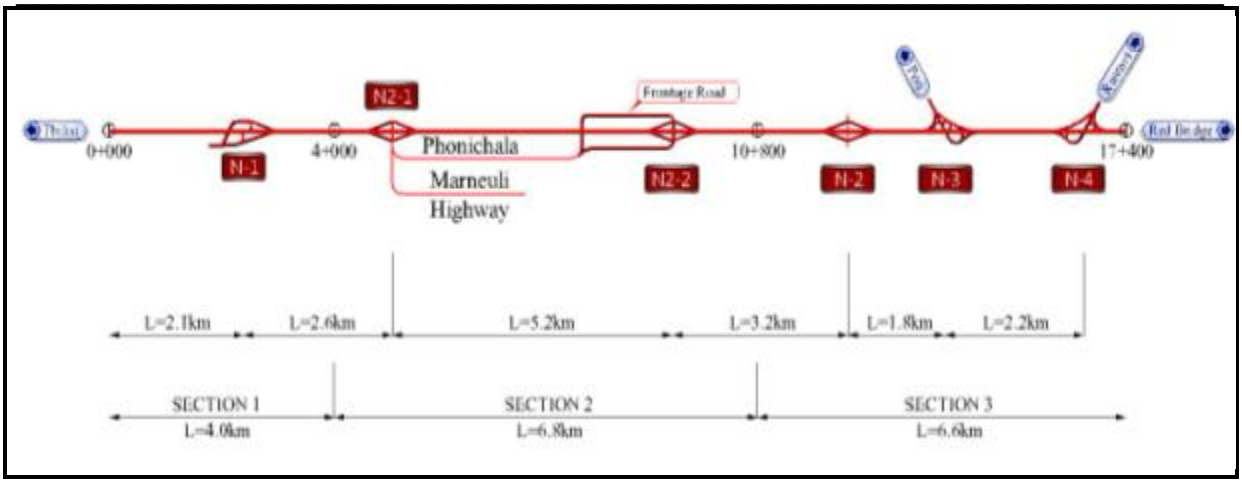


Fig. 2.4 location of Interchange (Section 1, Section 2 and Section 3)

47. Total 3 spots of interchange on Section 2, the status is as follows;

- Interchange N2-1 where is STA 4+620, is planned as diamond type. It is designed to ensure connectivity with exsting Marneuli Highway and Phonichala access road by planning establishing underpass on main route and roundabout with 2 lanes upper underpass.
- Interchange N2-2 where is STA 8+300, is planned as diamond type. It is designed to ensure connectivity with exsting Phonichala access road and frontage road by planning establishing underpass bridge on main route and 2 roundabout under underpass. Frontage road is designed to enhance safety and comfortability of users moving into Phonichala city by estabilishing it separation from new expressway.
- Interchange N2-3 where is STA 9+840, is planned as diamond type. It is designed to ensure connectivity with frontage road by planning establishing underpass bridge on main route and 2 roundabout under underpass of main route.

48. The 2nd section has two bridges with a total length of 66.0m . Besides, flyover bridge with a length of 54.0m can be expected to cross the main roads.

49. The stream sections crossing the main highway will be designed in compliance with standard design practice by using pipe or box culverts.

Table 2.3 Summary of Bridges

Name	Location	Length(m)	Width(m)	Horizontal Radius (m)	Remarks
Bridge 1	STA.7+496.000	33	29.74	700	
Bridge 2	STA.9+824.092	33	28.04	∞	
Flyover Bridge	STA.8+296.642	2@27=54	12.39	∞	
Total Sum		**120**			

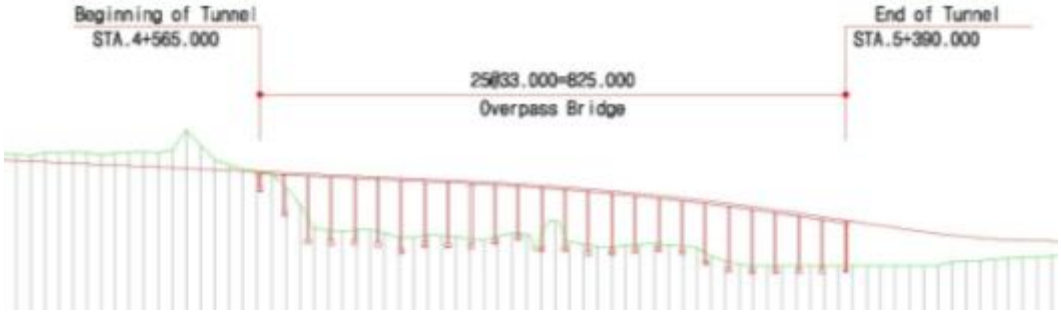
50. The Consideration at the location of railway

51. It is required for Design consultant to consider the plan crossing the railway in terms of economy, constructability and harmony with surrounding area because the road is planned to pass this location.

52. Preferentially, the overpass bridge can be planned without consideration of the underpass tunnel because the train has been running at a speed of approximately 40km/hr at large twice a day while the Consultants had the site-survey. Though the overpass bridge can be easily considered by the reflection of the regional experiences which have not done the construction method to cross under the railway in service and the underpass tunnel can be hardly considered especially under in-service railway in this region, the overpass bridge does not have the advantages of the aesthetical view in the vicinity of riverside and economic feasibility.

53. On the other hand, the underpass tunnel does have the advantages of harmony with surrounding area, as the structure is nearly not to be seen, and economic feasibility.

54. Therefore, The underpass tunnel can be adopted herein as the structural plan to cross the railway at **STA. 4+975.68km**.

<table>
<tr><td rowspan="2">Option 1</td><td>Overpass Bridge</td></tr>
<tr><td> 
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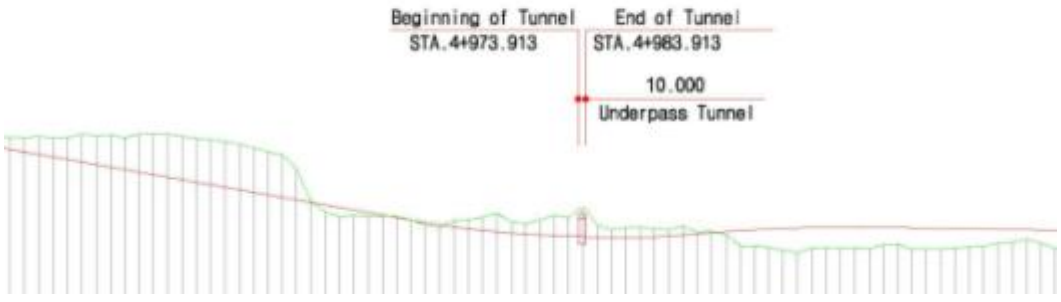
<tr><td colspan="2">Total Cost : 52.7 million USD</td></tr>
<tr><td rowspan="2">Option 2</td><td>Underpass Tunnel</td></tr>
<tr><td> 
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<tr><td colspan="2">Total Cost : 3.8 million USD</td></tr>
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Fig. 2.5. Tunnel under the Railway (STA. 4+974km)

Plan of retaining wall

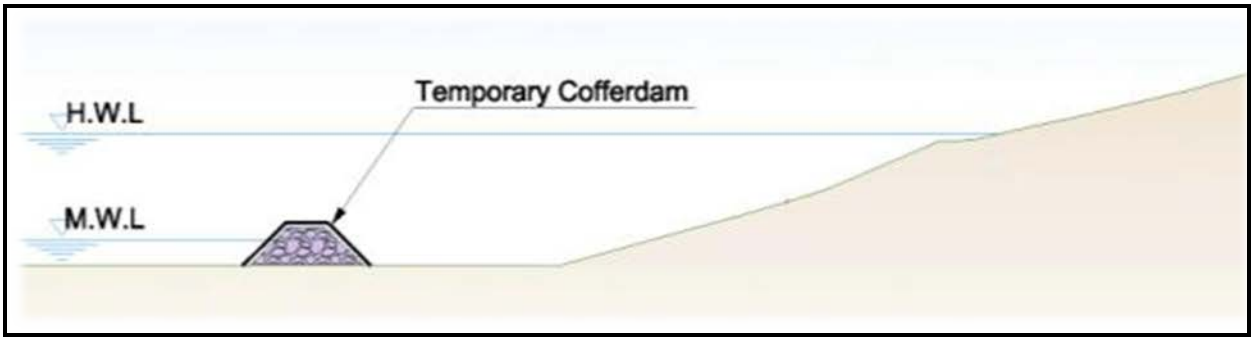
55. **Retaining walls** are structures designed to restrain soil to unnatural slopes. In this project, they are used to bound soils between two different elevations especially in riverside areas where engineered for the specific purpose of roadway overpasses.

56. The length of retaining wall is about to 1.66 km (Sta. 5+100~6+760, left side) mainly on the river-side and the heights of those vary from 3.0m to 12.0m.

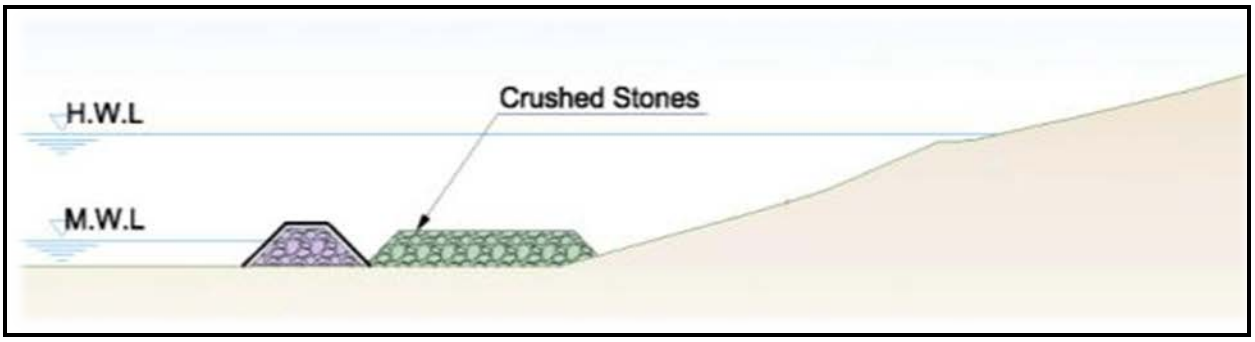
57. As the retaining walls are constructed mainly on the riverside, the temporary cofferdam should be considered during construction, and the score protection should be planned in service as well.

Construction Method

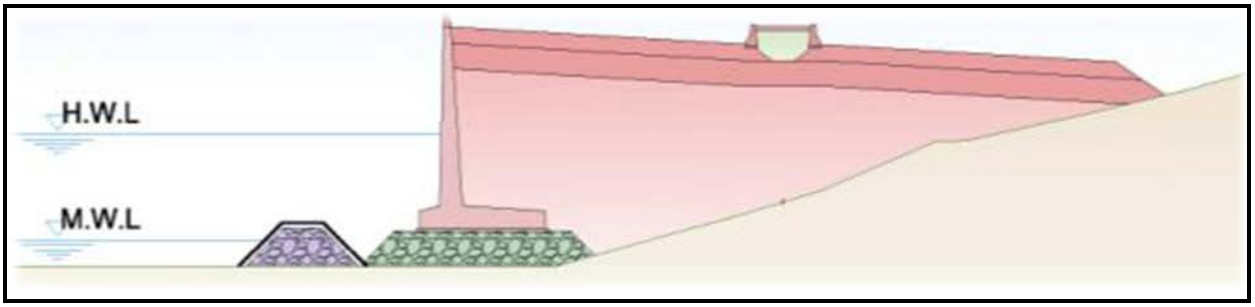
(1) Step 1 : The temporary cofferdam is constructed in the designated section.



(2) Step 2 : After excavating for bed, the crushed stones under the diameter of 110mm is substituted as the ground with the height of approximately 1.0m to increase ground bearing capacity for foundation.



(3) Step 3 : The retaining wall is constructed.



Step 4 : The scour protection is installed.

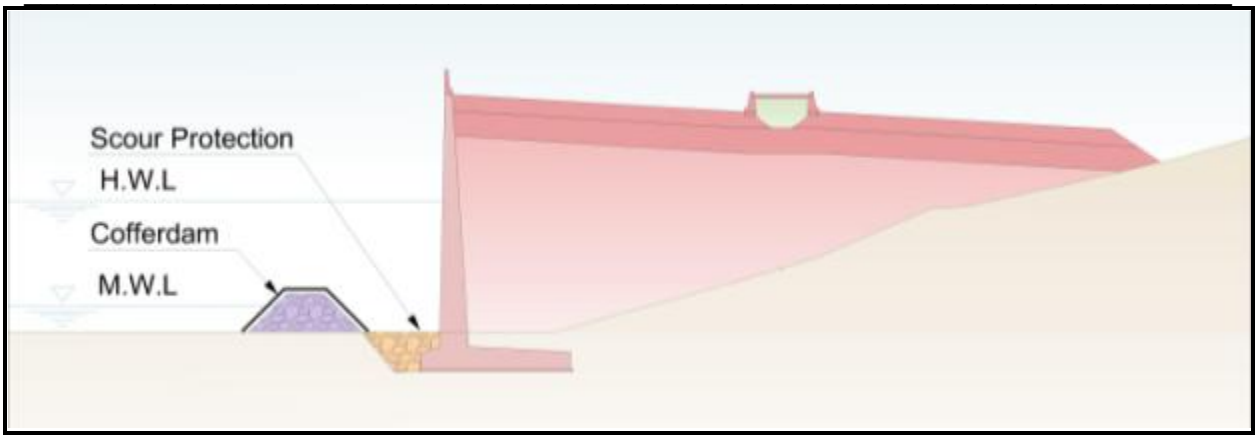


Fig. 2.6. Method of retaining wall

58. The cofferdams which will be layered by sacks filled in crushed stones are planned to prevent the water from flowing in the limited working section, which would be wrapped with water-proof sheet made from rubber or polyvinyl.

59. The scour protection measures would be planned to be layered by stones with the diameter 1.0m above in front of retaining wall after the completion of the reinforced concrete retaining wall.

60. Design consultant plans to fill the materials such as the crushed stones with the diameter 100mm below as the base under the foundation of retaining wall, and the scour protection measures would be planned to be layered by stones with the diameter 1.0m above in front of retaining wall after the completion of work for the reinforced concrete inverted-T type retaining wall.

Table 2.4. Quantities of each materials to be installed along the Mtkvari river are as follows.

No	Pavement Layers	Quantities
1	Temporary cofferdam(110mm crusthed stone)	1500 ㎥
2	Retaining foundation(100mm Crushed stone)	3350 ㎥
3	Scope protection(diameter 1m stone)	1000 ㎥
4	filling materials behind retaining wall(Good quality soil)	23500 ㎥

2.10 Utility Relocation

61. There are many utilities to be relocated during the constructing near the existing road. The Consultant have been in contact with the 11 Utility companies. The Consultant has been under preparation of utility relocation design for the project site area.

Table 2.5. List of Utility companies & utilities relocation design companies on Project area

No	Name of company	Utility Type
1	KazTransGaz	Gas
2	GWP	Water supply and sewage
3	JSC Telasi	Power supply
4	ENERGO-PRO Georgia	Power transmission lines
5	SINATLIS QALAQI LTD and relevant organizations in Rustavi and Gardabani	Electric poles
6	Caucasus Online	Internet
7	Silknet	Internet and telephone
8	Akhali Kselebi	Telephone
9	CGC	Cables
10	FOPTNET	Cables
11	Deltacom	Cables

2.11 Road Safety

Traffic regulations and safety

62. Construction of dividing strip, installation of road signs, pavement marking, installation of guide posts and steel guardrails shall be done under the present project to ensure traffic regulations and safety.

Sidewalks, Bus Stops and Shelters

63. Sidewalks are constructed on residential area from sta.4+000~9+600. Bus stops with acceleration-deceleration lanes shall be contructed on Ponichala-Rustavi road section. Construction of shelters and footbridges on both sides of the road is envisaged in the design at sta. 5+100, 6+100, 6+900, 8+840 and 9+240.

2.12 Construction works

Preparatory works

64. During the road construction, the existing utilities and communications infrastructure, such as water supply and sewerage pipes, power lines, optical-fiber cables, etc., will be necessary to be relocated. The utilities subjected for relocation were listed above.

Prior to starting the road construction works, the Project envisages the accomplishment of the preparatory works.

65. The preparatory works include:

- Fixing of road layout and construction corridor - 6.8 km
- Relocation of the utilities
- Tree felling - about 700 trees
- Felling and digging out of bushes – 22,200 m^2
- Disassembly of the existing buildings and premises and all related works
- Arrangement of the building site for the road construction off archaeological remnants.

66. The project also envisages giving out the compensations for land plots, premises and plantations within the ROW.

Earthworks

67. Excavation volume – 420,000 m^3
Embankment volume – 674,000 m^3
Filling materials to be transported from quarries and borrow pits for arrangement of the embankments – 254,000 m^3

68. The volumes of earthwork according to the kilometres and types of treatment are given in the kilometre-based spread sheets of earthworks.

69. The project envisages scattering and levelling of the vegetation ground layer over the fill slope and seeding perennial grass.

70. For the construction of the retaining wall 19,000 ㎥ will be excavated for cutting and 209,000 ㎥ of filling materials will be needed for construction of embankment.

Blasting works

71. Blasting works are not envisaged during the construction of Tbilisi-Ponichala section of Tbilisi-Rustavi road.

Removing the topsoil

72. Prior to making the subgrade, the project envisages cutting the humus soil layer for 15 cm from km 13,000m^3 in total and further using it to seed perennial grass over the fill slope.

<u>Waste Generation</u>

73. Various wastes will be produced throughout the construction process. The main waste producing areas are: construction sites and construction camps. Small amounts of waste are expected along the access and heavy equipment movement routes with ground and soil pollution.

74. Milling of the existing asphalt concrete pavement shall be done prior to the construction of roadway. About 25,400 m^3 of milled asphalt should be stored in reserve and reused for construction of the road pavement.

Waste Classification

75. During the construction, the following types of waste will be produced:

- Household;
- Hazardous industrial;
- Non-hazardous industrial;
- Inert

Inert building materials

76. Generally, the major proportion of the remains generated in the road construction process is inert debris - fill of the cut ground and elastic rocks, and debris not used for construction purposes and subject to placement. The total amount of inert building materials generated during the construction of the design road section, is little as compared to other road sections:

- The mill of the existing pavement layer - 25,400 m^3 (must be placed as a reserve and further used for asphalt pavement or repairs of other road sections)
- Excavation material 420,000 m^3 generated from cutting areas located in sta. 6+700~7070 and sta. 4+000 ~ 4+560 will be used to make the fills.

77. The sites of placement of inert waste will be selected by the construction contractor in agreement with the local authority.

2.13 Equipment Use during Construction

78. Table – 2.6 provides a list of the typical equipment that will be used to construct the highway. The actual machinery to be utilized for the construction will be the responsibility of the Construction Contractor. Any emission approvals required under the Georgian Law on Ambient Air Protection for temporary concentrations will be obtained on the basis of actually machinery used before construction begins.

Table 2.6 Typical List of Equipment for Construction Activity

Sl.No	Equipment Type and Characteristics	Minimum Number required
1	Bull Dozer with Ripper	4
2	Front loader	3
3	Tipper-Dumper	6
4	Motor Grader	2
5	Truck Excavator	1
6	Back Hoe	2
7	Vibratory Roller	2
8	Pneumatic Roller	1
9	Tandem Roller	3
10	Vibratory Screen	1
11	Crusher	1
12	Fully Automatic Batching Plant	1
13	Fully Automatic Hot-Mix Plant	1
14	Paver Finisher with Electronic Sensor	1

Sl.No	Equipment Type and Characteristics	Minimum Number required
15	Compressor	2
16	Mobile Generator	2
17	Water Tank with sprinkler	2
18	Crane	1
19	Concrete Paver With Electronic Sensor	1

2.14 A complex of auxiliary building objects

79. The construction contractor will make a decision in connection to the auxiliary building objects (structure, content, location, designing, etc.). Despite this, by considering the existing experience in carrying out the construction works along other sections of E-60 road, we suppose there will be a complex of auxiliary building objects built, including a construction camp to place 200 workers (covering approximately 1.5 ha area), transport and equipment yard for 100 vehicles and 150 heavy techniques (covering approximately 2 ha area) (bulldozers, excavators, cranes, etc.).

80. Decision on construction of the Asphalt Production Plant will be taken by construction contractor: he may chose to use existing suppliers of asphalt or install his own concrete mixing plant.
In chapter 8.1.1.13 of EIA related to the mitigation measures, we described the procedures and conditions used to design and operate the above-mentioned building objects, as well as variants of optimal locations.

2.15 Quarries

81. Identification of qauerries and borrow pits is responsibility of the Civil Works Contractor (Contractor). Before start up of construction activities the Contractor has to define the quarries and borrow pits to be used and reflect this in the description of construction works and in work plans and specifications. At the same time, before engaging Contractor, the IEE should describe existing opportunities for fill material supply and potential impacts related to exploration and transportation of materials. Here below, we describe several quarries and borrow pits located in the project area, which could be used for project. Characteristics of some of the quarries are presented in Annex 5.

Fig. 2.7. Quarries and Borrow Pits in Project Area

Table 2.7 Quarries and Borrow Pits in Project Area

#	License No.:	Date	Duration	Entrepreneur	Reserve m^3	Telephone	Remark
1	100739	23.03.2009	5 y.	Transcaucasus Energy Ltd	100 000		
2	100607	10.08.2009	5 y.	Physical Person Irakli Lomtadze	40 000		
3	100427	10.03.2009	5 y.	Beni Ltd	54 000		
4	100723	19.11.2009	5 y.	Beni Ltd	56 000		
5	100842	17.07.2006	10 y.	Georgian Cement Ltd	120 000		
6	278	25.08.2006	10 y.	Karier Service Group Ltd	64 000		
7	1000165	29.06.2007	5 y.	Inertuniversal Ltd	14 325		
8	1000069	29.06.2007	5 y.	Olympi T Ltd	14 325		
9	1000428	03.01.2012	5 y.	MT Group Ltd	45 000		
10	1000358	09.01.2012	5 y.	JSC Mshen Mechanizatsia	50 100		
11	1000262	13.11.2009	3 y.	L & Z Inert Ltd	35 100		
12	1000165	29.06.2007	5 y.	Inertuniversal Ltd	14 325		
13	1000172	26.08.2011	5 y.	Physical Person Marlen Gvidiani	13 500		
14	343	30.08.2006	10 y.	Commercial Trade Company Didgori Ltd	100 000		Recomm.
15	1000423	17.02.2012	5 y.	Karieri Ltd	39 600		
16	912	11.05.2007	5 y.	Iberia Ltd	44 740		
17	78	19.04.2006	10 y.	Gzamsheni-4 Ltd	100 000	577 41-86-44	Recomm.
18	100620	03.05.2006	10 y.	T.T Ltd	80 000	577 41-86-44	Recomm.
19	1000178	29.08.2011	5 y.	Rike Ltd	12 900		
20	731	13.06.2006	10 y.	Tbilisi Ltd	300 000		
21	1000166	16.01.2008	5 y.	Inertuniversal Ltd	71 400		

2.16 Traffic Management During Construction

82. Road construction will not disrupt normal traffic operations and travelling through a construction zone for the main road. The contractor has to prepare detail traffic management plan mainly for construction of the interchanges where the local traffic is concerned.

83. The frequency of crashes in work zones is disproportionately higher than at other locations. Therefore the primary consideration in work zone traffic control is safety. If driver can easily understand the traffic control and have adequate time to make decisions, they will operate their vehicle in a safe manner.

84. Maintaining the full carrying capacity is usually not possible during construction periods. As construction progresses, travel lanes are either narrowed, closed or rerouted.

85. Due to the excessive traffic volumes on the project road sections at the design interchanges, lane closures might not be considered to maintain traffic completely out of the construction area. Lane closures on 2-lane road will generally require shifting traffic to the shoulder or provide traffic for both lanes on a 1-lane roadway.

86. For the higher trafficked road sections shifting traffic to the shoulder should be considered, whereas for the other project road sections the use of alternating traffic on 1-lane roadways may be acceptable.

87. Traffic shifting is one of the least disruptive work zone strategies since the same number of lanes are retained and narrow lanes, while reducing speed, have minimal effect on capacity. Utilization of the shoulder as temporary traffic lane in order to maintain the same number of lanes requires that the shoulder pavement is able to adequately support anticipated traffic loads. Re-gravelling and sealing of the existing shoulder is required to sustain the traffic load during construction and permit the safe movement of traffic at a reasonable speed. Adequate signing must be provided to guide drivers to the temporary shoulder lane.

88. During construction access to driveways could temporary blocked by the construction zone, thereby affecting access and parking for the adjacent business and residences. Alternative access should be provided where feasible, with guide signs to inform the public.

89. The Contractor shall give written notification to all landowners, tenants, business operators, and residents along the right-of-way of the construction schedule, and shall explain the exact location and duration of each construction activity. Potential obstruction to their access shall be identified and alternative access provisions shall be made, if feasible.

Detailed Traffic management during construction

90. The design is that 2 lanes of existing road expand into 4~6 lanes on starting section (Sta. 4+000~Sta. 4+600) and ending section(Sta. 8+200~EP). Therefore traffic management plan is necessary to maintain existing traffic flow system on two sections during construction period.

Beginning Section (STA. 4+000 ~ STA. 4+600)

91. The typical cross sections of each traffic management steps for beginning section are presented in figure below.

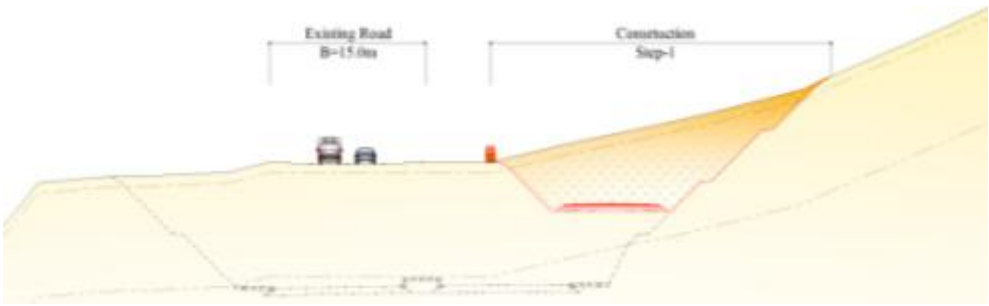
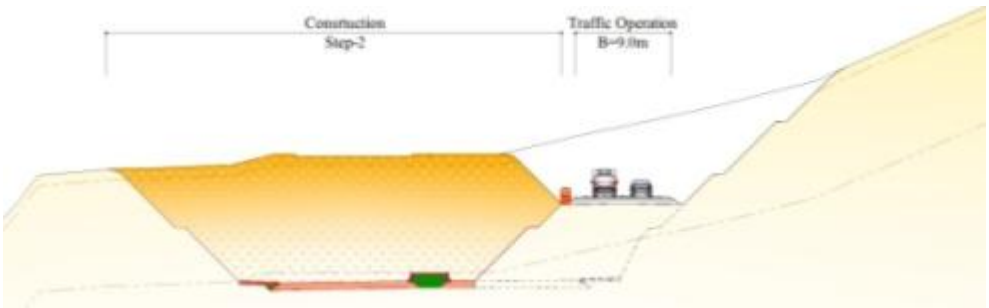
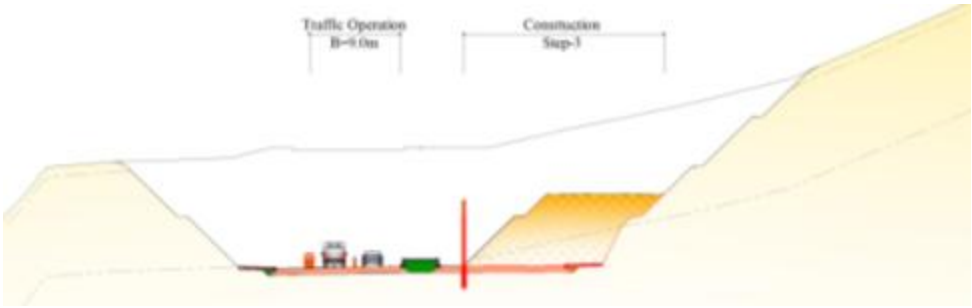
STEP	CROSS SECTION
Step-1	
Step-2	
Step-3	
Step-4 (Completion of construction)	

Fig. 2.8 Detailed Traffic management on beginning section

Ending Section (STA. 8+200 ~ EP)

92. The typical cross sections of each traffic management steps for beginning section are presented in figure below.

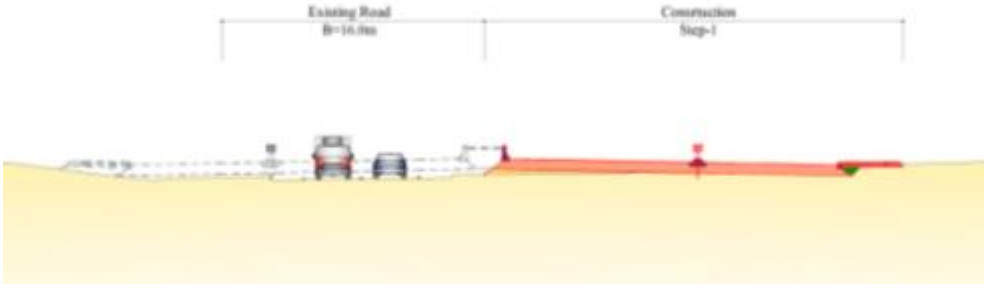
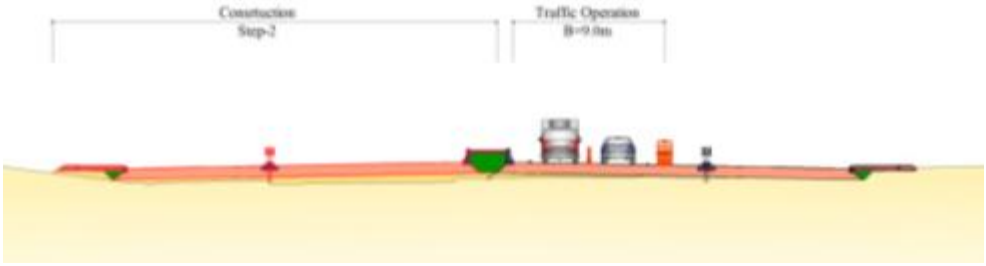
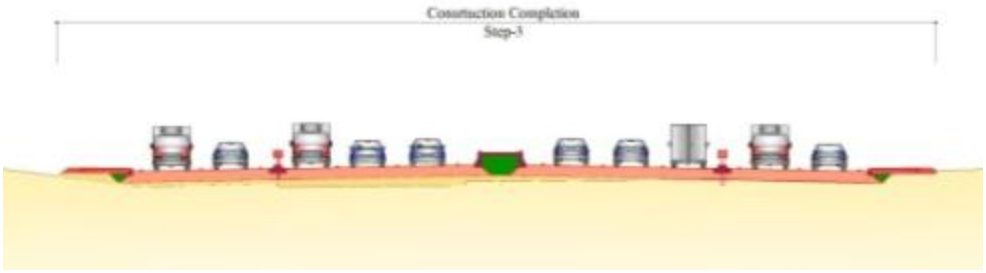
STEP	CROSS SECTION
Step-1	
Step-2	
Step-3 (Completion of construction)	

Fig. 2.9 Detailed Traffic management on ending section

93. The proposed traffic management scheme solves the traffic disruption problems for section 3. However, the simultaneous execution of civil works on excavation section, riverside section and residential section may create additional traffic problems. To minimize these risks we propose to split construction schedules in a way that intensive works on critical sites are carried out at one section at the same time.

Public information

94. Accurate and timely reporting of project information is a valuable element in the overall strategy for managing a work zone. The use of resources such as newspapers, radio, and television, can greatly improve the public's perception and acceptance of necessary delays and inconveniences. Key benefits of a public information program associated with construction activities are:

- Advance notice might encourage users to seek an alternative route around the project
- Advanced notice might encourage users to travel at off-peak times, or when construction sites are dormant
- Motorist acceptance might reduce speeding and other aggressive driving behavior in work zones

3. GOVERNMENT POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Introduction

95. Annex 1 describes in detail the environmental legal framework and administrative structure in Georgia including environmental regulations, measures required and indicates the institutions at the local and national levels responsible for issuing permits, licenses, and enforcing compliance with environmental standards. Below is a brief description of the environmental permitting process in Georgia, ADB safeguard requirements, and the differences between two systems.

3.2 Georgian Legislation Related to Environmental Permitting

96. 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.

97. In line with the mentioned laws, a provision "On the environmental Impact Assessment" is proved by Decree No. 14 of October 4, 2011 of the Minister of Environment and regulates the legal relations associated with the assessment of environmental impacts.

98. The Law on Licenses and Permits was adopted by Parliament of Georgia, on June 24, 2005. The new 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 cancelling of licenses and permits (Article 1, Paragraph 1).

99. The Laws on Environmental Impact Permit and Ecological Examination: The Laws published on 14.12.2007 and in force since 01.01.2008. These new laws integrated all recent Georgian legislation.

100. The Law 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.

101. 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 are a part of conditions of the Construction Permit.

102. 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.

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

Current Legislations Related to Environmental Permitting

104. Below is the list of laws relevant to environmental protection:

1994	Soil Protection
1996	System of Protected Ares
1996	Minerals
1996	Environmental Protection
1997	Wildlife
1997	Tourism and Resorts
1997	Water Protection
1997	Transit and Import of Hazardous Waste within and into the Territory of Georgia
1998	Resorts and Sanitary Protection of the Resort Zones
1998	Dangerous Chemical Substances
1998	Pesticides and Agrochemicals
1999	Atmospheric Air Protection
1999	Forest Code
2003	Red List and Red Data Book of Georgia
2005	Licensing and Permitting
2007	Environmental Impact Permit
2007	Ecological Expertise
2007	Cultural Heritage

Public Consultation Procedures

105. Clause 6 of the Law on Environmental Impact Permits provides detailed requirements and procedures for conducting public consultations and establishes timeframes for information disclosure and discussion.

According to Article 6, the developer is obliged to carry out public discussion of the EIA before its submission to an administrative body responsible for issuing a permit. Where an activity requires a construction permit this must be done before initiating stage 2 of the process for issuing a construction permit. The detailed description of Public Disclosure requirements is discussed more fully in this document in Chapter 9 on Public Consultation and in Annex 1.

Procedure of Official Submission of EIA/IEE to MoE

106. Article 8 of the Law on Environmental Impact Permits specifies the documents which must be submitted by an operator to obtain a permit:

(1) A written statement to the Ministry under the rules established by 'Law of Georgia on Licenses and Permits'.
(2) The following information:
    (a) An EIA/IEE 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

107. Article 9 of the Law on Environmental Impact Permits describes the procedures for issuing an Environmental Impact Permit. The issue is also 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 a decision on issuing Permit within the 20 days of the permit request by the project proponent.
2. MoE, in accordance with the law on Ecological Examination, ensures the quality of the submitted documentation and the Issuance of Conclusion on Ecological Examination.

108. Either the 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 issued by the MoE dated October 4, 2011

109. The Provision is proved by Decree No. 14 of October 4, 2011 of the Minister of Environment and regulates the legal relations associated with the assessment of environmental impacts.
The procedure to assess the environmental impact includes drafting the confirmatory documentation and permits for the businesses on the legally established list, identifying any source of expected environmental impact, its nature and degree and integrated assessment of their environmental, social and economic outcomes in obtaining the environmental expert conclusion.

110. The given Provision defines the procedure to draft the environmental assessment report by a business actor to ensure the environmental and social-economic balance of future economic development. It precedes the decision of the Ministry of Environmental Protection of Georgia about the purposefulness of the business and relevant project to be implemented by the business actor.

111. The assessment of the environmental impacts covers the identification and description of direct and indirect impacts in the context of the planned activity and study of their outcomes on:

- Human's residential space and health; vegetation cover and fauna;
- Natural and modified eco-systems; landscapes, air, water, soil, climate;
- Historical monuments and cultural values;

- Social-economic factors;
- Assessment of the existing state of geological and hydrological environments and expected risks.

112. The objects of environmental assessment are the activities on the list under clause 1 of article 4 of the Georgian Law “On Environmental Permit”.

113. 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

114. 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;

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

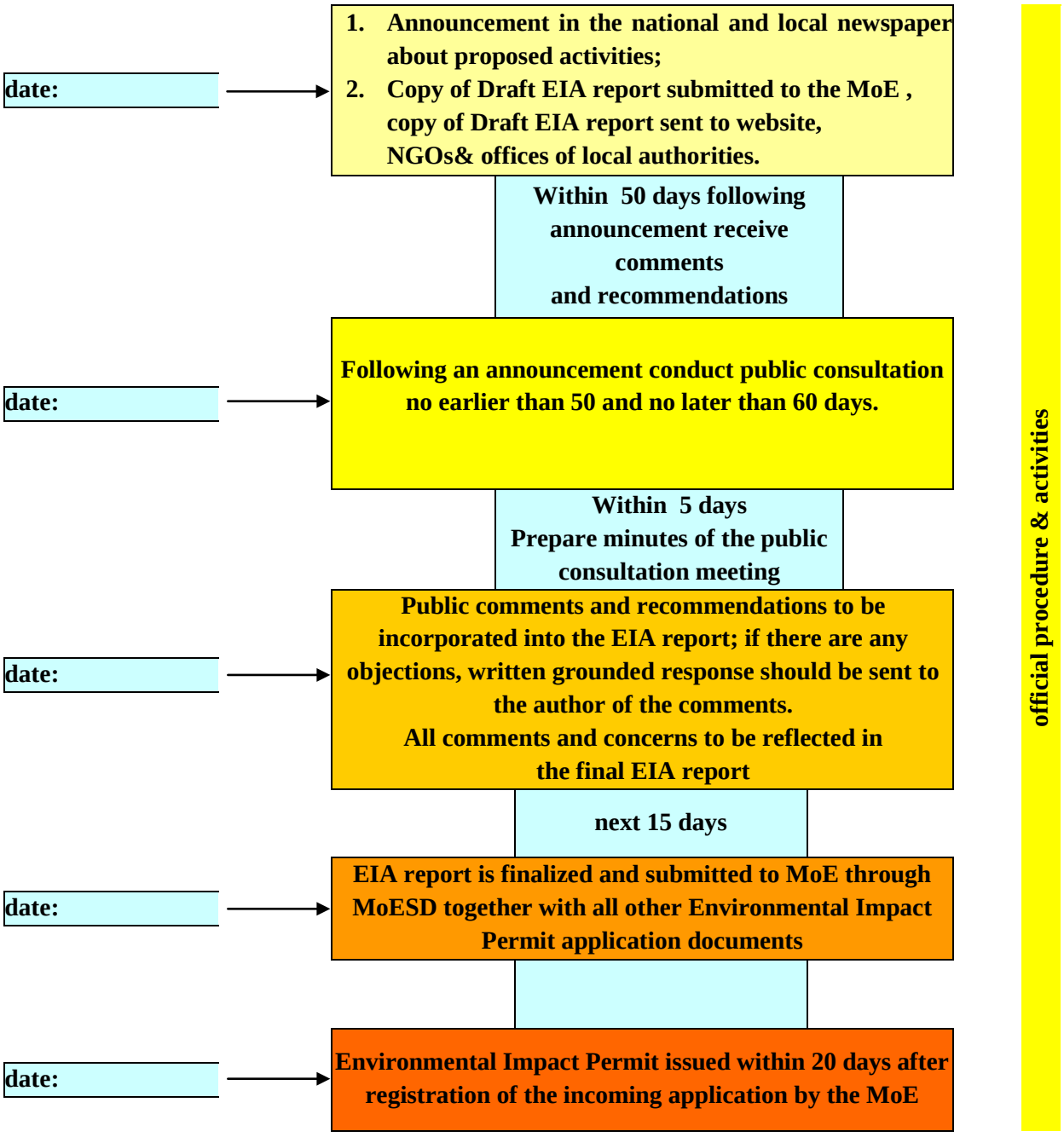


Fig. 3.1 Disclosure and Environmental Impact Permit Procedure

Rules for Construction Projects by Government Ministries

116. In accordance with paragraph 1a of the Decree N 160 of the Georgian Government (08/23/2006), where construction is carried out by a Ministry of the Government of Georgia or an entity acting on behalf of Ministry, no Permit for the Construction is required to be formally issued. The project documentation and the review procedures should, however, comply with the requirements set forth under the Rules and Conditions for Issuing Construction Permit as described above.

3.3 ADB Environmental and Social Safeguards Requirements (SPS 2009)

117. According to ADB Safeguard Policy Statement (2009) and Operational Manual Fl (2010), the Project is classified as category "A" and therefore an EIA is required for the Project. The process of determining a project's environment category is to prepare a Rapid Environmental Assessment (REA). REA requires the completion of the environmental categorization form prior to the project initiation. REA uses sector-specific screening checklist, taking into account the type, size, and location of the proposed project; sensitivity and vulnerability of environmental resources in project area; and the potential for the project to cause significant adverse environmental impacts. A project is classified as one of the four environmental categories (A, B, C, or Fl) based on the most environmentally sensitive component. Categories are as follows:

118. **Screening and Categorization.** ADB will carry out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose. Screening and categorization is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements.

119. **Environment Categorization.** ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

120. (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.

121. (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than forcategory A projects. An initial environmental examination is required.

122. (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

123. (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI (paras. 65-67).

124. **Involuntary Resettlement:** ADB will screen all projects to determine whether or not they involve involuntary resettlement. For a project involving involuntary resettlement, a resettlement plan will be prepared that is commensurate with the extent and degree of the impacts. The degree of impacts shall be determined by (i) the scope of physical and economic displacement, and (ii) the vulnerability of the affected persons. For FI projects, see paras. 65-67.

125. **Information Disclosure:** In line with ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. ADB will post the following safeguard documents on its website:

(i) for environment category A projects, draft environmental impact assessment reports at least 120 days before Board consideration;

(ii) draft environmental assessment and review framework, draft resettlement Frame works and/or plans, and draft Indigenous Peoples planning frameworks and/or plans before project appraisal;

(iii) final or updated environmental impact assessments and/or initial environmental examinations, resettlement plans, and Indigenous Peoples plans upon receipt;

(iv) environmental, involuntary resettlement, and Indigenous Peoples monitoring reports submitted by borrowers/clients during project implementation upon receipt.

3.4 EIA Requirements under Georgian and ADB Procedures

126. The following Table presents EIA requirements under Georgian and ADB procedures

Table 3.1 EIA Requirements Under Georgian and ADB Procedures

#	Action	Georgian Legislation	ADB Requirements
1	Screening	Project Proponent in consultation with MoE	Bank and Consultant hired by Project Proponent
2	Scoping	Not required. Could be conducted voluntarily by Project Proponent.	Obligatory. Bank and Consultant hired by Project Proponent
3	Draft EIA	To be prepared by Environmental Consultant.	To be prepared by Environmental Consultant.
4	Public Consultations	The EIA should be available for public review during 45 days. Publication of information in central and regional mass-media. Arrange consultation not later than 60 days from the date of publication.	At least two consultations for Category A projects – one at the scoping stage and one for the draft EIA.
5	Final EIA	Consider all comments received during public consultations, incorporate accepted remarks and explain rational when the comments are disregarded.	Consider all comments from Bank and public. Agree with the Bank on each raised point. Incorporate accepted public comments and explain rational when the comments are disregarded.
6	Management Plans	No clear guidelines on format, content and timing	Incorporate Monitoring and Management Plans in the EIA.
7	Review and Approval	MoE	Bank and separately - MoE (if the EIA is required by Georgian legislation)
8	Disclosure of final EIA	Not requested	Publication (mainly electronic) of the final EIA.

3.5 Environmental Screening for Current Project

127. In line with the legislation of Georgia, the activities related to the construction or reconstruction of the International and National motor roads and highways needs an Environmental Impact Permit to be issued and an Environmental Impact Assessment to be drafted.

128. The project is not related to the development of new territories or construction on the sensitive environmental sites. The project envisages the modernization of the existing road, i.e. its widening from a 2-lane road to a 6-lane road and construction of relevant infrastructure. Under ADB SPS 2009 - Provision on the Environmental and Social Safety Policy, the project belongs to category B. Preparation of the Initial Environmental Examination document is required for B category projects.

129. The format of required IEE for ADB and EIA for Ministry of Environment of Georgia is very similar, with some minor differences. In order to harmonize the ADB and Georgian requirements, one environmental assessment document will be prepared. It will be prepared in the ADB IEE format and in compliance with the requirements of Regulation on EIA issued by the MoE dated October 4, 2011. The Georgian version will be entitled as EIA.

130. Public consultation is necessary in line with the legislation of Georgia and requirements of ADB SPS 2009.

3.6 Administrative Framework

3.6.1 MDF and the Roads Department (RD or RDMRDI)

MDF

131. MDF has overall responsibility for the Project. This includes Environmental Management and the financing and supervision of all LAR tasks and for cross-agency coordination. MDF will exercise its functions and will be responsible for the general management of the planning and supervision to ensure implementation of all safeguards tasks.

132. MDF will be responsible for all LAR tasks both at central and local government level. Among other tasks MDFG will be responsible for (i) screening the projects and ensuring that the LARPs are sent to ADB for review, (ii) hiring and supervising the consultants that will prepare/execute the LARPs; (iii) establishing needed LAR capacity in each Municipality where LAR is relevant; (iv) ensuring proper internal monitoring; and (v) hire, following ADB recommendation, the external monitoring agencies. MDFG will also provide all needed documentation to ensure the prompt allocation of LAR budgets from the Government of Georgia and further payments to the APs, will maintain the coordination on all LAR related activities, and will engage in training as needed. In order to give MDFG the needed capacity to carry out these multiple and complex tasks the Program will provide to the MDFG the needed training.

133. The Roads Department of Ministry of Regional Development and Infrastructure (RD or RDMRDI) is responsible for elaboration of policy and strategic plans related to developing motor roads, management of road and traffic related issues and construction, rehabilitation, reconstruction and maintenance of the roads of public use of international and national significance, utilizing funds from the state budget, lawns, grants and other financial sources.

134. Thus, the RDMRDI is responsible for the implementation of road operation and maintenance tasks in relation with the current project.

3.6.2 Ministry of Environmental Protection (MOE)

135. 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

136. 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.

137. 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

138. Nuclear and Radiation Safety Department is responsible for
- Development of Nuclear and Radiation Safety Policy
- Radiation Safety Control

139. 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

140. Inspection of compliance with the conditions of Environmental Impact Permit

141. 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.

3.6.3 Ministry of Economy and Sustainable Development (MoESD)

142. 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.

143. 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.

3.6.4 Other Responsible Governmental Institutions

144. The Ministry of Culture, Monument Protection and Sports 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.

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

3.7 International Treaties and Conventions

3.7.1 The Convention on Biological Diversity, 1994

146. International cooperation is a dominant feature and driving force for environmental reforms in Georgia. 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 of plant, animal, and microbial life to begin using biological resources in a sustainable way and to ensure equitable sharing of benefits from biodiversity.

147. 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, which 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:

148. One out of 34 biologically richest and endangered land ecosystems (Conservation International);

One out of 200 vulnerable Eco regions (WWF);
One out of 221 endemic bird habitats (Bird Life International);
One of the World Agro biodiversity Centers.

3.7.2 The Convention on the Conservation of Migratory Species of Wild Animals

149. 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 was 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 Water birds" (AEWA).

150. 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.

3.7.3 Convention on Wetlands of International Importance

151. The Convention on Wetlands of International Importance, also called the Ramsar Convention aims to provide the framework for national action and international cooperation for the conservation and sustainable use of wetlands and their resources, especially as waterfowl. The convention was developed and adopted by participating nations at a meeting in Ramsar on February 2, 1971, and came into force on December 21, 1975. It entered into force on July 06, 1997 in Georgia.

3.7.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

152. CITES is one of the largest conservation agreements in existence, it is an international agreement between governments. The conventions aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 different species of animals and plants. The text of the convention was agreed upon in 1973, and CITES entered into force on 1 July 1975. The date of accession for Georgia was September 13th, 1996 and the agreement entered into force on December 12, 1996 in Georgia.

4. DESCRIPTION OF THE ENVIRONMENT

4.1 Physical Resources in Project Area

4.1.1. Climate

153.According to the climatic zoning, the cities of Tbilisi and Rustavi are included in the moderately humid subtropical climatic zone. The territory of the design road is characterized by moderately warm climate, transient from steppe to moderately humid (with hot summer and moderately cold winter). Below, we give the brief climatic description of the area:

1154. Temperature. The average annual temperature is 12.7^{0}C. The temperature of the coldest month (January) is +0.9^{0}C and that of the hottest months (July-August) is +24.4^{0}C, while the absolute maximum is +40^0. The soil freezing depth is 5 cm.

155. Atmospheric precipitations. The average and annual precipitations is 505 mm. The most rainy months and May and June, with the average precipitation amount of 86 mm and 72 mm, respectively. Average annual humidity is 66%. Snow cover appears on December 30 and disappears on March 1. The maximum of daily precipitations is 130 mm. Intense rains are frequent in Tbilisi with about 5 occasions a year on average.

In the Diagram below we give detailed information about the average monthly temperature and precipitation frequency in Tbilisi:

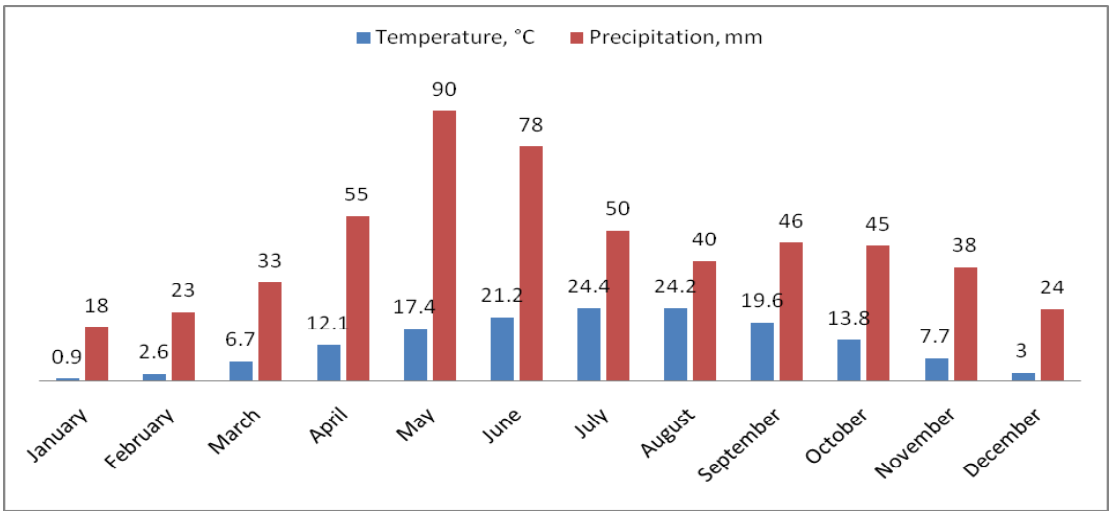


Diagram 4.1a. Average monthly temperature and precipitation frequency in Tbilisi

156. The main climatic characteristics are given in the tables below.

Table 4.1b Climatic data for Tbilisi

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
Peak high °C	19.5	22.4	28.7	34.3	34.9	38.7	40.0	40.3	37.9	33.3	27.2	24.0	40.3
Average high °C	6.0	7.4	12.1	18.2)	23.4	27.5	30.8	30.8	26.0	19.8	12.9	7.5	18.7
Average low °C	-2.2	-0.9	2.4	7.4	12.2	15.7	19.0	18.6	14.7	9.2	4.1	-0.2	8.4
Peak low °C	-24.4	-14.8	-12.8	-4.8	1.0	6.3	9.3	8.9	0.8	-6.4	-7.1	-20.5	-24.4
Precipitations, mm	19	26	30	51	78	76	45	48	36	38	30	21	498

157. The tables below show the climatic data based on the continuous observations (1881-1960) of Tbilisi weather station.

Table. 4.1 Duration of sunshine (hours)

M o n t h s												Annual Total
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
104	110	149	170	211	253	272	264	206	170	110	93	2112

Table. 4.2 Air temperature °C

M o n t h s												Average Annual	Annual Ampli-tude
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
0.9	2.6	6.6	11.9	17.3	21.1	24.4	24.2	19.6	13.8	7.6	2.8	12.7	23.5

Table. 4.3 Absolute minima of atmospheric temperatures °C

M o n t h s												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
-23	-14	-13	-4	1	7	9	9	1	-5	-7	-19	-23

Table. 4.4 Absolute maxima of atmospheric temperatures °C

M o n t h s												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
18	22	29	32	35	38	40	40	38	33	27	22	40

Table. 4.5 Soil surfase temperature °C

M o n t h s												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
0	3	8	15	22	27	31	30	23	15	7	2	15

Table. 4.6 Absolute maxima of soil surface temperatures°C

M o n t h s												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
27	34	48	55	64	69	70	69	62	51	36	28	70

Table. 4.7 Absolute minima of soil surface temperatures°C

Months												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
-26	-16	-15	-6	-1	6	8	8	-1	-8	-13	-22	-26

Table. 4.8 Annual repetition of wind directions

Cardinal points								
Nth	Nth/E	E	Sth/E	Sth	Sth/W	W	Nth /W	Calm
26	3	4	25	8	2	4	28	33

Table. 4.9 Wind speed (m/sec)

Months												Average Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2.2	2.7	2.8	2.8	2.5	2.5	2.8	2.3	2.1	2.0	1.7	1.8	2.4

Table. 4.10 Mean number of strong wind days (≥15m/sec)

Months												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2.0	2.2	2.9	2.5	1.4	1.1	1.0	1.1	1.0	1.0	1.2	1.3	19

Table. 4.11 Average atmospheric precipitation (mm)

Months												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
16	22	31	52	86	72	48	37	42	42	35	22	505

Table. 4.12 Maximal atmospheric precipitation (mm)

Months												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI		
68	87	88	130	198	220	175	203	179	139	126	83	767

Table. 4.13 Minimal atmospheric precipitation (mm)

Months												Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
0	0	1	5	5	3	1	0	1	4	1	0	241

Table. 4.14 Maximum daily precipitation

Months											
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
23	27	30	43	109	126	80	147	77	57	75	46

Table. 4.15 Relative air humidity (%)

Months												Average Annual
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
73	**69**	**66**	**62**	**64**	**60**	**56**	**57**	**64**	**73**	**77**	**76**	**66**

Table. 4.16 Air absolute humidity (mb)

Months												Average
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
5.2	5.4	6.1	8.6	12.4	14.8	17.2	16.7	14.2	11.0	8.2	5.9	10.5

4.1.2 Air Quality

The available data on the air quality in Tbilisi

158. At present the National Environmental Agency monitors the air quality in Tbilisi in three points located in Agmashenebli, Tsereteli and Moscow avenues. The last two ones were installed in 2009 and at present only CO and SO_2 concentrations are measured. The observation point at Agmashenebeli Avenue is in a relatively better condition measuring the following parameters of the ambient air: the total amount of particulate matter, carbon oxide, Nitrogen dioxide (NO_2), lead (Pb) and low level ozone concentrations.

159. The following can be concluded based on the available data on the ambient air quality in Tbilisi:

- the concentrations of CO, SO_2, NO_2 and particulate matter in Agmashenebeli Avenue which has heavy traffic and is located in the center of Tbilisi exceeds the national standards in 2004-2010. The lead concentration has decreased since 2008. and is now slightly lower than the national standard. Low-level ozone measurements started in 2010. These measurements are carried out only in Agmashenebeli Avenue and according to the National Environmental Agency the concentration of this pollutant is within the limits of the maximum allowable concentration (MAC).
- The data of 2010 showed that CO and NO_2 concentrations in Tsereteli Avenue, where the trafiic is heavy, exceeded the national standards.

160. In 2010 CO concentration was within the limits of the national standards in Moscow Avenue, which is quite far from the city center. However, NO_2 concentration in this area exceeded the national standard.

Project study data

161. Within the limits of the presented EIA, the air sample analysis on 4 project sites was made by the Environmental Agency. Site 2 is located in Phonichala within the road section 2. The objective of the air pollution analysis is to give an approximate evaluation of the existing situation on a particular project site, which can be used to forecast the data of the project impact analysis and traffic pollution. The report of the Environmental Agency showing the results of the air sample analysis is given in Annex 2. Below, we give a short abstract.

Table 4.17 Results of measuring the polluting substances in the atmospheric air. Compared with the instant (single-shot) maximums admissible concentrations (MAC)

№	Site of measurement	t^0	Humidity %	Concentration mg/m^3			
				Dust	CO	NO_2	SO_2
№ 2	Ponichala (9,0km)	3.0	32	0.098	1.42	0.076	<0.1
MAC				0.5	5.0	0,2	0,5

162. As the Table shows, the indicators of background emissions along the project road are within the established norms.

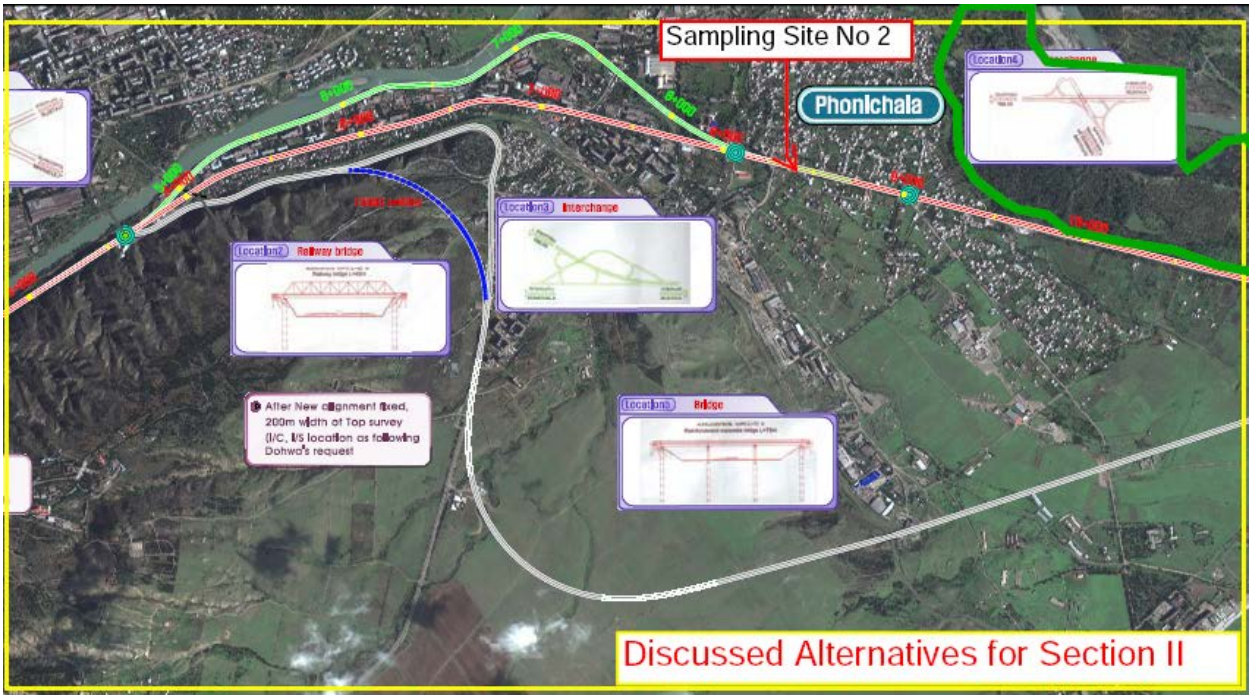


Fig. 4.1 Air sampling sites

4.1.3. Background noise and Vibration

Existing information about the background noise in Tbilisi

163. In March of 2004, the Institute of Geophysics of the Academy of Sciences of Georgia accomplished test studies in the residential areas at night and by day, in particular at 8 sites in Digomi massif in windless weather. The same group made similar measurements at 10 points of Old Tbilisi in December of

2005. The averaged noise does not exceed the parameters established for the residential areas.[1] In particular, the maximum permissible level is 55 dB 2 m from the residential houses by day and it is 45 dB at night. It is established that noise in the central streets and mains of Tbilisi exceeds the admissible level in rush hours (See Table 4.3) and reaches 78 dB on some sites of major road mains and streets, while the maximum permissible level from 7 pm to 11 pm is 65 dB and from 11 pm to 7 am it is 55 dB along the central road mains. The highest indicator of 78-80 dB is fixed in Varaziskhevi.

Table 4.18. Background noise in some districts of Tbilisi

Measurement site	Noise level, dB	In excess of the admissible norm, dB
Rustaveli Avenue 15	76	11
Left bank of the river Mtkvari	76	11
Varaziskhevi	80	15
Melikishvili street	76	11

Source. Institute of Environmental Protection, 2002

164. The difference between the data is clear if considering that the main source of noise in Tbilisi is traffic.

Table 4.19 Admissible noise levels in Georgia for the areas in the immediate vicinity of the residential houses

Time	Admissible equivalent (averaged) noise, dB	Maximum admissible noise levels, dB
7.00 – 23.00	55 (65*)	70 (80*)
23.00 – 7.00	45 (55*)	60 (70*)

*Note. The equivalent and maximum sound levels (dB) for eth noise originating in the area due to the car and railway traffic, distanced from the construction isolating the first echelon of sound-protected residential houses, hotels, hostels by 2 m, directed towards the common city and regional mains and railway, is admitted to be 10 dB more (precision = +10 dB; see values in brackets) than the basic admissible value..

Project study data

165. The background noise was measured along the design road in close vicinity with the apartment buildings (Site1 - km5+300, Site 2 - km5+800; and Site 3 - km6+600) – and at the Site 4 km 8+200 near the existing road – (3m). Measurements conducted at 14:00 pm on April 15, 2013. The existing background noise was measured with a device “PCE-EM882”. For half an hour, the readings were measured in every 1 minutes (total of 30 readings for each point) and the average indicator was calculated for every noise point. The average noise level amounted to:

Site 1 - 62 dB
Site 2 – 58dB
Site 3 – 63dB
Site 4 – 65dB

166. The maximum noise level was 75 dB. Thus, the fixed noise level near the apartment buildings is within the established norms, but is close to the limit.

[1] Decree No. 297/N of August 16, 2001 of the Ministry of Labor, Health and Social Affairs “On approving the standards of environmental quality”

167. The repeated session of measurements has been executed in August 2013 – noise and vibration has been measured near the apartment buildings along the design road and at the point, where the design road merges with the existing Tbilisi-Rustavi road. Evaluation has been conducted by the consulting company "Ecotech Ltd", by PhD Nugzar Sulamanidze and PhD Anatoli Nikolaishvili. The noise measurements were made by means of German device Robotron 00017 and the vibration measurements by means of Robotron 00042 with filters 01025.

168. The measurement data is provided in a table below.

Measurement site	Noise, dbA	Vibration, db(V)
1. Building 2F, Km 5+300	45	25
2. Building $9F_1$, Km 5+350	40	23
3. Building $9F_1$, Km 5+450	43	24
4 Building $9F_2$,, Km 5+500	42	22
5. Building 6F, Km 5+650	43	23
6. Building 5F, Km 6+800	41	21
7. Km 8+200 Point, where the design road merges existing road; At the edge of road;	76	65
Admissible Maximum Level for Day-time (7.00 – 23.00) for the first row of residential buildings adjacent to roads;	65	74
Admissible Maximum Level for Night-time (23.00 – 7.00) for the first row of residential buildings adjacent to roads;	55	69


Fig. 4.2. Noise and Vibration Measurements

4.1.4. Background radiation

Existing data

169. According to the data of 2009 of the Monitoring and Forecasting Center of the Ministry of Environmental Protection and Natural Resources of Georgia, the background radiation level for Tbilisi (exposition strength of γ-radiation in the near-ground atmospheric air) was 14.4 mR/hr.

Project study data

170. The radiation background was screened along the whole selected route of the mains section. Measurements were made on December 15, 2011 with a standard Russian device СРП 6801. The measurements were made during traveling by car all along the road and most densely populated stationery area (starting point of Ortachala 0.00 km). The radiation background levels varied between 6 to 8 mR/hr at different place.

Fig. 4.3 Device CPII 6801 for Radiation Measurements

4.1.5. Information about the surface watercourses and ground pollution

Existing information about the surface water quality

171. The surface water quality in Tbilisi and Georgia is monitored by the National Environmental Agency of the Ministry of Environmental Protection.

172. The monitoring usually takes place in three sections of the river Mtkvari: 1) Zahesi, at the entrance of the city, near Zemo Avchalhesi (Avchala hydropower station); 2) Vakhushti bridge, in the center of Tbilisi; 3) Gachiani, along the river Mtkvari lower reach, beyond the city limits. 33 major parameters are examined monthly on these sites. In addition, the National Environmental Agency ensures seasonal monitoring of microbial parameters near Ku lake (Tortoise lake).

173. A 10-year-long observation shows that the river Mtkvari in Tbilisi is mostly polluted with nutrients - ammonium ions, whose concentration at the three points of observation (above the reach, in the city center and below the reach) exceeds the maximum permissible standards of Georgia and European Union for several times. This is caused by the untreated sewage waters flowing into the Mtkvari threatening the trouble-free performance of the sewerage system and discharge water treatment plant. Another polluting substance for fish, sodium nitrite exceeds the maximum admissible concentrations fixed by EU only, but is within the limits of Georgian standards.

Table 4.20. Water quality in the river Mtkvari in Tbilisi hydropower station section

Water-bearing phase	pH	Ion content, mg/l								P mg/l	Si mg/l	Fe mg/l
		Ca^{2+}	Mg^{2+}	Na+K	HCO_3	SO_4^{2-}	CL	NO_3	NO_2			
Winter low-water season	7.61	45.4	12.6	7.0	163.5	35.6	4.3	3.00	0.002	0.023	7.00	0.04
Spring flood	7.39	36.0	5.1	10.5	122.6	23.0	3.3	3.50	0.019	0.001	3.0	0.02
Summer low-water season	8.02	55.7	11.9	26.2	180.0	76.9	8.5	1.50	0.007	_	4.3	0.02
Autumn freshet	7.59	46.2	11.9	17.0	167.8	49.9	6.4	_	_	0.038	2.9	0.01

174. At the same places, particularly at Vakushti bridge and Gachiani (2008-09), high concentrations of biological oxygen demand (BOD-5) are fixed. On the other side, the concentrations of diluted oxygen meet Georgian and EU standards (admissible minimum) and are quite high for normal fish development what is presumably caused by relatively rapid flow and high water level. The concentration of other nutrients - sodium nitrites and phosphor ions is within the admissible norms.
The indicators of the water quality in the river Mtkvari in Tbilisi hydropower station section and river water regime in different phases are given in Table 4.20.

Project study data of surface water quality

175. The water sample of the river Mtkvari was taken near the starting site of the design road (Ortachala) and close to the end point of section 2 (in Krtsanisi Park, near km 11.00 of design road). The report of the Environmental Protection Agency showing the results of the surface water samples is given in Annex 3. Below, we give a brief summary.

Table 4.21. Design studies data on the pollution of soil with heavy metals

#	Description	Maximum Permissible Concentration	Mtkvari Ortachala	Mtkvari (in the Patriarchate's forest)
			N 41^{0}40'31,6'' E$_O$ 44^{0}50'10,0''	N 41^{0}37'09,5'' E$_O$ 44^{0}56'24,0''
1	Turbulence, NTU		1.67	1.58
2	pH	6.5-8.5	8.211	8.603
3	Diluted oxygen, mg/l	4 – 6	8.15	8.45
4	Hydrocarbonates, mg/l		173.2	173.2
5	TDS, mg/l		257.0	274.0
6	Total nitrogen, N, mg/l		2.772	2.479
7	Total phosphate, mg/l		0.266	0.135
8	Chlorides, mg/l	350	20.2	19.37
9	Oil products, mg/l	0.3	0.024	0.012

Information about the soil pollution

176. Within the limits of Tbilisi and particularly, near the design site, no information about the ground pollution could be obtained. Therefore, we rely on the project study data only. The samples (see fig. 4.2) were taken at the sampling site No 2 (km 9.0) and 3 (km 13.5). Analysis to assess the pollution was made on heavy metals, particularly lead. The report of the Environmental Protection Agency showing the results of the ground sample analysis is given in Annex 3. Below, we give a brief summary.

177. Tentative Allowable Concentration (TAC) of Heavy Metals in Soils of Various Physical-chemical properties (total content mg/kg)

Table 4.22. Design studies data on the pollution of soil with heavy metals.

#	Description	Ponichala **(9,0km)**	Rustavi highway **(13,5km)**
		N 41^{0}37'58,7'' E$_O$ 44^{0}55'07,7''	N 41^{0}35'54,3'' E$_O$ 44^{0}56'30,4''
1	Lead, Pb, mkg/g	15.4	42.33
2	Zinc, Zn, mkg/g	61.9	91.6
3	Cobalt, Co,mkg/g	12.76	12.69
4	Copper, Cu,mkg/g	81.8	98.6
5	Nickel, Ni, mkg/g	18.2	19.7

Table 4.23.

No	Pollutant	Soil Type	TAC considering the background	Aggregate condition of the Pollutant in Soil
	Nickel	a) sandy and sandstone b) acid soils (clay and loam) PHKCI<5,5. c) neutral and close to neutral (clay and loam) PHKCI<5,5.5,5.	20 40 80	Solid: as salts, sorbed, in the composition of minerals
	Copper	a) sandy and sandstone b) acid soils (clay and loam) PHKCI<5,5. c) neutral and close to neutral (clay and loam) PHKCI>(5,5.	132 33 66	Solid: as salts, sorbed organic-mineral compounds, in the composition of minerals
	Zinc	a) sandy and sandstone b) acid soils (clay and loam) PHKCI<5,5. c) neutral and close to neutral (clay and loam) PHKCI>(5,5	55 110 220	Solid: as salts, sorbed organic-mineral compounds, in the composition of minerals
	Lead	a) sandy and sandstone b) acid soils (clay and loam) PHKCI<5,5. c) neutral and close to neutral (clay and loam) PHKCI>(5,5	32 65 130	Solid: as salts, sorbed organic-mineral compounds, in the composition of minerals

4.1.6. Topography and relief

178. Tbilisi is located in South Caucasus at $41^0$43' North latitude and $44^0$47' East longitude. The capital of the country is situated on the both banks of the river Mtkvari, at 380-770 m altitude above sea level. It has an amphitheatre shape and is bordered with mountains from its three sides. Tbilisi is bordered by Saguramo Ridge from the north, by Iori Plateau from the east and south-east and by the branches of Trialeti Ridge from the south and west (See Fig. 4.4). The city is stretched along 33 km along the river Mtkvari and covers the area of 372 km^2.

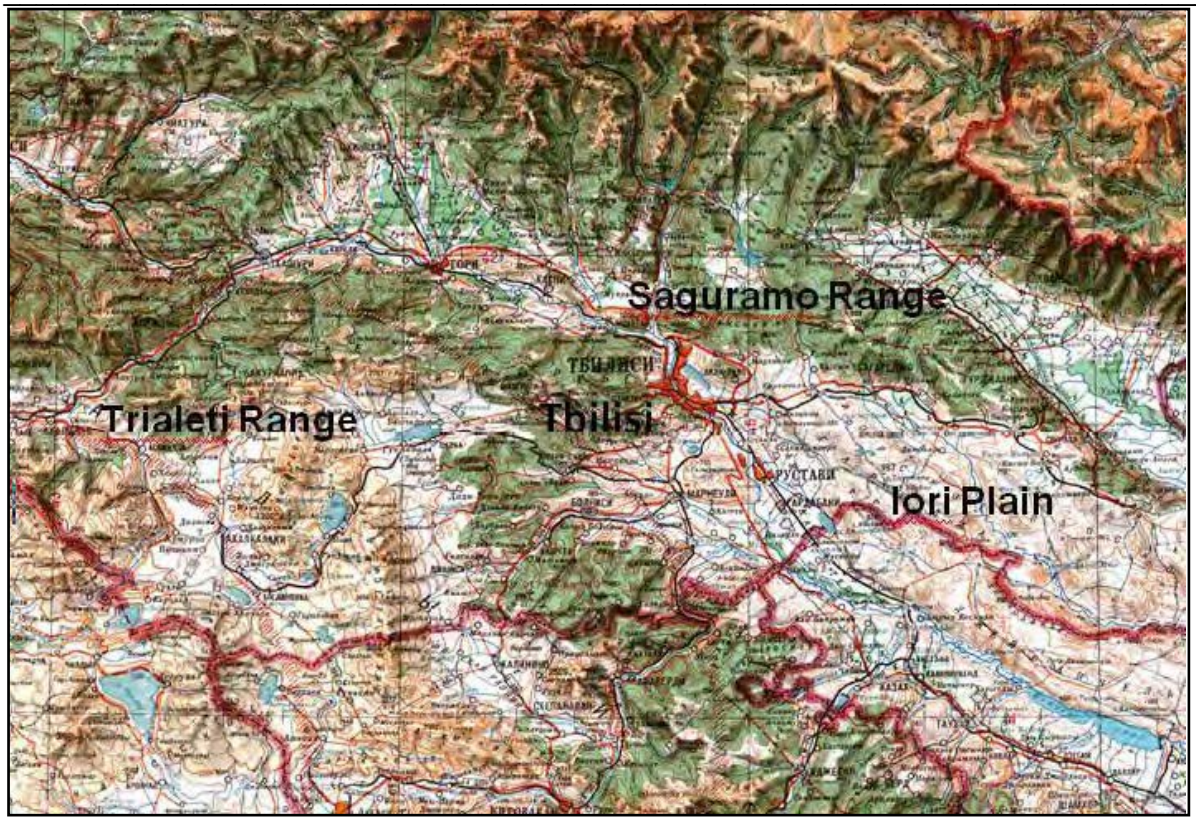


Fig. 4.4 Topographic map of Tbilisi

179. The river divides the capital into two. The left part of Tbilisi exceeds its right part with its area and population. The portion of the city on the left bank of the river Mtkvari is stretched from Avchala district to the river Lochini, and the relief of its right bank is presented by the branches of Trialeti Ridge descending as escarps towards the Mtkvari gorge. Therefore, the major obstacles for the city to extend on the right bank of the river are mountains. Within such geographic environment, there are highly densely populated sections, while other areas of the city due to their complex topographic relief, are not developed. The south-eastern part of the city is located at 350 m above sea level and the settled areas of Mtatsminda are located at 550-600 m above sea level.

180. The relief of Tbilisi is complex and its diversity is the result of its geomorphological structure. The relief had been subject to a strong transformation for centuries. Out of the natural-tectonic phenomena, the landslides, mudflows, erosion and floods are active. Landslide and gravitational phenomena are the main factors hampering the development of Tbilisi and damaging the city infrastructure.

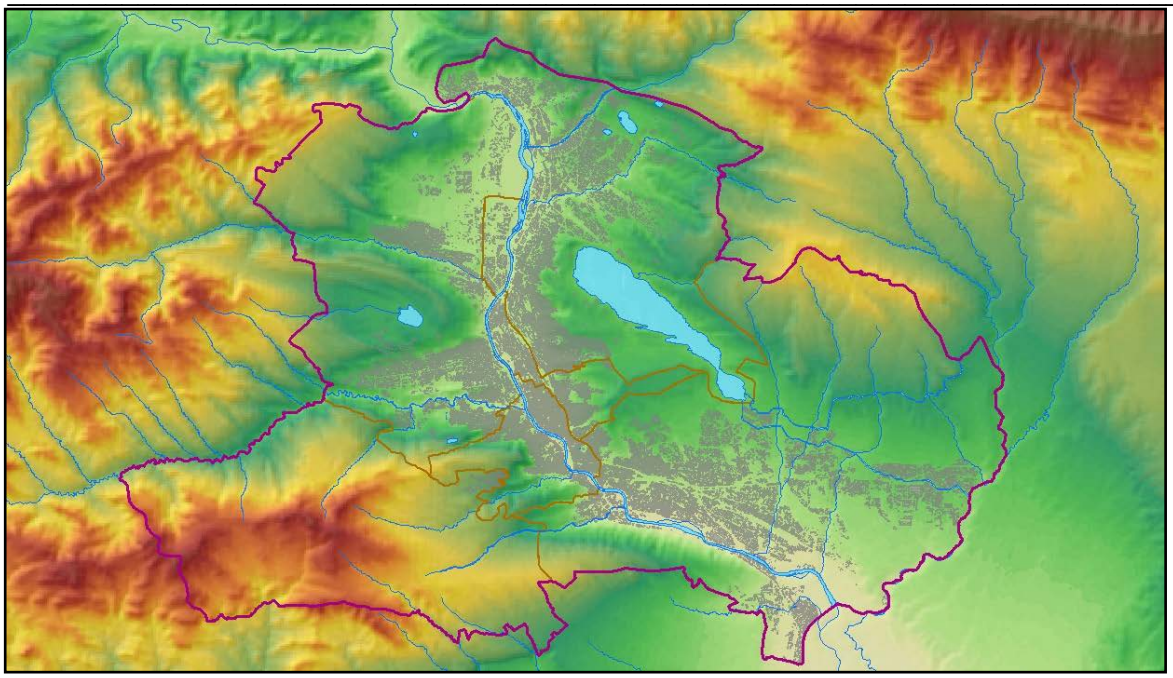


Fig. 4.5 Topography

181. There are two zones of modern relief identified within the limits of the study area, in particular, the Lesser Caucasioni and Kvemo Kartli Plain. The former morphological element is represented as Teleti ridge, which is the south-eastern end of Trialeti Ridge and covers the extreme northern-eastern part of the study area (a small part of it). The height of Teleti ridge gradually reduces eastwards and over the settlement adjacent to Soganlugi it merges with the alluvial plain of the river Mtkvari. The subsidence of the ridge in the east results from the subsidence of the paleogenic stratum in the same direction. The ridge is asymmetric in shape with its northern slope inclined more (20-45º) than its southern slope (15-20º). A coincidence of the morphological form and tectonic structure is observed over Teleti ridge. In particular, its crest coincides with Teleti anticline. The crest section of the ridge is characterized by hilly relief with its absolute heights varying from 440 m to 606 m. The relative height of the northern slope of the ridge in relation to the river Mtkvari varies between 80-200 m.

182. Kvemo Kartli valley covers a significant section within the limits of the study area, which is presented as Asureti-Tsalaskuri plain and is located between Teleti and Ialguja ridges. The territory is presented by the terrace surfaces of the river Mtkvari (the I and II right over-floodplain terraces). The surface of the plain is inclined south-east (up to 10º), towards the bottom of Ialguja ridge. On its part, the surface of the plain is slightly complicated with small gorges (Tsiviskhevi, Satirmatsaskhevi), flowing across the villages Soganlugi and Krtsanisi.

4.1.7 Geology and tectonics of the area

183. According to the tectonic zoning of Georgia (E. Gamkrelidze, 2000), the study area is included in the southern and Bolnisi sub-zones of the folded system of the Lesser Caucasioni. The geology of the area is participated by the rocks from the Middle Eocene through the Quaternary periods.

184. The deposits of volcanogenic-depository formation of the Middle Eocene are spread in the north-western part of the study area. The area of spreading of these deposits coincides with that of Teleti

anticline and they are represented by layered tufas and tufa-breccias. The stratum is characterized by facial modifications, which are strongly dislocated.

185The deposits of the Upper Eocene are spread in the north-western part of the study area. Lithologically, the Upper Eocene is divided into two strata: the lower Navtlughi stratum and the upper Tbilisi stratum with nummulites. Only the former stratum is spread over the study area. It is mainly represented by marls, argillite-like clays with sandstone and tufa-sandstone interlayers. The total thickness of Navtlughi stratum in the environs of Teleti ridge varies from 150 to 260 m.

186. The Oligocene (Khadum horizon) deposits are spread in the central part of the study area, which are mostly represented by clays with gypsum and rarely with sandstones. The thicknesses of Khadum horizon clays reach 50-70 m.

187. The Lower Miocene deposits, which are spread in the southern part of the study area, is presented by two lithological strata: the lower sandstone stratum belongs to Sakaraulo horizon, and the upper stratum, which is almost totally structured with Maykop habitus clays, belongs to Kotsakhuri horizon. Sakaraulo deposits almost horizontally lie over the deposits of the Oligocene age. The horizon is structured with strong sandstones with quartz-arkose content with clay and micro-conglomerates interlayers. The sandstones are of a typical whitish color. The total strength of the horizon reaches 600 m. The deposits of Kotsakhuri Age are presented by non-carbonate thin-layer dark clays, which reach 600 m when weathered. The dark clays of Kotsakhuri Age disintegrate into thin brown slates during weathering. At some places, there are broken sandstones and sand interlayers spread in the given clays. The average strength of the horizon is 600 m.

188. The deposits described above over the study area are covered with the Quaternary deposits of different thicknesses almost everywhere, which on their turn are presented by the I and II right over-floodplain terraces of the river Mtkvari of alluvial genesis and deposits of deluvial-proluvial genesis. The deposits of alluvial genesis in the study area are spread most of all and are presented by marly, well-treated shingle with the admixture of boulders (5%) and sand-gravel filler (15-20%). The thickness of the mentioned deposits within the limits of the study area reaches 10-15 m.

189. Deluvial-proluvial deposits in the study area are mostly spread in its northern part and are presented by clay ground (clay and loam) with the admixtures of detritus and grit (20-25%). Their thicknesses, if considered visually, vary between 3 and 5 m. The greatest tectonic unit in the study area is the eastern end of Bedena-Teleti anticline, which on its part is divided into Teleti and Tabori anticlines. On their part, these anticlines are divided by Krtsanisi and Tsalaskuri synclines.

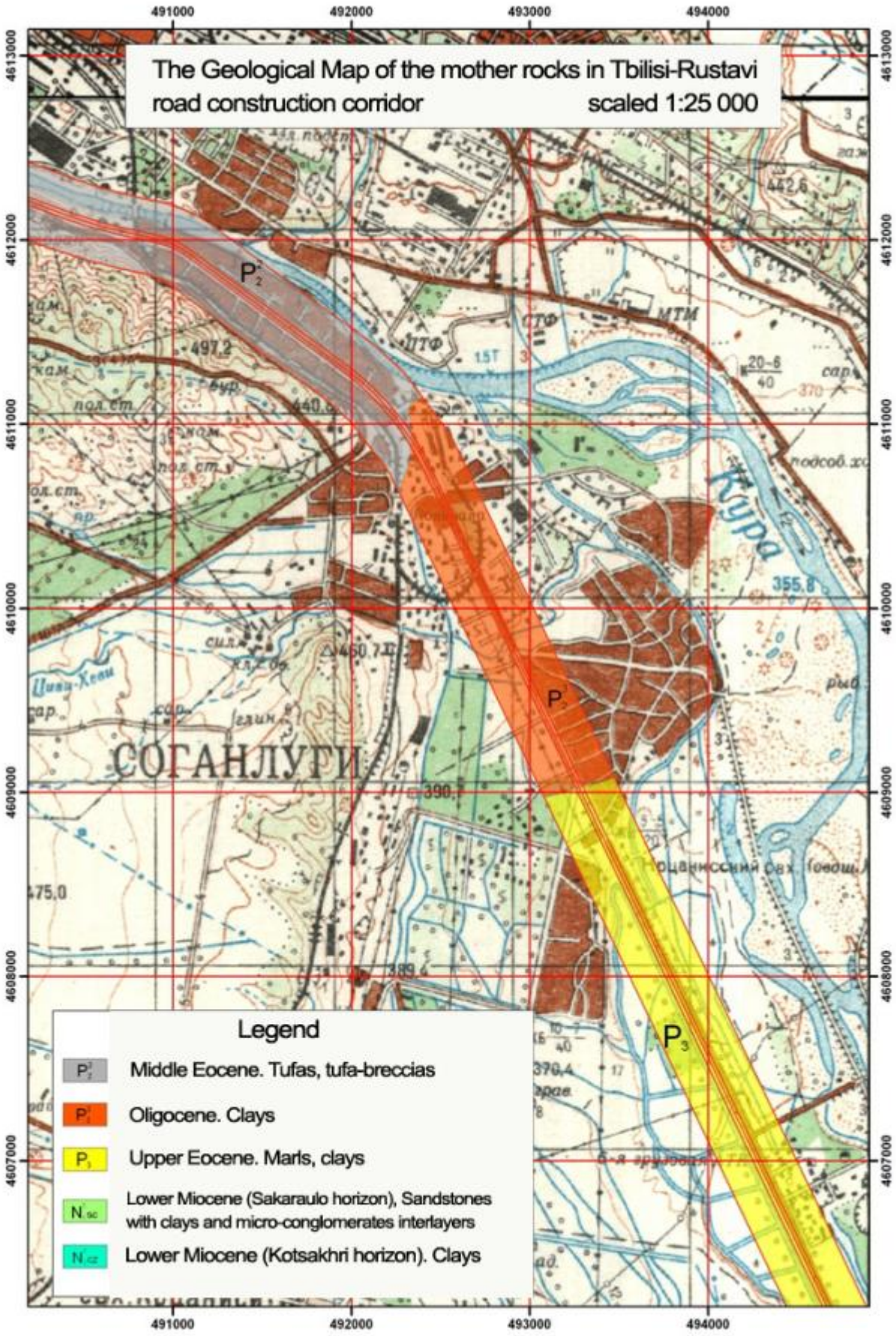


Fig. 4.6 Geological Map of Project Area

Seismicity

190. The study area is located within the limits of Aspindza-Tbilisi morphostructural unit, which on its part is complicated by tectonic faults crossing one another. The zone is located within the high-risk area of seismicity. According to the macro-seismic zoning of Georgia, the study area belongs to point 8 seismic zone (Decree No. 1-1/2284 of the Minister of Economic Development of Georgia of October 7, 2009, Tbilisi "On approving building standards and rules - "Earthquake-resisting construction" (PN 01.01-09)). The settled areas in the study area, which are Tbilisi, Soganlugi and Rustavi, face the danger of point 8 earthquakes. According to the existing statistical data, high-magnitude earthquakes capable of significantly damaging the modern engineering structures (including the road) and impacting the morpho-dynamics of the relief, have occurred more than once historically as well as in the near past. Below, we give the existing statistical data.

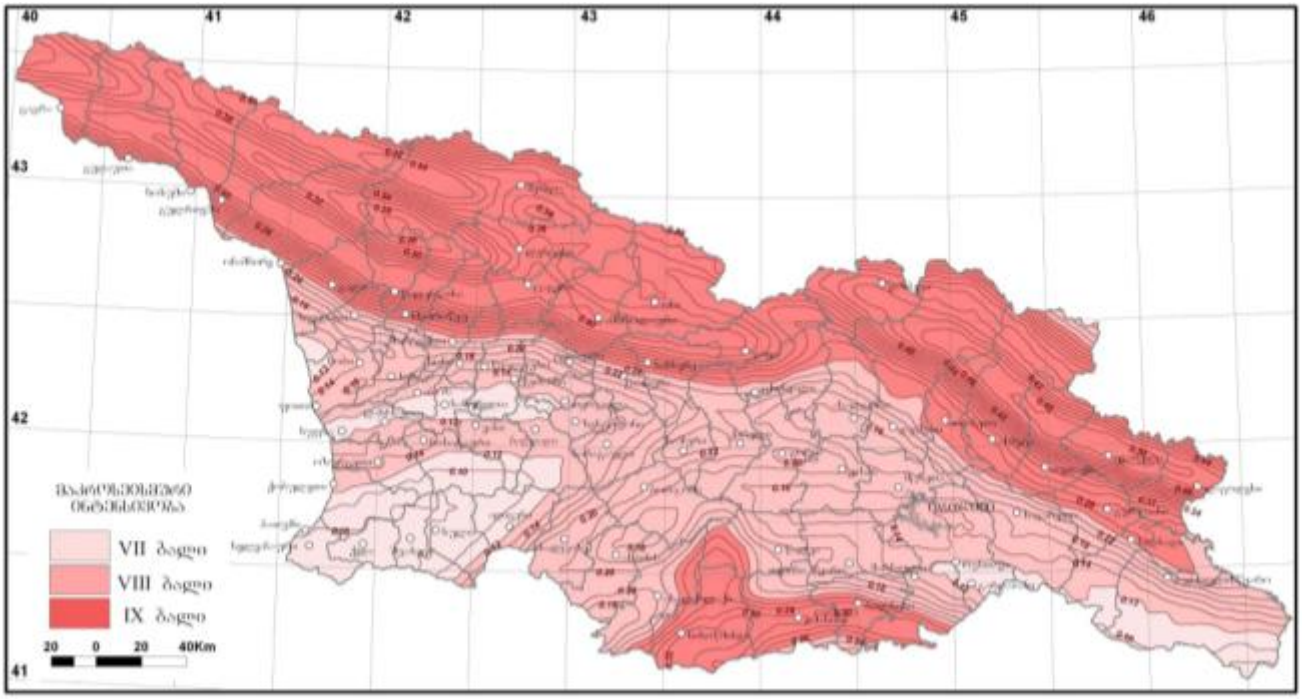


Fig. 4.7. Seismic Hazard Map indicating maximal horizontal acceleration and intensity
Note: accelerations are given in "g" units.

191. A 6-7-point earthquake in Tbilisi took place in the years of 1283, 1318, 1803, 1827, 1859, 1909, 1920 and 2002. According to the earthquakes occurred during the XX century, the duration of quakes varies between 2.1 and 3.6 seconds. The nature and direction of spreading the seismic waves mostly depend on the location of tectonic fault structures. The dominating direction (sub-lateral) of spreading of the seismic waves in the study area is northern-western-southern-eastern.

192. Below we give the characteristics of maximum horizontal accelerations of seismic waves (dimensionless coefficient of seismicity) for the settled areas within the limits of the study area:

1. 0.17 m/sec^2 in Tbilisi
2. 0.12 m/sec^2 in Rustavi
3. 0.174 m/sec^2 in village Soganlugi.

Hydrogeology

193. According to the hydrogeological zoning of Georgia (Buachidze I. (1979)), the study territory is located in the region of porous and fissure waters of Marneuli-Gardabani artesian basin of block Artesian basin of Georgia and in the region of fissure and fissure-karst waters of Tbilisi water-pressure system of water-pressure system of Adjara-Trialeti folded zone.

194. Two principal hydrogeological complexes may be identified within the limits of the study area: the water-bearing horizon of main rocks and the water-bearing horizon of Quaternary rocks. The water-bearing horizon of the main rocks is presented by Eocene, Oligocene and Miocene water-proof laguna-marine and volcanogenic deposits: tufas, tufa-breccias, clays, sandstones, marls, argilites. Out of the volcanogenic rocks of the Middle Eocene, there are rare fresh and cold water outcrops at the bottom of the gorge edges as seepage waters. An exception is the thermal waters of deep circulation in the rocks of the same age. According to their chemical content, the underground waters associated with the Middle Eocene rocks, are of two main types:

195. Thermal curing waters with their outcrops associated with tufogenic waters. With their chemical content, these waters are chloride-hydrocarbonate-sodium, with the mineralization of 0.25-0.34 gr/l and sulfate-chloride-sodium-calcium, with the mineralization of 0.68-0.87 gr/l. Their temperatures vary from 26 to 50ºC.

196. Cold water outcrops, which are associated with volcanogenic rocks, are hydrocarbonate-calcium-magnesium, with the mineralization of 1.4 gr/l to 2.6 gr/l and sulfate-hydrocarbonate-calcium-sodium, with the mineralization of 0.6 gr/l. The temperature varies from 6 to 18ºC. It should be noted that the underground waters of deep circulation of the Middle Eocene are characterized by high content of hydrocarbon of up to 12 mg/l. These waters often contain methane of up to 19.26-22% and nitrogen.

197. The deposits of Oligocene-Lower Miocene - clays, sandstones, marls, argilites are characterized by low collector properties. Even some sandstone species, containing carbonates, are in fact waterproof. The underground waters in these deposits mostly circulate above the local erosion section level and locally outcrop over the edges of watercourses (rivers, gorges), where they cross water-bearing layers of minor thicknesses. The flow of the springs is little (one-hundredth of litre per second), and the springs associated with fissure sandstones have a greater flow (up to 0.3 m/sec). The underground waters are of different chemical content, with their mineralization mostly depending on the content of gypsum in the rocks. The waters are sulfate, sulfate-hydrocarbonate, sulfate-chloride and sodium-calcium-magnesium with the general mineralization of 3.2-6.6 gr/l. They are characterized by high value of hardness (pH=7).

198. Out of the rocks (alluvial, deluvial, proluvial) of the water-bearing complex structured with the Quaternary deposits, the high terraces of the river Mtkvari are mostly water-infused in the study area. The water outcrops associated with the given deposits are mostly of a little flow. With their chemical content, the waters are sulfate-hydrocarbonate and calcium-sodium-magnesium. Their general mineralization varies from 1.0 to 1.0 gr/l.

199. During the road construction and operation in fact no pollution of the underground waters along the road corridor is expected.

4.1.8 Assessment of the Design Corridor Engineering-Geological Conditions by pickets (kilometer points)

Averaged physical-mechanical (geotechnical) properties of the grounds structuring the study area

200. Below we give the Averaged physical-mechanical (geotechnical) properties of the grounds structuring the study area.

201 .The density of tufas is 1.1 gr/cm^3, their porosity is 7%, their softening ratio is 0.86, the angle of internal friction is 37º, the adherence is 170, the temporal resistance uniaxial strength (Rc) is 70, the modulus of deformation is 2, and the modulus of elasticity is 4.

202. The density of sandstones is 2.30 gr/cm^3, their porosity is 8%, their softening ratio is 0.77, the angle of internal friction is 29º, the adherence is 9, the temporal resistance uniaxial strength (Rc) is 100, the modulus of deformation is 4, and the modulus of elasticity is 10.

203. The density of clays is 1.95 gr/cm^3, their coefficient of porosity is 0.70%, their plasticity index >17, index of consistency is 0.0-0.25, the filtration coefficient <0,001, the angle of internal friction is 20º, the adherence is 0.60, the provisional estimate resistance (Rc) is 5 k ^{rce}/cm^2, the modulus of deformation is 240, and the modulus of elasticity is 390.

204. The density of marls is 2.30 gr/cm^3, their porosity is 31%, their softening ratio is 0.81, the angle of internal friction is 31º, the adherence is 40, the temporal resistance uniaxial strength (Rc) is 50, the modulus of deformation is 2, and the modulus of elasticity is 5.

The density of argilites is 2.0 gr/cm^3, their porosity is 32%, their softening ratio is 0.30, the angle of internal friction is 19º, the adherence is 3, the temporal resistance uniaxial strength (Rc) is 10, the modulus of deformation is 2, and the modulus of elasticity is 4.

205. The density of loams is 1.75 gr/cm^3, their porosity is 05%, the number of plasticity is 10, the consistency index is 0.0-0.25, the filtration coefficient is 0.05, the angle of internal friction is 21º, the adherence is 0.25, the provisional estimate resistance is 2 kg/cm^2, the modulus of deformation is 190, and the modulus of elasticity is 340.

206. Shingle with boulder admixtures (5%) and sand-and-gravel filler. The density of the given ground is 1.95 gr/cm^3, the porosity coefficient is 0.60, the filtration coefficient is 50 m/day, the angle of internal friction is 35º, the adherence is 0.07, the provisional estimate resistance (R_0) is 6 kg^{force}/cm^2, the modulus of deformation is 480, and the modulus of elasticity is 3800.

207. The constituent grounds of the road corridor are mostly characterized by favourable bearing properties and in fact no complications in this respect are expected during the road operation.

General description of the engineering-geological conditions of the road construction corridor with the indication of piquets (kilometers)

208. The section of KP 04km+600m-KP 13km+00m runs within the borders of the I right over-floodplain terrace surface of the river Mtkvari. Most of the territory is populated, and a part of its ending is used as agricultural plots of field. The geology of the territory is participated by shingle of alluvial genesis with the admixtures of boulder and sand-and-gravel filler, which are covered with loams of different thicknesses. No hazardous geological processes are fixed on the given territory and no origination or activation of such processes is expected in the future. According to the complexity of the engineering-geological conditions, the given territory belongs to the I (simple) category.

Fig. 4.8 Small island of alluvial genesis

209. The report is attached by a schematic map of zoning of the construction corridor of the design road and adjacent territories according to the engineering-geological conditions (degree of geological hazards), with three categories identified according to the given sign: sections of the I (simple), II (average) and III (complex) categories. The areas are categorized by considering different factors, in particular, by geomorphologic conditions; geological conditions – relation of the premises and communications to the geological environment; hydrogeologycal conditions; geological processes and their possible impact on premises and communications; presence of specific grounds and their impact on communications, etc.

210. The I (simple) category unites the territory located within one geomorphologic element, with its surface being horizontal and not dissectioned. In a geological respect, the territory is presented by no more than two lithological layers with their location being horizontal (or slightly inclined), or by rocky rocks, which be may covered with non-rocky rocks of a little strength, outcropping onto the surface. As for the underground waters, they are either absent, or presented by one sharply expressed horizon and having a homogenous chemical composition. No hazardous geological processes or specific grounds (settling, swelling, etc.) are found here.

211. The II (average) category includes the territories, which are spread within the limits of several geomorphologic elements of a similar genesis, with their surfaces slightly inclined and dissectioned. In a geological respect, the territories are presented by no more than four lithological layers. The rocky rocks have uneven surfaces and are covered with non-rocky deposits. The underground waters are presented by two or more formed horizons and have different chemical composition. Hazardous geological processes are limited. As for the specific grounds, they do not play an important role in making a design decision.

212. The III (complex) category includes the territories, which are spread within the limits of several geomorphologic elements of different genesis, with their surfaces strongly dissectioned. In a geological respect, the territories are presented by more than four lithological layers with their strengths sharply varying. The rocky rocks are very much weathered and fissured. They are covered with non-rocky rocks. The horizons of the underground waters are not sharply distinct. Some areas are structured with alternating water-bearing and water-resistant rocks. Hazardous geological processes are widely spread, or the territory is potentially dangerous in respect of origination and activation of hazardous geological processes. The mentioned circumstances and existence of specific grounds are of a decisive importance

when making decisions during the designing and building of new communications and in the exploitation phase.

Conclusion

213. As a conclusion, we may say that in the final account, the study section of Tbilisi-Rustavi road, in respect of geological hazards, is in fact characterized by favourable engineering-geological conditions. Lateral erosion along the river bank near the revetment (upstream and downstream) is not expected, as it is limited by natural bed-rock exposed in the river channel and revetment (the bedrock limits lateral erosion in these locations and this is the reason, why the channel here is narrower than in other sections of Mtkvari river). The major problem here is flooding risks. Accordingly the river bank protection measures should be considered within the project.

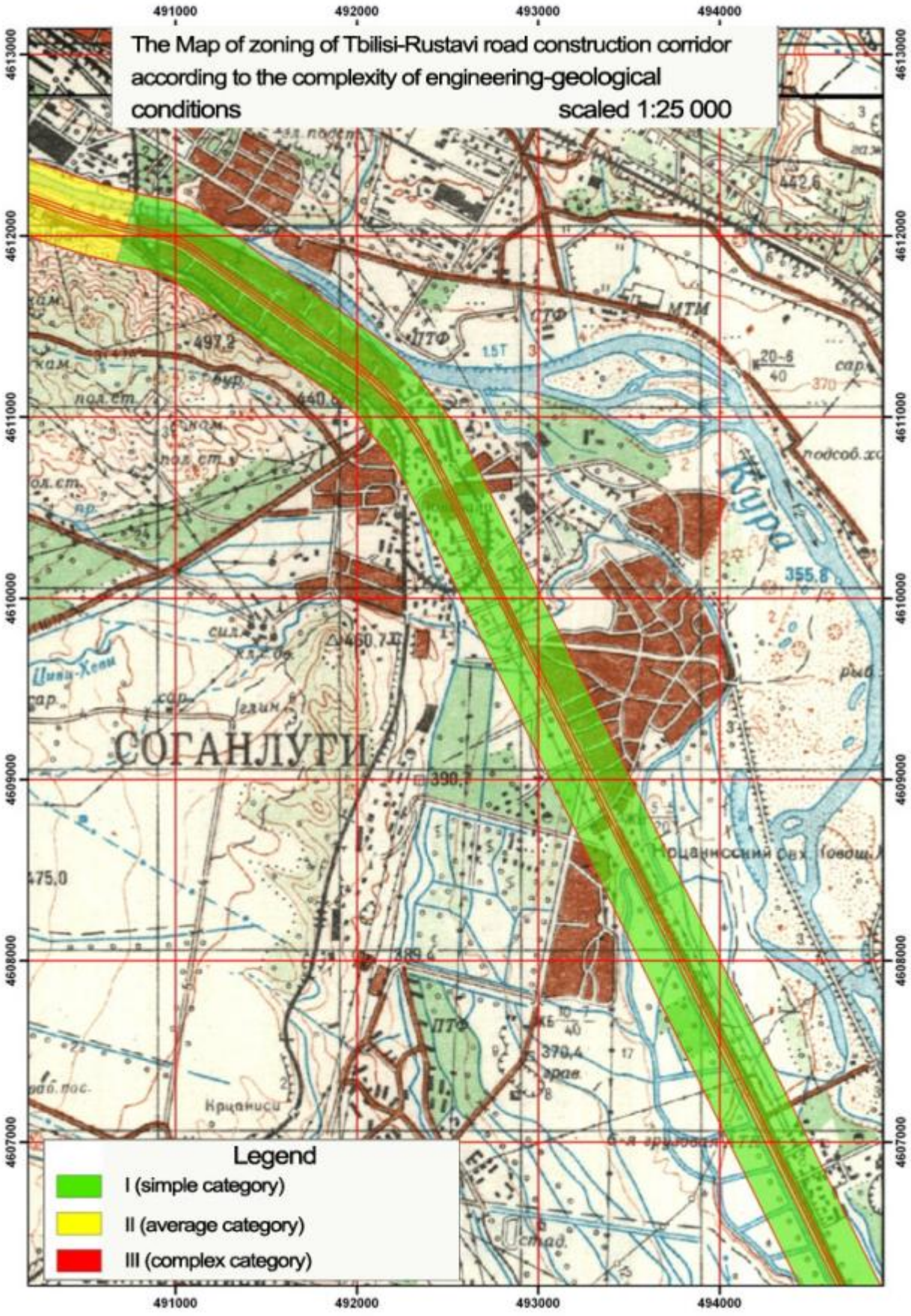


Fig. 4.9 Geotechnical Map of Complexity of the Geoengineering Conditions

4.1.9 Water Resources

4.1.9.1 The river Mtkvari

214. The detailed report describing hydrology of the project section of Mtkvari river (discharge rates, general scour, flooding levels of water bed without revetment, with one-side and two-side revetments) is given in Annex 8. Here below we provide brief summary of hydrological patterns of Mtkvari river and neighbouring dry gorges.

215. The bed of the river Mtkvari runs all along Tbilisi-Rustavi rehabilitation road. The river Mtkvari, the biggest river in South Caucaus, heads from the springs at the altitude of 2720 m above sea level on the northern slope of Kizil-Gyadik mount in Turkey and flows into the Caspian Sea on the territory of Azerbaijan.

216. The length of the river is 1364 km and the area of its catch basin is 188.000 km^2. The length of the river across the territory of Georgia is 350 km. The hydrographic network of the river along this section is made up of 12211 rivers with the total length of 35465 km. The basin of the river Mtkvari has an asymmetrical shape and covers Main Caucasioni ridge on the territory of Georgia, Somkhit-Javakheti high mountainous zone and intermontane tectonic lowland. The lowest part of the basin is the intermontane lowland, which is Kartli Plain.

217. The geology of the upper part of the river basin is presented by the rocks of a volcanic origin. The geology of the piedmont is presented by Paleozoic, Jurassic and Cretaceous sandstones and Eocene clays. The geology of Kartli valley is presented by Old and Modern alluvial deposits. There are brown and black soils spread along the river across the plain.

218. The vegetation cover of the basin above 2500 m altitude is presented by alpine vegetation, with a wide band of subalpine vegetation below. There is a mixed forest growing in the piedmont with dominating hardwood species. Kartli Plain is mostly cultivated with agricultural crops.

219. The river is fed with glaciers, snow, rain and ground waters. Its water regime is characterized by spring floods caused by seasonal snow melting and summer and winter relatively stable low-water periods. The most water-bearing period is spring with 47-58% of the annual water flow. The flow in summer is 22-27% and exceeds that in autumn or winter. In some years, spring floods coincide with freshets caused by rains and leads to catastrophically high water levels. The flood of April 18 of 1968 is a classic example of such a catastrophe, when the peak water level in Tbilisi exceeded 5-6 m above the normal level.

220. Low water levels and discharges are mostly fixed in winter. In this period, the icy phenomena are instable. The average number of icy days is 8-14 on average.

221. Along the rehabilitation road section, the river Mtkvari flows through a single, non-branched bed, with its banks protected with concrete dikes (KP 0+000 to KP 2+200).

222. The river Mtkvari is widely used for irrigation, power engineering and industrial water-supply purposes. The closest HPP plants are located upstream from project sites in Ortachala district of Tbilisi and in Zahesi (between Tbilisi and Mtskheta).The headworks arranged past the city of Rustavi supplies the irrigation and power engineering water to Gardabani irrigation system and Gardabani thermal power plant. r. Mtkvari is not used for navigation. Fishing in r. Mtkvari has no economic value but mostly a leisure meaning.

4.1.9.2 Brief Hydro graphic Characterization of Gorges Crossing Tbilisi-Rustavi Road

223. The nameless gorges crossing the first section of Tbilisi-Rustavi road (from KP 0+500 till KP 7+000) start from the northern slopes of Teleti ridge between the altitudes of 785 to 525 m, while gorges crossing the following sections (from KP 7+000 till KP 17+800) – from the northern slopes of Iaghluji ridge within the same altitudes. The majority of the mentioned gorges join r. Mtkvari from the right side, while some of the gorges spread on the right terrace of r. Mtkvari and disappear within the terrain until crossing the rehabilitation road. Part of the small gorges fall into the "water household" irrigation channel running parallel to the rehabilitation road. The channel does not function at present.

224. The geology of the dry nameless gorge basins is composed of the Quaternary period deposits, which are covered with loamy soils. Gorge basins are stripped of forest cover. Only thin shrubbery and grasses are present from vegetation here. The beds of the gorges from Iaghluji ridge are utilized through industrial areas and agricultural crops on the right terrace of r. Mtkvari after crossing Tbilisi-Rustavi road.

225. The gorges are dry the most part of the year. Water flows in the gorges only in the period of intensive rain and melting of the thin snow cover. Discharges and levels of the flash floods caused by rain significantly exceed the same values caused by snow melting.

226. Gorges crossing rehabilitation Tbilisi-Rustavi road have not been studied in hydrological terms. Hence, the values of maximal water discharges of these gorges crossing the rehabilitation road are identified using the method given in the "Technical Instruction for Calculation of the Maximal Discharge of Rivers in Conditions of Caucasus."

227. According to the mentioned method, the values of maximal discharge of those rivers and gorges, the area of the water catchment basin of which does not exceed 400 km^2, are calculated with the below formula:

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

Where R – it is the rayon parameter. Its value in Eastern Georgia is deemed as 1.15;

F – the area of the water catchment basin in cross-section for calculation in km^2;

K – climate rate of the rayon, the value of which is taken from special map and in our case is 5;

τ - recurrence in years;

$\bar{i}$ - leveled inclination of the river flow or gorge in units from the starting point till cross-section for calculation in km;

Π - rate of characteristic of soil cover in the river basin. Its value is taken from a special map and respective table;

λ - rate of the basin forestation, the value of which is calculated as follows:

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

Where F_t - the area of forested basin in %;

δ - rate of basin form, the value of which is calculated as follows:

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

Where $B_{\max}$ - the maximal width of the basin in km;

B_{sas} - average width of the basin in km, the value of which is calculated by relation $B_{sas} = \frac{F}{L}$.

228. During the calculation of the maximal discharge of those small gorges, the area of the water catchment basin of which is less than 5 km^2, the below specially processed rates corresponding to the areas of the water catchment basins are introduced in the above formula:

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

229. The values of morphometric elements required for the calculation of the maximal water discharge of the gorges crossing the rehabilitation road are identified using 1:25000 scale topographic map as well as the values of the maximal water discharge for recurrence of 100 years, 50 years and 10 years. The values are given in the below Table 4.24.

Table 4.24. Morphometric Elements and Maximal Water Discharge in M^3/Sec for the Gorges Crossing the Rehabilitation Road

Gorge # or name	F km^2	L km	i kal	$\prod$	K	λ	δ	K^I	Maximal discharge			
									$\tau = 10$ years	$\tau =$ 500 years	$\tau =$ 200 years	$\tau =$ 100 years
11	0.19	0.63	0.230	1	5	1	1	0.70	3.80	2.92	2.06	1.58
12	0.11	0.56	0.205	1	5	1	1	0.70	2.60	2.00	1.41	1.09
13	0.12	0.45	0.222	1	5	1	1	0.70	2.80	2.15	1.52	1.17
14	0.62	1.70	0.068	1	5	1	1	0.70	6.89	5.30	3.74	2.88
Tsivikhevi	13.1	8.85	0.052	1	5	1	1	_	53.0	41.4	29.2	22.4

230. In addition to the gorges crossing the rehabilitation road, r. Kura maximal annual discharges have also been identified for Tbilisi-Rustavi section. The analogue method is used for the determination of the maximal discharges of r. Kura within Tbilisi-Rustavi section. The data of r. Kura – hydrological point Tbilisi are taken as analogue. The date comprises 66 years of observations (1925-1990). Within the mentioned period the maximal discharges of r. Kura in hydrological point Tbilisi cross-section had fluctuated from 448 m^3/sec (1947) to 2450 m^3/sec (1968).

231. In The variation row of maximal water discharges within 66 years of hydrological post in Tbilisi cross-section for r. Kura have been statistically processed following СНиП requirements 2.01.14-83 using the method of moments. As a result of the processing, the below parameters of distribution have been received:

232. The average perennial value of maximal discharges Q_0=1162 m^3/sec;
Variation rate Cv=0,31;
Asymmetrical rate value Cs=4Cv, which is received through the closest empirical and theoretical point coincidence on the probability cell.

233. Assessment parameters of representativeness of the variation range of observations have been determined – relative average square error of the average perennial maximal discharge value and variation rate, which lies within acceptable limits. The average square deviation has also been identified and is δ=360.

234. From the received parameters and ordinates of three parameter gamma-function the maximal discharge of various supply waters of r. Kura has been calculated. The maximal discharges of various supply waters have been identified through Gumbel method as well, during which the recurrence rate K for extreme values (according to Gumbel distribution) is selected through specially processed table according to observation period (in our case 66 years).

235. The maximal discharges of r. Kura in Tbilisi are calculated on the basis of individual catastrophic maximal discharges determined by the Institute of Hydro-Meteorological Scientific Research as well. According to the mentioned calculations the below parameters of the distribution function have been identified:

Average perennial value of maximal discharges: Q_0=1148 m^3/sec;
Variation rate Cv=0,56;
Value of asymmetry rate Cs=2Cv=1,12.

Through the received parameters and binominal distribution function ordinates values of various supply of r. Kura are determined.

236. The values of the various supplies of maximal discharges of r. Kura in Tbilisi hydrological post cross-section according to the determined three parameter gamma-distribution, Gumbel distribution and the Institute of Hydro-Meteorology are given in Table 4.25.

Table 4.25. R. Kura – Hydrological Point Tbilisi Maximal Water Discharges Q M^3/Sec

Supply P%	0,1	1	2	5	10	20
Gamma-distribution	3030	2300	2140	1835	1630	1425
Gumbel distribution	3100	2395	2185	1900	1680	1500
Hydro-meteorological Institute	3480	2910	2765	2475	2270	2060

237. The maximal discharges of r. Kura identified by the Institute of Hydro-Meteorological Scientific Research of Georgia are accepted as calculation values for hydrological point Tbilisi cross-section.
As there is fairly insignificant difference between the water catchment basins of hydrological point Tbilisi cross-section and Tbilisi-Rustavi rehabilitation road section, the maximal discharges of r. Kura identified for hydrological point Tbilisi cross-section are deemed as calculation values for Tbilisi-Rustavi rehabilitation road section.

4.2 Ecological Resources – Landscape and Flora

4.2.1 Landscape and Soils

238. Landscapes of Tbilisi are diverse. Many regions of specific landscape border each other in the surroundings of Tbilisi. Due to these particular components of landscapes and the whole landscape itself are so diverse. Plain and hilly part of Tbilisi environs developed the landscape typical for the grassland of Eastern Georgia, while the landscape of Western and Northern part is mainly woody and mountainous, creating altitude zones. Due to human impact original natural landscapes have been significantly modified on the territory of Tbilisi. Relatively untouched landscapes still remain in the zone of mountain-forests and, partially, in the areas unsuitable for rural development. In all remaining parts of the city there are modified, secondary natural or cultural landscapes.

239. Due to diversity of natural conditions and relief the soil of Tbilisi and its surroundings are of various types. There are grey-brown, meadow grey-brown, humus-sulphatic, alluvial, saline, alkali, forest brown and black soils. Erosion processes are observed in the surroundings of Tbilisi. Due to them a wide area is

occupied by thin washed down soils with different types of bear land rocks. In the gardens and parks of Tbilisi there are soils cultivated to different degree. This soil has lost its natural shape and now represents a cultural variation of the original soil.

4.2.2 Vegetation

240. The report comprises the results of the review of literature and scientific research, which aimed at the study of the flora and vegetation within the corridor of the project of Tbilisi-Rustavi section of the Tbilisi-Tsiteli Khidi (Red Bridge – border with Azerbaijan) road and more specifically – the discovery of sensitive habitats and communities within the section.

241. Botanical description of the zone of interest is based upon the literature sources and field research as well as our own experience and knowledge. It should also be noted that research with the aim to obtain more detailed information enabled to fill in the existing gaps and obtaining detailed data on design and construction. Such data is necessary for environmental assessment in botanical terms. Consequently, as a result of the above mentioned researches the expected negative and residue impact on the flora and vegetation of the areas adjacent to the corridor have been revealed.

242. The stress has been made on verifying presence of Communities and species (included in Georgian Red List, Red Book, endemic, rare) of various conservation value in the project impact zone, as well as plants of economic value (medicinal, odorous, wild fruit, fiber, tubers, decorative, drinking, raw material and firewood forests, forage, hay meadow-pasture, wild predecessors of crops, etc.).

243. Along with endangered species and sensitive habitats with various conservation values forests are especially notable; if residual impact is determined on the forests, eco-compensation measures should be implemented, which comprises the restoration of equivalent forest habitat.

General review of flora and vegetation within a broader area surrounding the project corridor

244. The project area is located in the geo-botanical district of Kvemo (Lower) Kartli lowland. The cover has been severely modified by economic activities of man. Territories with natural vegetation are scarce in the district (one of the least within the regions of Eastern Georgia). It is especially true for plains, where natural vegetation had been substituted with landraces a long time ago. Vegetation cover developed within the district, despite significantly limited distribution, is very diverse and complex in terms of types of individual plants and genesis of formations as well as the development history. Forest vegetation is diverse in phyto-cenological terms. Mono-dominant forests of Georgian oak (*Quercus iberica*) and high mountain oak (*Quercus macranthera*) are developed on the highest part of the area. It is noteworthy that high mountain oak descends fairly low in the mentioned region. Oak-hornbeam (*Carpinus caucasica, Quercus iberica*) and poli-dominant leaved forest stands (Georgian and high mountain oak, European ash - *Fraxinus excelsior*, hornbeam - *Carpinus caucasica*, lime - *Tilia caucasica*, field maple - *Acer campestre*, etc.) are distributed in the area as well.

245. At some area of the district (mainly r. Khrami and Algeti basins) relict forest species have been preserved – remnants of arid open woodland: pistachio (*Pistacia mutica*) and Caucasian hackberry (*Celtis caucasica*). Many species typical for arid open woodland occur within the above: Georgian maple, Balkan maple (*Acer hyrcanum*), fig tree (*Ficus carica*), buckthorn (*Rhamnus pallasii*), Christ's thorn (*Paliurus spina-christi*), spirea (*Spiraea hypericifolia*), smoke tree (*Cotinus coggygria*), elm leaved sumac (*Rhus coriaria*), lonicera (*Lonicera iberica*), jasmine (*Jasminum fruticans*), etc. This relict forest vegetation, which had also been present in the driest south-eastern part of Eastern Georgia, formed large communities in Kvemo Kartli lowland too. These communites had been later destroyed due to irrational exploitation of men (chaotic logging, periodical grazing in the forest).

246. Floodplain forests have been also destroyed. They have been preserved in the form of remnants only (mainly in r. Iori floodplain). The following should be noted in the composition: willow (*Salix excelsa, S. alba, S. pseudomedii*) and asp-willow (*Populus canescens, P. nigra, Salix excelsa*) stands. Elm (*Ulmus foliacea*), nut tree (*Juglans regia*), mulberry (*Morus alba*), floodplain oak (*Quercus longipes*) are mixed in small amounts. The following are most typical from shrubbery: salt cedar (*Tamarix ramosissima*), blackberry (*Rubus sanguineus*), blackthorn (*Prunus spinosa*), hawthorn (*Crataegus pseudoheterophylla*), Black Sea dogwood (*Thelycrania australis*), silk vine (*Periploca graeca*), old man's beard (*Clematis vitalba*), sea buckthorn (*Hippophae rhamnoides*), etc.

247. Xerophilous and hemi-xerophilous shrubbery is widespread within the district, namely, slopes of hills and plateaus - Christ's thorn (*Paliurus spina-christi*), oriental hornbeam (*Carpinus orientalis*), spirea (*Spiraea hypericifolia*), poli-dominant forb shrubbery. According to genesis, the mentioned shrubbery is secondary and developed in the former forest areas (oak, arid open woodland). Tragacanth communities are frequent on severely eroded dry slopes – milkvetch (*Astragalus microcephalus*) and prickly thrift (*Acantholimon lepturoides*).

248. Steppe grass formations are developed on plains and elevated areas (plateaus, hills). Beard grass (*Botriochloa ischaemum*) steppe is the most widespread. According to the origin, the beard grass steppe of the area is secondary and it has developed on the former forest areas (arid open woodland, floodplain forests, plain and mountain oak forests). Beard grass steppe is diverse in phyto-cenological terms. In some areas beard grass is combined with wormwood (*Artemisia fragrans*) and bi-dominant beard-grass – wormwood community is formed. Beard grass-glasswort (*Botriochloa ischaemum, Salsola nodulosa*) is relatively rare. Christ's thorn-beard grass (*Paliurus spina-christi, Botriochloa ischaemum*) complexes are common on elevated areas, while needle grass steppe (*Stipa pulcherrima, St. Lessingiana*) occurs in the form of smaller plots on hill slopes and in fragments. Poli-dominant grain-forb grass are present on larger areas (*Achillea micrantha, Agropyron repens, Bromus japonicas, Cynodon dactylon, Festuca sulcata, Filagoarvensis, Phleum phleoides, Ph. Paniculatum, Salvia sclarea, Xeranthemum squarosum,* etc).

249. Semi-desert vegetation occurs within the district (Marneuli and Gardabani plains). It is mainly developed on lowlands and depressions, chestnut and salinized soils. The semi-desert vegetation is mainly represented by wormwood (*Artemisia fragrans*) communities. Glasswort (*Salsola nodulosa*) communities and other semi-desert formations are relatively rarer. Edifier wormwood is entirely dominant in wormwood cenosis. The following other vegetation (characteristic species) is observed - *Caragana grandiflora, Scorzonera lanata, Sterigmostemum torulosm, Torularia torulosa,* etc. Ephemeras and ephemerids are abundant in cenoses in spring - *Alissum tortuosum, Brachypodium distachyon, Gagea commutata, G. dubia, Medicago minima, Pterotheca marschalliana,* etc. Wormwood semi-desert is the winter pasture of the best quality (mainly for sheep).

250. Wetland communities grow in marshes and wetlands. These communities are formed by cattail (*Typha latifolia, T. laxmannii*).

The detailed characterization of the flora and vegetation within the project impact zone

251. It is noteworthy that detailed botanical research has been conducted within the project corridor of Tbilis-Rustavi road. Consequently, negative and residual impacts as a result of the planned project construction and operation have been assessed. Presence of plant communities and species (Red List, endemic, rare) of various conservation value have been checked within the project impact zone as well as plants of economic value. Sensitivity of habitats for this project has been estimated using 4 grade scale of sensitivity: **low conservative value or low sensitivity** (strongly transformed urban and rural landscapes with no natural vegetation and limited areas of roadside greenery); **medium sensitivity** (degraded natural

habitat and artificial recreational park zones); **high value of sensitivity** (natural habitats supporting biodiversity, presenting Red- Data species etc.) and **extremely high value** (protected areas and other natural habitats important in terms of preservation of populations of endangered and protected species of animals and communities of rare and endangered plants). No sensitive habitats are presented within the project area. Only 2 small sites of medium sensitivity have been described.

252. The project area covers road sections from Km 4+00 till Km 10+800. At the starting point (Km 4+00 – Km 4+700 /GPS coordinates of plot #11 are N41^{0}39'07.4''/E 044^{0}55'13.1'', 368 m a.s.l..) within the area adjacent to Kvemo (Lower) Ponitchla a fragment of degraded floodplain forest is present – floodplain poplar *Populus hybrida, Elaeagnus angustifolia, Tamarix ramosissima, Smilax excelsa,* blackberry -*Rubus* sp., *Typha latifolia.* **It is the habitat of medium sensitivity (medium conservation value).**

Fig 4.10. Fragments of Floodplain Forest with Dominance of Floodplain Poplar

Description – Site No1
41 39.721'
44 52.808' 403 m above sea level

253. There is an artificial pine forest (Pinus nigra, Pinus eldarica) south of the motorway at the slope of 5-10^0 gradient. The pine diameter at breast height (DBH) is 80cm and the height is 6m. The undergrowth of the pine forest consists of Jerusalem Thorn (Paliurus spina christi), Spiraea (Spiraea hypericifalia), buckthorns (Rhamnus palasii), golden chain or golden rain (Laburnum anagyroides), grasses comprise Melica taurica, Origanum vulgare, Sisymbrium irio, Silybum marianum, Sonchus oleraceus, Bromus riparius, etc.

254. Two rows of pines (with 3 m spacing) grow south of the motorway about 20m away from the road. Therefore there are 4 pines in a 10m section along the motorway (total of 2 two rows or 8 pines). The section is about 20m (i.e. 16 pines).

255. North of the motorway there is a narrower strip of pines, which means the number of pines is half as many.

256. In the next section (towards Rustavi) there are mainly pines on the southern slope and on the opposite side of the motorway there are cypresses (*Cypresses sempervirens*) in addition to pines.

257. Afterwards there are black locusts (*Robinia pseudoacacia*) and soapberries or sapinidus (*Koelreuteria paniculata*). No pines grow in this section. North of the motorway there is a row of cypresses.

258. Then the slopes are sparsely covered with pines

Description – Site No2
41 39.635’
44 53.098’ 398 m above sea level

259. There are four cedars (Cedrus deodara), a few cypresses and 1 pine north of the motorway. In the section up to the next site there is a small number of soapberries, mulberries (Morus aba) and pines.

260. South of the motorway there are xerophytes like Artemisia and Paliurus including Spanish broom (Spartium junceum) and ephedra (Ephedra procera).

261. Further, after the railway bridge the road follows r. Mtkvari embankment and passes densely populated sections of Kvemo (lower) Ponitchala (Km 4+700 – Km 7+545). Mainly cultivated species are represented in the residential parcels within the section.

Description – Site No3
41 39.624’
44 53.500’ 376 m above sea level

262. There are white willows (Salix alba) and orchards (most of them now wild) comprising mulberries, pomegranates, plum, apples, almonds, etc on the left bank of the Mtkvari River.

Description – Site No4
41 39.445’
44 53.971’ 370 m above sea level

263. On the left bank of the Mtkvari River there is common reed (*Phragmites communis*) and sparsely growing fig trees (*Ficus carica*).

Description – Site No5
41 39.155’
44 55.523’ 380 m above sea level

264. There is almost no vegetation on the fluvial terrace and eroded slope of the Mtkvari river left bank. Above the slope there are various buildings.

265. Thin forest zone (fragments of the forest adjacent to the Park) in the vicinities of vil. Ponitchala is located East and Nort-East at a distance of 300m from the road alignment. Floodplain poplar, willow, Russian olive, tamarisk and greenbrier formed vegetation is present in the thin forest. **However, the road alignment turns right towards the existing road before entering this sensitive zone and thus, project is not affecting the forest area**.

266. Km 7+545 – Km 8+200: the continuation of road is directed towards the junction with Tbilisi-Rustavi road. Steppes are directly abutted by oak-elm formations. It is the transitional stripe between thorny steppes and typical floodplain forests. Tamarisk with admixtures of pine, Russian olive, hawthorn, Christ’s thorn, elm, apricot, mulberry, and prune are dominant on saline soils. Along the road alignment a well kept agricultural orchards-gardens are present. Artificial plantations of nut with sequence of Russian olive, almond and hawthorn are located at the same road. The locals use the grass cover of the undergrowth for cattle grazing. In the remaining part of the route the vegetation is steppe (forb grass-needle grass) and steppe-shrubbery. Km 8+200 - Km 9+800: The alignment passes along the existing road in a densely populated area with only artificial roadside greenery plantations.

Description – Site No6

41 38.531’

44 54.828’ 310 above sea level

267. There are artificial plantations (cedars, plane trees, pines) along the existing motorway on the north side. The same types of plantations are found in the section between Descriptions No 5 and No6.

268. In the lower part of the highway at the edge of the Krtsanisis forest-park along the road (Km 9+ 800 – Km 10 +00 GPS coordinates of plot are N41^{0}37’40.2’’/E 044^{0}55’21.4’’, 360 m a.s.l.) the following species are present: *Morus alba, Prunus divaricata, Ulmus foliacea, Cedrus deodara, Populs gracilis,* Pinus sp., *Platanus orientalis*. **It is a habitat of medium conservation value.**

Description – Site No7

41 37.817’

44 55.304’ 366 m above sea level

269. There are pines, cedars and cypresses along the motorway on the north side (the beginning of Krtsanisi recreational forest).

Description – Site No8

41 37.736’

44 55.349’ 353 m above sea level

270. There are plane trees, walnut trees, thujas, oak trees (Quercus iberica) and blackberries (Rubus sp.) in Krtsanisi recreational forest. The diameter at breast height (DBH) of plane trees (Platanus orientalis) is 260cm and the height is more than 20m. There are also some smaller plane trees with the DBH of 180cm and the height of 20-22m. The DBH of thujas (Thuia occidentalis) is 80cm and the height is 10-12m. The DBH of oak trees is 140cm and the height is 14-16m.

Description – Site No9

41 37.607’

44 55.416’ 361 m above sea level

271. There are mulberries, cedars, fig trees, poplars and blackberries on the north side of the motorway.

272. The DBH of mulberry trees is 180cm and the height is 10-12m.

273. The DBH of cedars is 140cm and the height is 10-12m.

Description – Site No10

41 37.442’

44 55.527’ 351 m above sea level

274. The road expansion covers the southern side of the existing motorway. Mulberry trees and mostly pines grow along the motorway. Then there is an alley of plane trees and willows growing along canals.

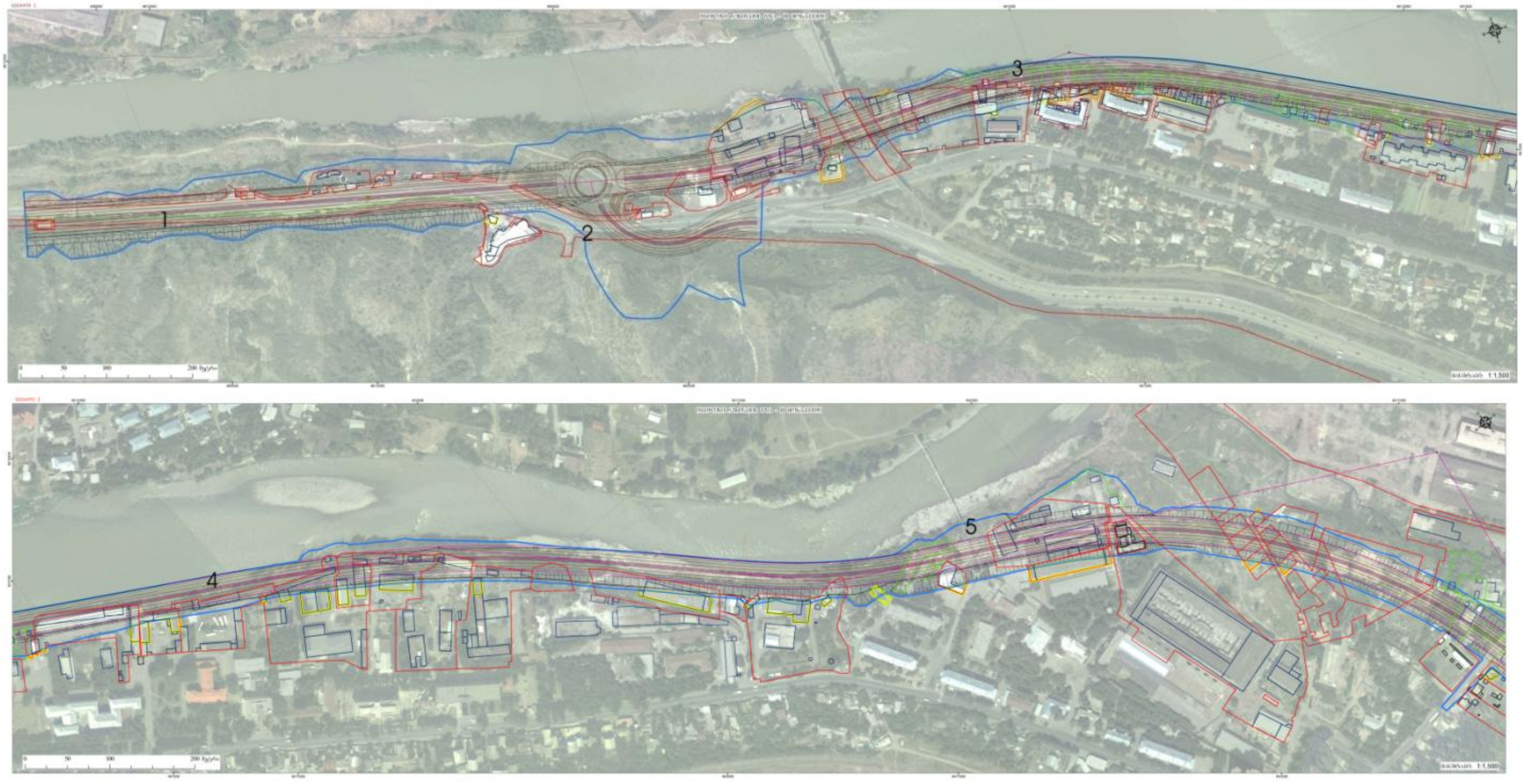
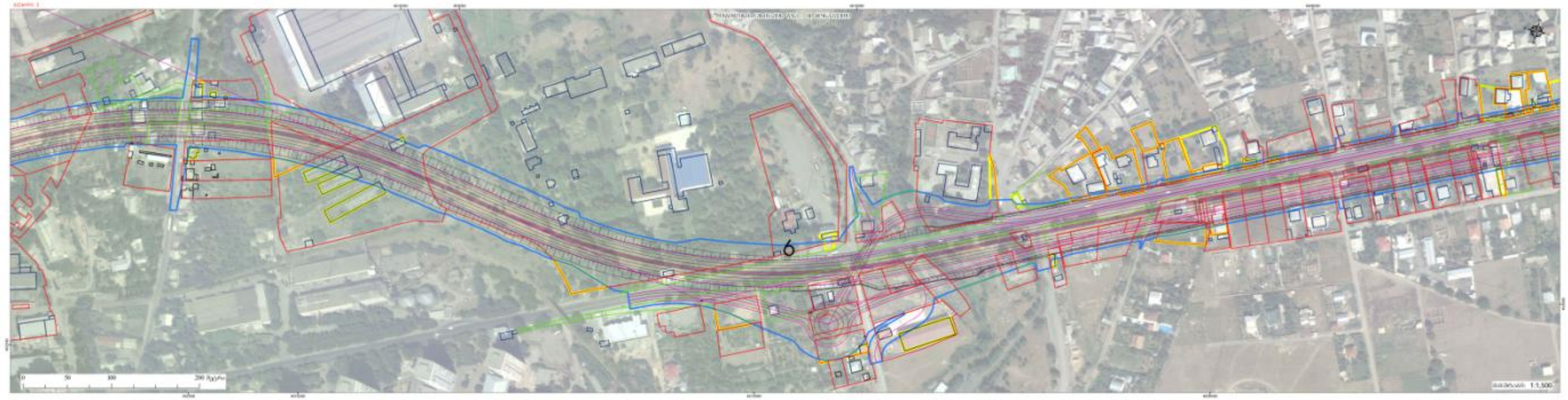


Fig.4.11. Description Sites



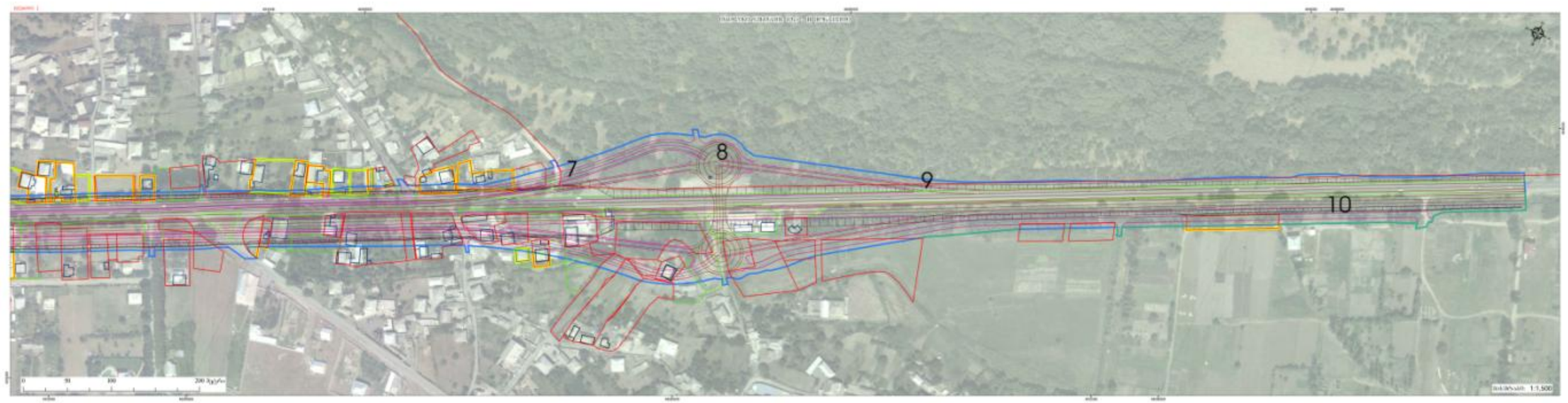


Fig.4.11. Description Sites(continuation)

Fig 4.12. Territory Adjacent to Krtsanisi Forest-Park with Elm, Cedar, Plane and Other Species

275. Semi-desert surrounds the floodplain forest. Residential areas are observed at several places at KP 12 km of the road section. Nut, mulberry, pine, cedar and cypress trees are planted in from of yards and residential plots along the highway in this area.

4.2.3 Ecologically Sensitive Sites

276. There are no sensitive ecological receptors affected by the project. Only two receptors of medium sensitivity are reported at locations Km 4+00 – Km 4+700 and Km 9+ 800 – Km 10 +00, as described in above in chapter 4.2.2.

Protected areas

277. **The road project will not affect any of the protected areas.** Gardabani reserve is located down the river Mtkvari flow. The only site possible to think of the area of a certain importance to protect the biodiversity in the region of Tbilisi-Rustavi road construction, is **Krtsanisi woodland park**. The forest in the park was restored in the 1940-50s. For a long time it was less accessible for the locals, and at the end of the Soviet era, it was used as a recreational area. A present, it has almost adopted the natural structure of the floodplain forest and there is a stable, though not very numerous animal population developed in it.

278. After the completion of the detailed botanical survey of the designed project corridor the precise identification of sensitive areas and their detailed description has become possible. To sum up, the project area does not include any section of ecologically valuable and sensitive landscapes, habitats or ecosystems. Below the only identified area of medium sensitivity is presented:

279. As we have mentioned, only a narrow strip at the edge of the Krtsanisis forest-park along the road (Km 9+ 800 – Km 10 +00 GPS coordinates of plot are N41^{0}37’40.2’’/E 044^{0}55’21.4’’, 360 m a.s.l.) will be affected by the project. The following species are present: *Morus alba, Prunus divaricata, Ulmus foliacea, Cedrus deodara, Populs gracilis,* Pinus sp., *Platanus orientalis*. In fact the affected strip is 2 rows of artificial plants belonging to the roadside greenery, which is bordering the zone of natural tree species of wood-park.

Species Included in Red List of Georgia

280. **As a result of the detailed field botanical research no species from the list of species of the Red List of Georgia has been found within the project impact zone**.

281. In addition, it is noteworthy that some rare, endangered and vulnerable species occur within the project area, i.e.: *Elaeagnus angustifolia* (rare plants), *Pinus eldarica* (species, which is becoming extinct).

4.3. Ecological Receptors - Fauna

4.3.1 General description of fauna

282. The Project envisages the reconstruction of the existing Tbilisi-Rustavi road from Gulia street in Tbilisi to Shartava street in Rustavi. Approximately 10 km of the old road runs across a densely populated, well-developed area (settlement Kvemo-Ponichala and village Ponichala). Along the given section, the reduction of the road width to 28 m is planned at the expense of the reduced width of the centre mall and roadsides. Underground and overground passages for pedestrians are planned to arrange in every 200-400 m along the road. The approved route bypasses the densely populated areas along the bank of the river Mtkvari. It also starts in Gulua Street, at the KP 5 km it runs under the railway bridge and continues not along the existing road, but eastwards, bypassing settlement Kvemo-Ponichala along the bank of the river Mtkvari. The obtained document shows that the new road section joins the existing road at KP 8 km and then, the highway runs exactly on the existing road Tbilisi-Rustavi.

General description of fauna

283. In a zoo-geographic respect, the territory may be attributed to the region of the river Mtkvari of Iran-Turan province of Mediterranean zoo-geographic sub-zone of Holarctic zone. The main landscape here is an accumulative plain, covered with and steppe semi-dissert vegetation with inclusions of shibliak vegetation. Most of animals here prefer open arid habitats. As exception one can list species occurring in the floodplain forest along the Mtkvari River.

Protected areas

284. The road project will not affect any of the protected areas. The nearest one, Gardabani Sanctuary (or Gardabani State Managed Reserve) is located downstream the Mtkvari River. The Krtsanisi forest park is only site that can be considered as an area of a certain importance for biodiversity protection within the impact area of the Tbilisi-Rustavi road construction. The forest in the park was restored in the 1940-50s. For a long time, it was less accessible for the locals, and at the end of the Soviet era, it was used as a recreational area. Today, it has almost adopted the natural structure of the floodplain forest. Stable, though not very numerous animal populations are developed there. The forest fragmentation and its isolation from the river Mtkvari floodplain will undoubtedly lead to the further degradation of the vegetation cover and fauna within limits of the forest park. The approved variant of the route - from the railway bridge along the river Mtkvari bank (from KP 5 km to the KP 8 km) is situated far away off the edge of Krtsanisi forest park and will not isolate it from the river Mtkvari floodplain.

4.3.2 Description of Biotopes in Project Area

284. At present, the whole area of the Project is mostly covered with agricultural plots – degraded pastures and maize fields near the banks of the river Mtkvari, with irrigated cornfields and vegetable gardens at some places. The floodplain landscape follows the river bank as a narrow strip. The abele (*Populus hybrida*), black poplar and willow riparian forest on the right bank of the river Mtkvari with blackberry, rough bindweed or sarsaparilla (*Smilax aspera*) and ivy undergrowth is preserved only on the territory of Krtsanisi forest park and in the lower reaches of the river. There are large trees preserved in the forest park. As for other areas, no forest vegetation grows within the construction corridor. The beds of small rivers are overgrown with reeds and bushes - blackberry, sarsaparilla, blackthorn, hawthorn and Russian silverberry (*Elaeágnus angustifólia*). They are mostly used by the locals as the place for kitchen gardens.

285. From the zoologist's stand point, there is no point in dividing the construction corridor in different sites. The short length of the road, uniform landscapes and it anthropogenic degradation, as well as high mobility of most of the animals in the area makes such specification odd.

286. Human has densely populated the given area long time ago and intensely uses it for agricultural, economic and industrial, recreational purposes and for waste disposal. The fauna in the entire considered area - within the road corridor and adjacent areas - is very much impoverished. Despite the fact that the fauna in the given area may be considered as a single complex, the extension area of different species over the sites covered with different biotypes is different. We think the identification of three groups of biotypes purposeful:

287. Urbanized sites (with dense town or village development and industrial enterprises) - all the variants from 0 km to 2 km and from 5 km to 8 km with minor interruptions. The approved route lies entirely within this ecosystem. Further, under variants 1 and 2, the village settlement continues along the both sides of the road up to km 9+200. According to variant 3, the town settlement on the right (south-eastern) side of the road spreads up to km 9-10. The approved route lies entirely within this ecosystem.

288. The steppes, hilly and foothill landscapes with bluestem grass or beard grass *(Bohtriochloa sp.)* and bunch grasses (*Stipa sp.)* steppes, dry scrubland (shibliak), dwarf-shrub (phrygana) and semi-desert vegetation over the hill slopes and in gullies. It occupies the greatest part of the construction area of the road. There are saline areas here and there. Under variants 1 and 2, the road will cross the given landscape from 9,5 km to Rustavi entry. According to approved route, the road runs across the steppes from 9 km to Rustavi entry. Variant 3 runs across the given landscape from 7.5-8 km to Rustavi entry.

289. The remnants of the floodplain landscapes with poplar forest and grasslands along the right bank of the river Mtkvari cross only the approved route from 6+600 km to 7+300 km, approximately.

290. Alternative 1 (Existing Road)

- Urbanized sites (with dense town or village development and industrial enterprises) - from 5 km to 8 km with minor interruptions
- The steppes, hilly and foothill landscapes from 9,5 km to Rustavi entry

291. Alternative 2 (Approved Preferred Route)

- Urbanized sites (with dense town or village development and industrial enterprises) - from 0 km to 2 km and from 5 km to 8 km with minor interruptions.
- The steppes, hilly and foothill landscapes - from 9,5 km to Rustavi entry.

- The remnants of the floodplain landscapes along the right bank of the river Mtkvari - from 6+600 km to 7+300 km, approximately (the approved route).

292. Alternative 3

- Urbanized sites (with dense town or village development and industrial enterprises) - from 0 km to 2 km and from 5 km to up to km 9-10 km with minor interruptions.

293. The steppes, hilly and foothill landscapes - from 9,5 km to Rustavi entry.

4.3.3 Fauna Within the Design Road Corridor

294. Urbanized sites (with dense town or village development and industrial enterprises) - from from Km 4 +00 to Km 10 +800 with minor interruptions.

295. The animals dwelling on the settled territory, are used to people and cars, intense noise and illumination in the night period. In such places, there are animal complexes made up of not large number of species. The population number of these species, except totally synanthropic species, such as rats, mice and sparrows, is generally small here. However, the given complexes are quite stable to the changing conditions and anthropogenic impact. Due to a large number of feral cats and dogs, the appearance of any protected species in the given area is less likely. As for other species, they are under a tense pressure of predation.

296. The only group of animals under the danger of a significant harm during the road building and operation, is Chiroptera. Ten species of them form colonies - the nursery colonies when they breed young animals (maternity colonies) and winter colonies when they hibernate. The bats form colonies in less attended basements or attics, underground communications and natural caves. Besides, three bat species (See Table 2) form colonies in tree hollows. Some buildings are to be demolished and some old trees are to be cut down in the process of widening the existing Tbilisi-Rustavi road and construction of new sites.

297. All Chiroptera in Georgia are protected under the Agreement on the Conservation of Bats in Europe (EUROBATS). The presence of bat populations in the buildings to be demolished or trees to be cut down should be confirmed using ultrasound bat-detectors.

298. Expected impacts along the given section:

- Demolition of some bat shelters in tree hollow, buildings or caves at the preparatory stage of the road construction.

299. The mitigation measures must include:

- Additional surveys with the aim of examining the presence of bat colonies directly in the construction corridor, and drafting the schedule of construction works acceptable in the biodiversity protection point of view;

- In case of detecting bat colonies, the employees of the Ministry of Environment Protection of Georgia must be informed of the fact immediately;

- In case of unavoidable demolition of the shelters (building or tree) of bat colonies in the period dangerous to them (end of November through the beginning of July), artificial bat shelters are to be arranged (bat-boxes).

300***. The steppes,*** hilly and foothill landscapes from 9,5 km to Rustavi entry. Due to the busy roads (Tbilisi-Red Bridge), near location of settled areas and enterprises, all natural functions of the area are

diminished. Because of a great number of village, shepherd's and stray dogs, the appearance of protected large mammals in the area is less likely. As for other species, they are under a tense pressure of preying.

301. The area of Tristram's Jird (*Meriones tristrami*) on the right bank of the river Mtkvari is of an alternating width, and the colonies of these rodents in the construction corridor are likely to appear at the end of summer.

302. These sites are used by many large birds of prey to ascent, flying using the thermals (warm air currents) during migration, and as a feeding ground.

303. The main functions of the given section are as follows:

1. Stop-over site during the migration of a number of large birds of prey
2. Feeding site during breeding the young birds and autumn nomadic movements
3. Habitat of Grey Dwarf Hamster (Cricetulus migratorius) and Brandt's Hamster (Mesocricetus brandti), the mammals included in the Red Data List of Georgia
4. Habitat of Mediterranean Tortoise (Testudo graeca) and Western Sand Boa (Eryx jaculus), the reptiles included in the Red Data List of Georgia
5. A possible habitat of Tristram's Jird (Meriones tristrami), the species included in the Red Data List of Georgia.

304. Expected impacts in the given area:

- Disturbance of feeding migratory birds or birds feeding their youngs, what is less significant, as the birds can fly to safer places
- Destruction of the colonies of such rodents as Brandt's Hamster (Mesocricetus brandti) and Tristram's Jird (Meriones tristrami) may reduce the number of their populations in the considered area, but the given impact is not critical in terms of the country or species, as a whole

305. The proposed mitigation measures must include:

- Additional field-surveys to check the presence of protected species directly in the construction corridor, and drafting the schedule of construction works acceptable in the biodiversity protection point of view;
- Prior to starting the construction works, it is necessary to be sure of the absence of the Tristram's Jird (Meriones tristrami) colonies on the construction sites of the highway and associated facilities;
- Necessary use of the equipment scaring the birds away from the electric wires stretched along the road;

306. The remnants of the ***floodplain landscapes*** along the right bank of the river Mtkvari - from Km 6+600 km to Km 7+300 km, approximately (the approved route).

307. A narrow strip of the degraded riparian forest with bushes and liana undergrowth along the bank forms the habitat for not many animal species. Because of a great number of shepherd's dogs and stray dogs, the appearance of protected large mammals in the area is unlikely. As for other species, they are under a tense pressure of preying.

308. A certain number of large old trees can be cut down. A jackal and red fox dwell on the right bank of the river Mtkvari. There are European pond turtles (*Emys orbicularis*) and large number of frogs accumulated in this area. There are gulls, sandpipers and ducks on the river Mtkvari..

309. The main functions of this area are as follows:

1. A habitat of trivial species of birds;
2. A feeding site for young birds and during autumn nomadic movements;

310. The river floodplain is the migration way for many mammals and birds spread on the given territory and a shelter for propagating individuals.

5. SOCIO-ECONOMIC CONDITIONS

5.1 Demography

Tbilisi

311. Tbilisi population reached maximum in 1992 – 1.276 million people. In the following years, when political turmoil occurred, the city population has decreased by almost 15 %.

312. The population number more or less stabilized in 2004-2005 and reached 1.08 million. From 2005 unequal growth has occurred (Table 5.1). During the recent decade the low population growth rate has been caused by two major factors: low fatality rate, which equals death rate and migration.

Table 5.1 Number of live births, deaths and natural growth of population in Tbilisi (2000-2010)[2]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Population (thousands)	1,097.5	1,088.5	1,081.7	1,079.1	1,078.2	1,079.7	1,103.3	1,101.1	1,136.6	1,136.6	1,152.5
Number of live births	15,380	15,648	16,057	16,058	16,059	16,060	16,061	16,062	16,063	16,064	-
Number of Deaths	11,690	11,408	11,465	12,597	12,424	11,164	12,454	12,040	12,123	12,397	-
Natural Growth	3,690	4,240	4,592	3,461	3,635	4,896	3,607	4,022	3,940	3,667	-
Population growth rate in Tbilisi	-0.9%	-0.8%	-0.6%	-0.2%	-0.1%	0.1%	2.2%	-0.2%	3.2%	0.0%	1.4%

313. Tbilisi population has always been multi-ethnical. Many ethnical groups lived in the city along with Georgians – Armenians, Azeri, Russians, Ukrainians, Jews, Greeks, etc. In XIX Georgians were actually the minority in the capital. Table 5.2 shows ethnical groups of Tbilisi in 1876-2002.

Table 5.2 Ethnical Groups Living in Tbilisi

	1876	1897	1922	1926	1959	1979	1989	2002
Total population (thousands)	104.0	159.6	233.9	294.0	694.7	1056.1	1246.9	1081.7
Georgians	22.2	42.2	80.9	112.2	336.3	656.4	824.4	910.7
Armenians	37.6	47.1	85.3	100.1	149.2	152.9	150.1	82.6
Russians	30.0	44.8	38.6	45.9	125.7	129.1	124.9	32.6
Ossetians		0.9	1.4	2.8	15.6	27.9	33.2	10.3
Ukrainians		2.7			10.9	12.6	16.1	3.3
Jews	1.3	2.9	8.8	8.9	17.3	14.8	13.5	1.6
Azeries			3.3	5.8	9.6	12.9	18.0	10.9
Kurds				2.5	12.9	23.4	30.3	2.1
Greeks	0.4	1.2	1.3	1.4	7.1	16.2	21.7	3.8
Other ethnic Groups	11.6	17.8	14.3	14.1	10.1	9.7	14.7	23.8

Rustavi

314. Small increase of Rustavi population has occurred during the last five years. Table 5.3 shows the dynamics of Rustavi population growth according to 1 January, 2011 situation.

[2] *Source: National Statistical Office of Georgia*, The number of people as of 1 January is provided for each year

Table 5.3 Dynamics of Rustavi Population 2007-2011

Years	2007	2008	2009	2010	2011
Population (thousand people)	117.9	117.3	117.4	119.5	120.8

Table 5.4 Nativity has increased in Rustavi in the recent years

Years	2006	2007	2008	2009	2010
Number of born	1238	1246	1619	1666	1824
Number of deceased	1144	1136	1151	1261	1095
Increase	94	110	308	405	729

315. The majority of Rustavi population is Georgian – 88 % of the population. Table 5.5 shows the distribution of the town population according to nationalities.

Table 5.5 Distribution of population by nationalities

Ethnical group	Number	Percentage
Georgian	102 151	88
Azeri	4993	4
Armenian	2809	2
Ossetian	1410	1
Russian	3536	3
Abkhazian	44	<1
Greek	257	<1
Ukrainian	395	<1
Iezid	293	<1
Other	4885	4

Gardabani

316. Gardabani municipality consists of 42 residential settlements, 1 town, 2 large villages and 39 villages. Large villages are: Gamarjveba – 53 thousand residents, Martkopi – 7.7 thousand residents, Sartitchala – 7.0 thousand residents. The total population is 114 thousand people. These are mainly ethnical Georgians – 54.2 % and Azeri – 43.6 %. Small group of Armenians is also present – 0.7 % as well as Russians – 0.7 % and Ossetians – 0.4 %[3].

317. Population density within the municipality is 100-125 residents per square km. Such industrial centers as Tbilisi and Rustavi are the main means of employment of the population. However, due to the fact that major part of the industrial enterprises has either stopped functioning or cancelled, the significant field of population employment is agriculture.

318. The main fields of agriculture are: vegetable growing, milk produce, fruit and flower growing.

[3]Statistics according to 2002 data

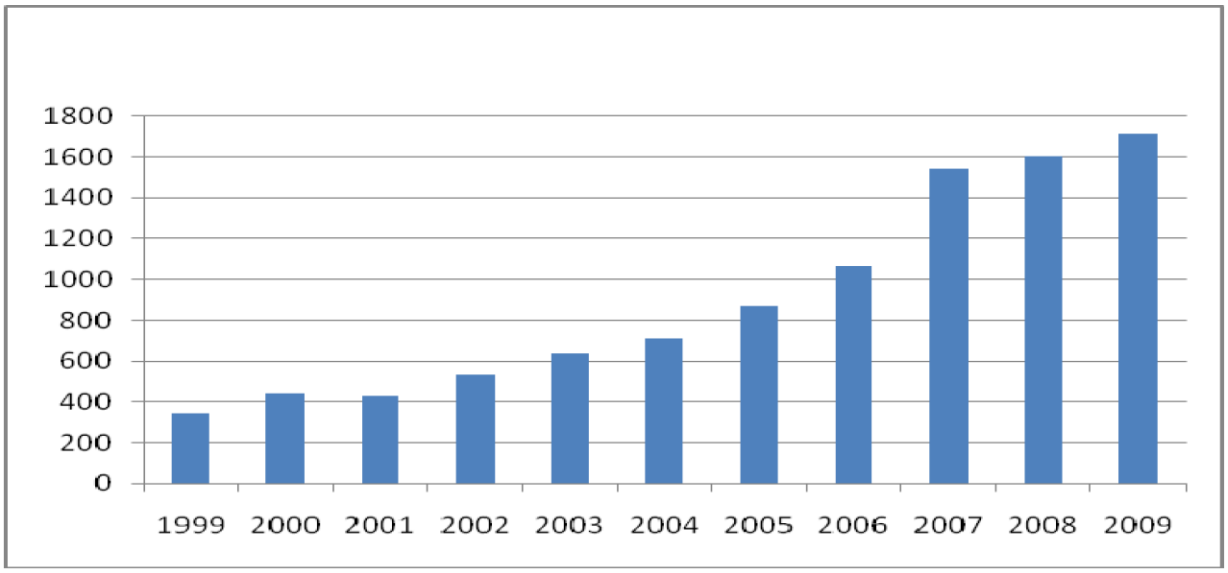
5.2 Socio-economic characteristics

Industry

Tbilisi

319. Recovery of economic, including industrial, activities started in second half of 1990-ies and continued through the first decade of the new millennium Table 5.6. Despite the revitalization, industrial production in Tbilisi still remains very low compared to its levels in Soviet time. Many of large scale enterprises in the sectors of heavy machinery, electric machines and microelectronics, textile and others either do not function or manufacture goods in very limited amounts. Currently, relatively well developed industrial sectors are wine production, production of other alcoholic and non-alcoholic beverages, food processing (meat and dairy products, fruits and vegetables), production of construction materials (cement, asphalt).

Table 5.6 Production in industrial sector in Tbilisi (in current prices, mln GEL)[4]



320. Along with the growth of industrial production in Tbilisi, the share of the capital city in the countries total industrial production is also increasing. At present about 45% of Georgia's industrial products, in monetary terms, is produced in Tbilisi.

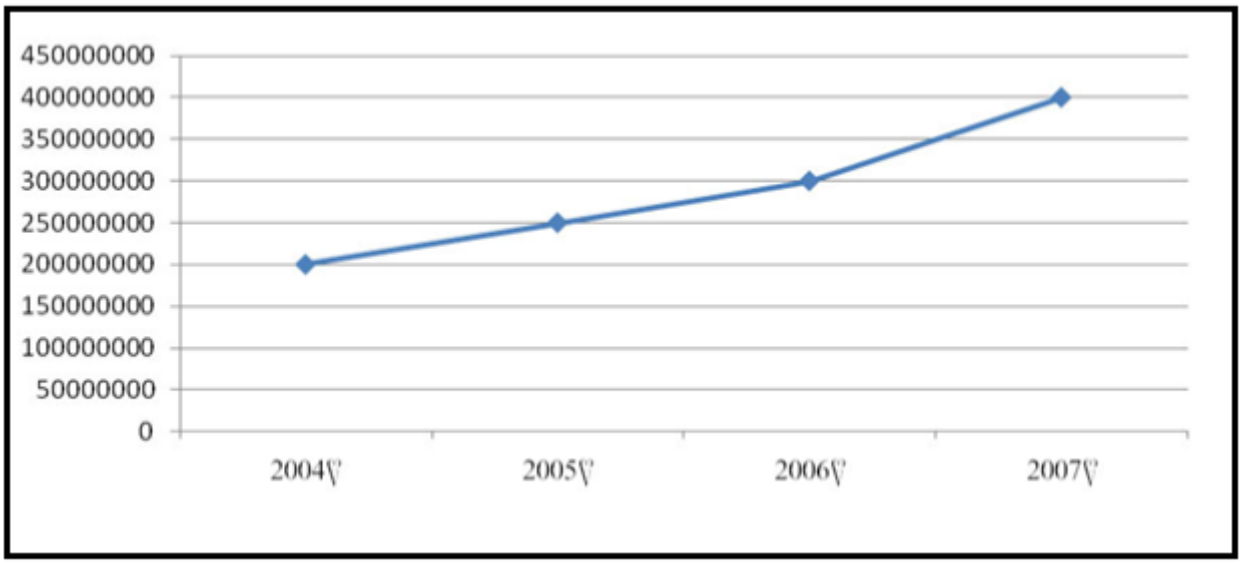
Rustavi

321. There are 26 large enterprises on the territory of Rustavi, from which the largest manufacturing companies are: JSC "Karat Plus" (former "Energy Invest"), JSC "Rustavi Metallurgical Plant", JSC "Heidelberg Georgia", JSC "Jeosteel", JSC "Kazbegi" and etc.

322. The growth of the cost of production and service of different branches and spheres in 2004-2007 made 98, 3% (Table5.7).

[4] *Source: National Statistical Office of Georgia. http://www.geostat.ge/*

Table 5.7 Dynamics of growth of service and produced goods in 2004-2009[5]



323. According to 2007 data, manufacturing industry plays the leading role in Rustavi economics. It's share makes 89.9 % ; building industry makes – 2.7 % and the share of the rest branches and spheres is very little.

Gardabani

324. Electro energetics is noteworthy from industrial fields, as Gardabani thermal power station is located here, which is the largest in Trans-Caucasus and started functioning in 1963. 5 hydro power stations on the upper highway of Kura and Samgori are also important. The power produced by the stations is distributed in Tbilisi and Rustavi, as well as entire Georgia and other districts of Trans-Caucasus. Industrial enterprises of construction material, light and food production are located in Gardabani. Gardabani carton-ruberoid plant is one of the large enterprises of the district. Fruit, grape and vegetable processing plants should be noted from food industry..

Agriculture

Tbilisi

325. Agriculture was well developed in suburbs of Tbilisi until 1990-ies. Main agricultural products produced here included fruits, vegetables, meat and dairy products. The products were sold mostly to Tbilisi markets. 44 Agricultural production has been decreased dramatically over the last two decades. According to statistical information provided by the National Statistica Office of Goegria value added of agriculture in Tbilisi reduced amounted 1 mln GEL by 2009 (Table 5.8) It is unclear whether this statistical data include agriculture in the villages that joined the city in 2006. In general, there is very little information available on agricultural activities in the city or around it. Moreover, there is further more limited information on environmental pressures related to this sector.

[5] Source: Department of statistics

Table 5.8 Agriculture Prices between 2006 and 2008 (in mln GEL)

	2006	2007	2008
Agriculture (current prices, mln GEL)	1.4	1.0	1.0

Rustavi

326. There is scarce data on the agricultural activities in Rustavi and its surroundings. The total area of the city is 6060 ha. The total area transferred to physical and legal persons amounts to 435.68 ha, including 165.68 ha of non-agricultural lands and 270.00 ha of agricultural lands.

Gardabani

327. The total area of the district is 160900 ha, including 66899 ha of agricultural lands, 37035 ha of arable lands, 2193 ha of hayfields, 22183 ha of grasslands and 17079 ha of non-productive land.

328. The dominant crops in the district are wheat and maize and the following annuals: tomatoes, eggplants, cabbages, onions, cucumbers, bell peppers, potatoes, carrots, grapes, wheat, water melons, melons, barley. etc.

329. An average of 70022 tons of agricultural products produced in the district are delivered to the local market annually, including 6900 tons of wheat, 1210 tons of barley, 35 tons of oats, 11500 tons of maize, 10 tons of beans, 967 tons of sunflowers, 45 tons of potatoes, 46780 tons of vegetables, 176 tons of pears, 98 tons of quinces, 224 tons of plums, 121 tons of cherries and sweet cherries, 121 tons of apricots, 56 tons of grapes, 1670 tons of grapes.

330. The agricultural production was a priority sector for Gradabani District. At present vegetable and grain production and poultry breeding remain the priorities of the region.

Employment and Unemployment Levels

Tbilisi

331. Unemployment level in Tbilisi is very high. During nearest last year's it's had achieved 29-30%.

Table 5.9 Employment and Unemployment Levels

Status	2005 y.	2006 y.	2007 y.	2008 y.
Active Population (labours)	429.8	434.7	480.7	430.1
Employed	305.0	303.6	346.1	302.1
Haired	248.9	248.8	291.0	240.6
Self employed	55.6	53.8	55.2	61.4
vague	0.5	1.0	0.0	0.1
Unemployed	124.8	131.1	134.6	128.0
Unemployment level (%)	29.0	30.2	28.0	29.8
Active level (%)	54.4	52.9	55.3	52.4
Employment level (%)	38.6	37.0	39.8	36.8

332. Despite the State Strategy on Gender Equality elaborated by the group of representatives of the Gender Advisory Council under the Chair of Parliament and the Governmental Commission working on

gender equality issues in Georgia (including representatives of government and non-government sectors), the number of employed men in Tbilisi is higher than that of women (see Table 5.11).

Table 5.10 Unemployment and Gender issues (2000-2008 years) m-men; W-women

Status	2000y.	2001y.	2002y.	2003y.	2004y.	2005y	2006y.	2007y.	2008y.
Unemployment level (%)	w.-9.7 m11.0	w.-10.7 m-11.6	w.-11.0 m-14.0	w.-11.5 m-11.5	w.-11.8 m-13.4	w.12.6 m-16.8	w.-11.7 m-15.2	w.-12.6 m-13.9	w.-16.8 m-16.1
Active level (%)	w-57.2 m-75.1	w-58.3 m-75.9	w-56.6 m-75.8	w-57.7 m-76.3	w-56.9 m-74.3	w-55.9 m-73.5	w-53.6 m-72.2	w-55.6 m-73.3	w-53.5 m-73.4
Employment level (%)	w-51.6 m-66.0	w-52.0 m-67.1	w-49.9 m-65.1	w-51.0 m-67.5	w-50.2 m-64.3	w-48.8 m-61.2	w-47.4 m-61.2	w-48.1 m-63.1	w-44.9 m-61.1

333. During nearest last 15 years employed pupil's wages are increased.

Table 5.11 Average wages. 1995-2008 year. (between employers)

Year	Amount	Currency
1995y	13.5	lari
1996y	29.0	lari
1997y	42.5	lari
1998y	55.4	lari
1999y	67.5	lari
2000y	72.6	lari
2001y	94.6	lari
2002y	113.5	lari
2003y	125.9	lari
2004y	156.6	lari
2005y	204.2	lari
2006y	277.9	lari
2007y	368.1	lari
2008y	534.9	lari
2008w	534.9	lari

Rustavi

334. According to 2008 data of department of statistics, 14 113 people were employed in Rustavi enterprises, among them 41,7% was woman and 58,3%- men. The total amount of employed people is divided according the following: large enterprises – 68,5%; middle-sized enterprises -14,2 %; small enterprises – 58,7%. According to kinds of economical activity, in the total number of employed people the most shares is on employees in manufacturing industry.

Gardabani

335. The population density varies between 100 and 125 inhabitants per square meter. The industrial centers like Tbilisi and Rustavi are the main means of employment provision. However, as many of the industrial enterprises stand idle or ceased their operations, agriculture provides a large share of employment. The main sub-sectors of agriculture are vegetable growing, dairy farming, fruit and flower growing.

Infrastructure and Development

Tbilisi

336. Sewage and drainage systems are covered 100% in the city. At the same time current infrastructure is very old and unsure. As for the existing situation in the water supply of Tbilisi, 70% of the city is supplied with no interruption, while 30% is supplied with water according to a set schedule. The city's water supply meets the national standards laid out in the law of Georgia "on potable water". In terms of ensuring the quality of the water supply, it should be noted that in the city's water supply company, Tbiltsqalkanali Ltd, which has a monopoly in the sector, 3 chemical-bacteriological laboratories and 1 chemical laboratory are in operation. These labs are 100% responsible for the quality of the city's water supply.

337. Throughout 2005- 2006 extremely important reconstruction and rehabilitation works have been carried out on the Tbilisi water supply network. The majority of central water pipelines have been replaced, which has significantly decreased the number of emergency shut-downs of the system and, accordingly, losses of water. A total of 59 km of the network in various districts of Tbilisi was replaced.

338. Municipal waste management has greatly improved recently. Private companies which service different districts of Tbilisi on the basis of tender results, acquired the respective equipment. Waste collection issue has drastically improved, two old landfills were closed and a new landfill in compliance with EU requirements was opened. Several companies obtained licenses for the treatment of hazardous waste of various types. It should be noted that hazardous waste management both in Tbilisi and entire Georgia remains one of the acute problems.

Rustavi

339. Rustavi public utilities have greatly improved recently. Limited power and gas supply, which had been an unsolved problem in Rustavi of the 90s, have been eliminated. Rustavi water supply is facilitated by "Rustavi Water". The mentioned company along with "Georgian Water and power" and "Mtskheta Water" is the member of the same investment group, which provides water supply and water related services to 51 621 subscribers in t. Rustavi. The majority of the rehabilitation works in the town has already been completed and the population is facilitated with water in almost uninterrupted regime. Waste water is directly discharged in r. Kura without any treatment.

340. Rustavi is supplied with gas by JSC "Rustavgas", which was established in 1996. In 2006 "Rustavgas" started individual meter installation and movement of the gas meters in entrances first time in Georgia. At present the town is entirely gasified. The cost of the used gas is $1m^3$ – 502 GEL and 790 GEL for legal entities.

341. Some improvements occurred in the solid municipal waste management. Company which serviced Rustavi purchased modern waste trucks and both metal and plastic containers. In 2011 a new landfill in compliance with EU standards was opened in Rustavi through EBRD and Sida funding. Hazardous waste management in Rustavi and entire Georgia is still a problem.

Gardabani

342. Gardabani water supply is facilitated by "Rustavi Water".The mentioned company along with "Georgian Water and power" and "Mtskheta Water" is the member of the same investment group, which provides water supply and water related services to 3984 subscribers in t. Gardabani. The company

provides for both water supply and water related services. The waste water flows into Gardabani water treatment plant and after mechanical treatment is discharged in r. Kura. T. Gardabani is gasified and facilitated with natural gas.

343. Municipal waste management is undertaken by a private company, which has respective infrastructure, while waste disposal is conducted on Rustavi landfill.

Transport

Tbilisi

344. Transport servicing of the population is one of the most significant indicators of urban life. Tbilisi has always characterized with the diversity of the transport system. Tbilisi metro has offered services to many passengers since its opening. According to 2009-2011 data, the number of passengers was about 206 000 daily. Since 1st October, 2010 the travel cost in Tbilisi metro can only be paid via digital travel card.

345. Auto-bus along with metro has remained one of the main municipal transports. 476 movable units of M3[6] category of auto-buses moves in the capital daily. The number of large load auto-buses is 110 and medium load auto-buses – 366 units. M2[7] category auto-buses have 2128 movable units.

346. Taxi - in Tbilisi as well as in any other city, taxi is the fastest above ground transport. Taxi is the only public transport in the capital which can be used 24 hours a day. Railway – the first train from Tbilisi to Poti arrived on 10th October, 1872[8]. At present there five railway stations in Tbilisi: Avtchala, Didube, Navtlughi and Tbilisi Central Station. The railway of the capital is linked with all regions of Georgia and Armenia, Azerbaijan and Russia. Railway will connect Georgia with Turkey in the nearest future.

Rustavi

347. The kinds of transport moving on intercity routs are: municipal transport (buses), private microbuses and taxes. Road signs and traffic lights are provided to regulate traffic. First in Georgia electronic boards, which reflect the schedule of bus movement were installed in Rustavi. The travelling fee by bus is 20 Tetris. The travelling by microbuses in the city is 50 Tetris. The fees of Rustavi-Tbilisi microbuses range from 1.30 to 1.50 GEL in accordance with the route you take. Travelling by taxi costs 1 km – 60 Tetris.

348. LTD "Rustavi Municipal Auto-transportation Company" is in charge of municipal transport. It owns 33 buses, among them: makes "Bogdan", "i-van", 18 units, "Dafi" make- 8, and so called "Pazik" – 1 unit.

Gardabani

349. Transport infrastructure of Gardabani district is well developed. Broad network of both automobile and railway highways is present here. The types of transport on internal town routes are: municipal transport (auto-bus), private route micro-buses and taxi. Gardabani is connected to Tbilisi and Rustavi through private route micro-auto-buses.

[6] Large and medium load autobuses
[7] Route taxis
[8] The Academy of Sciences of Georgian SSR, economic-geographic research of VakhushtiBagrationi Institute of Geography, Tbilisi Press, Soviet Georgia, 1989

Healthcare

Tbilisi

350. Polyclinics, dispensaries, health centers, women consultation clinics, doctor ambulatories and hospitals (inpatient healthcare) make up the core of the primary healthcare in Tbilisi.

351. Table 5.12 provides data of the healthcare system in Tbilisi.

Table 5.12 Health Care Facilities in Tbilisi

Number of hospitals 78	Number of hospital beds 4078
Independent woman consultations, clinics and dispensaries 117	Number of physicians (excluding dentists) 10098
Number of paramedical personnel 7079	
Number of hospitals 78	Number of hospital beds 4078
Independent woman consultations, clinics and dispensaries 117	Number of physicians (excluding dentists) 10098

352. At present, nearly all health care providers are private actors, independent of the state except the centres of tuberculosis, infectious disease and mental hospital. There are also various state programs in healthcare system for specified diseases covered from the public funds. Much hospital stock has been sold to the private investors for redevelopment and modernization. Mandatory social health insurance, introduced in 1995, which proved to be ineffective, was abandoned in 2007[9]. Private health insurance is being promoted by the current government as the main mechanism for the pre-payment of health services in Georgia. Private insurance coverage for households living below poverty line and teachers of the public schools of Tbilisi is paid from the public funds but all other individuals are expected to purchase insurance coverage on their own initiative. There are a number of private companies in the country offering medical insurance coverage, however as unemployment is high and average households income is low, many people cannot afford paying insurance premiums 30. Out-of-pocket payments remain the main source of funding for the health system in Georgia. This situation reduces access to appropriate medical services for much of the population.

Rustavi

353. In Rustavi operates three inpatient hospital, five outpatient clinics, and maternity homes. From July, in the New – Psycho-neurological clinic, which patients with mental problems as well as ambulatory and hospital services were provided. Also in town is the Blood Transfusion Centre, and anti-tuberculosis health centers. It also operates a national skinning – Center, which was created to prevent breast cancer and women age 40 and over is free mammology research. In addition, there are a number of diagnostic centers, medical, dental clinics and private offices.

Gardabani

354. The following function within Gardabani municipality: new Samgori doctors' ambulatory, children's polyclinic, Gardabani district infectious hospital, Gardabani maternity hospital, Davit Gugunashvili dental cabinet and therapeutic cabinet. Doctors' ambulatories also function in the following large villages and villages: Kesalo, Sarthitchala, Norio, Nazarlo, Martkopi and Kumisi.

[9] National Healthcare System Analysis Report 2001-2007, Ministry of Health. 2009. http://www.moh.gov.ge/

355. Local self-government of Rustavi with Regional hospital of Gardabani , Tbilisi City Hospital # 5, mediation services and other health facilities supported by a number of medical action, to which free health examinations and various kinds of expensive medicines and other commodities have been granted. Demonstrations have already been used internally moved individuals, families' mothers, vulnerable families.

Education

Tbilisi

356. The legislative base of the education has greatly improved in Georgia recently, priority directions have been identified and public involvement increased in the educational process.

357. According to 2006 situation 15 elementary professional educational institutions have been recorded in Tbilisi, of which 2 are self financed. State funds 8 secondary professional educational institutions. The involvement of the local authorities into the social dialogue is very important for the effective use of the mentioned potential. The dialogue should aim at establishment of the workforce with quality professional skills on the labour market of the capital. Moreover, respective structures of the local authorities should coordinate the mentioned process.

Table 5.13 Higher Education Institutions Functioning in Tbilisi in 2002-2006[10]

Sector	2002/2003	2003/2004	2004/2005	2005/2006
Number of higher education institutions	105	102	116	106
State sector	15	15	15	13
Non-state sector	90	87	101	93

Rustavi

358. 26 public schools,20 private schools, 1 higher educational institution, 3 state profession re-qualification centers and up to 10 private colleges function in Rustavi at present,. The number of pupils was 19 984 for the beginning of the 2010/2011 study year (according to data of 5th April, 2011).

359. As regards pre-school institutions, the legal status of Rustavi kindergartens changed in 2008 and non-commercial legal entity "Association of Kindergartens" was established. It is financed from the local budget.

Gardabani

360. public schools, 2 secondary professional institutions and 1 higher educational institution function within Gardabani municipality.

5.3. Expected social impact of the Project

5.3.1. General social impact of the Project

361. The proposed Project has short and long-term impacts on the local population. The social impact of the road reconstruction Project should be considered within the context of improvement of traffic safety and traffic conditions in big cities (Tbilisi, Rustavi) and transit potential of Georgia. The impact will be significant not only for the whole country, but for the population living along the road.

[10]Source: Department of Statistics of the Ministry of the Economic Development of Georgia

362. At present, the traffic safety level along Tbilisi-Rustavi road is not satisfactory (particularly complex is Rustavi-Ponichala section). The Project guarantees the traffic safety consistent with the international standards. The Project guarantees the international-level road capacity and safety of the transit cargo streams from Azerbaijan. The Project is important for cargo streams (by modernized mains from Rustavi to Tbilisi detour and then, by the detour) and passenger car streams, which will presumably travel through Tbilisi.

363. The Project is particularly important for the population of the city of Rustavi, whose great part works or studies in Tbilisi. The possibility of safe, rapid and comfortable travel will be an important positive social result for this social group. Improved roads ensure better integration of the local population in the social-economic system and better access to the markets, supplies and services. This includes better prospects of receiving timely medical aid.

5.3.2. Construction-related social impacts

364. In a short term perspective, the Project will bring a certain benefit for the local population, as it will create employment prospects (approximately 100 new jobs will be generated for the local population). The resettlement impacts are described in Section 5.3.

365. Impact. Negative impact caused by construction disturbance (dust, emissions, noise) is temporal, insignificant and controllable through using good construction practice.

366. Mitigation. Dust control by watering; using at least 2 tanks; noise control, installing mufflers to the equipment; working by day.

367. Impact. Secondary biological pollution (e.g. anthrax) caused by the ground works near the soil nidi of infection (e.g. unregistered anthrax pits).

368. Mitigation. Permanent monitoring during the ground clearance and excavation works. Stopping or suspending the construction works in case of a pit discovery. Notification of the local service of the veterinary department and using veterinary sterilization measures before renewing the works.

369. Impact. Dangerous traffic conditions with overlapping traffic flows with the existing traditional traffic.

370. Mitigation. Consideration of proper preventive measures and safety signs along the roads under the project, including illumination, and instructing the drivers.

371. Impact. Infrastructure. The major elements of communal infrastructure, which can come under the impact, are transmission lines, water-supply systems and irrigation pipes and channels.

372. Mitigation. Dislocation and rehabilitation of the infrastructural elements; permanent monitoring during construction; full rehabilitation in case of damage.

373. Impact. Potential conflict with the local population because of impact on water-supply and power-supply sources, as well as other infrastructure, impact on the access to ground or infrastructure, noise disturbance, conflicts with workers, etc.

374. Mitigation. A building contractor must assign an officer to communicate with the local population and must develop a communication plan. All conflicts must be settled by negotiations and reasonable compromises.

5.4. Land Acquisition and Resettlement

375. The detailed Resettlement Action Plan is under preparation and the first draft LARP will be submitted to ADB for the end of July. The census surveys, detailed measurements, sociological assessment and other field works are under the way .

376. According to preliminary assessment, this project will affect as minimum 161 households. Its impact is related to permanent take of 256 private land plots with total area of 171,671 sq.m. 44 of the affected land plots (17,234sqm) are used as agricultural. Vegetables are cultivated on these affected land plots. Acquisition of only 65 land plots is associated with losses of 240 trees. The main impact is related to the loss of land, structures and businesses. In total 241 structures will be destroyed, including buildings owned by 70 businesses. Around 45 households will be physically relocated. 70 legal entities will suffer in terms of business impacts (either temporary interruption or mostly permanent loss of business facilities). According to the ADB SPS 2009 this sub-project is thus classified as of category A and needs the preparation of a Full scale Resettlement Plan (LARP)

Principles Adopted for the Project

377. To reconcile the gaps between Georgia laws/regulations and ADB's SPS (2009), MDFG has drafted this LARF for the Project, which, after endorsement by the Government, is seen as a tool for ensuring compensation at replacement cost of all items, the rehabilitation of informal settlers, and the provision of subsidies or allowances for AFs that may be relocated, suffer business losses, or may be severely affected.

LARF Principles and Entitlements adopted for this MFF

378. Based on the Georgian laws on land acquisition and the provisions on involuntary Resettlement in the ADB *Policy Safeguards Statement (2009)*, core involuntary resettlement principles are developed for this MFF which are as follows:

- Land acquisition, and other involuntary resettlement impacts will be avoided or minimized exploring all viable alternative project designs;
- where unavoidable, a time-bound LARP will be prepared and APs will be assisted in improving or at least regaining their pre-program standard of living;
- consultation with APs on compensation, disclosure of resettlement information to APs, and participation of APs in planning and implementing sub-projects will be ensured;
- vulnerable and severely affected APs will be provided special assistance;
- non-titled APs (informal dwellers or squatters) will receive a livelihood allowance in lieu of land compensation and will be fully compensated for losses other than land;
- legalizable APs will be legalized and fully compensated for land losses;
- provision of income restoration and rehabilitation to all APs;
- the LARP will be disclosed to the APs in the local language;
- payment of compensation, resettlement assistance and rehabilitation measures will be completed prior to the contractor taking physical acquisition of the land and prior to the commencement of any construction activities on a particular package; and
- establishment of appropriate grievance redress mechanisms to solve APs grievance if occurs.

Eligibility

379. APs entitled for compensation or at least rehabilitation provisions under the Project are:

- All APs losing land either covered by legal title/traditional land rights, legalizable, or without legal status;
- Tenants and sharecroppers whether registered or not;
- Owners of buildings, crops, plants, or other objects attached to the land; and
- APs losing business, income, and salaries.

380. Compensation eligibility will be limited by a cut-off date to be set for each subproject on the day of the beginning of the AP Census and DMS. APs who settle in the affected areas after the cut-off date will not be eligible for compensation. They, however will be given sufficient advance notice, requested to vacate premises and dismantle affected structures prior to project implementation. Their dismantled structures materials will not be confiscated and they will not pay any fine or suffer any sanction.

Compensation Entitlements

381. Entitlement provisions for APs losing land, houses, and income and rehabilitation subsidies will include provisions for permanent or temporary land losses, buildings losses, crops and trees losses, a relocation subsidy, and a business losses allowance based on tax declarations and/or lump sums. These entitlements are detailed below:

- **Agricultural land impacts** will be compensated at replacement value either with replacement plots of the same value of the land lost and at location acceptable to APs where feasible, or in cash free of transaction costs at current market rates or (if no land markets are active) based on the reproduction cost of the affected land. The cash at market rates option has been selected for the Program. When >10% of an AP agricultural land is affected, AP (owners, leaseholders and sharecroppers) will get an additional allowance for *severe impacts equal to* the market value of a year's gross yield of the land lost. In case of severe impact on other income, the APs will be paid additional compensation corresponding to 3 months of minimum subsistence income. Transaction taxes/fees will be paid by the EA or waived. Legalizable APs will be legalized and paid as titled owners. Non-legalizable APs will be compensated with one time self-relocation allowances in cash equal to 1 year of minimum subsistence income. Residual non-affected sections of a plot that becomes inaccessible or unviable to use after acquisition will also be compensated.
- **Non-agricultural land (Residential/commercial land).** Legal settlers will be compensated at replacement rate either with replacement plots of same value as plots affected and at location acceptable to APs where feasible, or in cash at current market rates, free of transaction cost. The cash at market rates option has been selected for the Program. Renters/leaseholders will receive a 3 months rent allowance. Non-titled/non-legalizable land users will be compensated with a 1 time self relocation allowance in cash equal to 1 year of minimum subsistence income. This allowance is to be to be calculated based on a 5 people family and the monthly-updated benchmarks indicated by the National Statistics Office of Georgia at time of LARP approval
- **Houses, buildings, and structures.** In order to address potential damages of vibrations or discomfort caused by road traffic, these items will be compensated in full for the whole building irrespective of the specific degree of impact. Compensation will be provided in cash at replacement cost free of deductions for depreciation, transaction costs or salvaged materials. All relevant APs are entitled to this provision by default irrespective of the registration status of the affected item.
- **Crops:** Cash compensation at current market rates for the gross value of 1 year's harvest by default irrespective of whether the crops were already harvested or not at the time of impact. Crop compensation will be paid both to landowners and tenants based on their specific sharecropping agreements.
- **Trees:** Cash compensation at market rate based on type, age and productivity of trees.

- **Businesses:** If business is lost permanently it will be compensated in cash equal to a 1-year income based on tax declaration or, if unavailable, based on the official minimum subsistence income. Temporary business losses will be compensated in cash for the business interruption period based on tax declaration or, if unavailable, official minimum subsistence income.
- **Affected business workers/employees:** Indemnity for lost wages for the period of business interruption up to a maximum of 3 months.
- **Relocation allowance**: APs forced to relocate will receive a relocation subsidy sufficient to cover transport costs and living expenses for 3 months.
- **Vulnerable Peoples Allowance:** Vulnerable people (APs below poverty line and widow or elder headed households) will be given an allowance corresponding to 3 months of minimum subsistence income and priority in employment in project-related jobs. The allowance is to be to be calculated based on a 5 people family and the monthly-updated benchmarks indicated by the National Statistics Office of Georgia at time of LARP approval
- **Severe Impacts Allowance;** APs losing >10% of agricultural land or >10% of non-agricultural income will receive a 3 months severe impacts allowance. This allowance is to be calculated based on a 5 people family and the monthly-updated benchmarks indicated by the National Statistics Office of Georgia at time of LARP approval
- **Community Structures and Public Utilities:** Will be fully replaced or rehabilitated so as to satisfy their pre-project functions.

5.5. Socio-Cultural Environment

5.5.1 Historical Context

Tbilisi

382. Feudal Georgia and generally entire Trans-Caucasus was covered with great many caravan routes. Through these routes Georgia connected to such distant countries as Arabia, India, Persia, Byzantium, etc. According to foreign and Georgian historical sources, the capital of Georgia – Tbilisi was a junction of trade caravan routes in the middle ages. The road of the developed centers of the old world and cultural realm also went through the city. Roads from different directions had resulted in many gates of the fortification of Tbilisi – Meidani Kari (Meidani Gate), Ganjis Kari (Ganja Gate), Mtsire Kari (Small Gate), Rabadis Kari (Rabad's Gate), Soghdebilis Kari (Soghdebil's Gate).

383. The capital of Georgia – Tbilisi is one of the oldest and most picturesque cities in the world located on the crossroads of the east and west. Its history comprising one thousand five hundred years is closely linked with the history of Georgian people. The city has witnessed peaceful life, intensive construction and cultural flourishing as well as countless invasions, ravaging and plundering and lengthy periods of foreign supremacy. Persians, Byzantines, Khazars, Arabs, Mongols, Turk-Selchukians and many more battled for Tbilisi and yet Georgian people have managed to preserve it as a capital of a strong united Georgian state.

384. As a result of archeological research it has been discovered that all districts of Tbilisi had been populated since fairly early periods (V-IV millennia B.C.) up to and including the late feudal age. Up to 385. archeological monuments of different periods have been discovered in Tbilisi so far. The stratigraphic layers of V-XIX c.c. urban life of Tbilisi have been most clearly revealed as a result of archeological excavations of territory adjacent to the garden close to Erekle II square; 8 m thick cultural layer comprised remnants of household and residential building of that period, water pipeline, ceramic

and other craftsmanship remnants, imported and local burnt and un-burnt ceramics, precious stone, glass, gold and silver jewelry, local and foreign numismatic material.

386. Old districts of Tbilisi are located in the southern part of the town near hot sulphur waters. In IV c. a bridge (near Metekhi) was built over the narrowest part of r. Kura, while a citadel (called Kala, Narikala, Deda-Tsikhe (Mother-Fortress) etc. in different times) was constructed on the mountain and its slope of the right bank. The citadel had been the architectural dominant of the city of early and developed feudal ages.

387. The above determined the structure of the city of the period, which had not significantly changed until XIX c. The initial appearance and planning structure have been preserved almost to these days. Later Tbilisi grew towards and against the river flow outside Tiflis and Kala.

388. According to foreign and Georgian historical sources, Tbilisi was a typical feudal city – economically strong and facilitated with conveniences in the middle ages. Trade, craftsmanship, markets and squares had been well developed. It was a large center of international trade relationships. Development was diverse as well – royal and aristocrats' palaces, citizens' houses, bathes, inns, caravanserais, and café-shops and of course – first churches, the construction of which, according to the tradition, is assigned to the founder of Tbilisi King Vakhtang Gorgasali (452-502). Tbilisi has been multi-national city since ancient times. People of all nationalities and religions felt well in the city, which is confirmed by cult constructions of all confessions preserved till now.

389. Similar to the old capital of Kartli – Mtskheta, the majority of the first churches of Tbilisi were built according to the names of the monasteries of the Holy Land of Palestine, according to the legend: Sioni – Virgin Mary's church, Golgotha – St. Cross church, Bethlehem – Virgin Mary's church, later called Petkhain, Tabor – Transfiguration church and Metekhi – Virgin Mary's church, which has connotations with the church built on the tomb of the Virgin in Gethsemane, Jerusalem. The symbolic icon of Aton mountain, yet another holy place, is the prominent dominant of Tbilisi today – Mtatsminda.

390. The appearance of Tbilisi of the late feudal age has been preserved in sketches by XVII c. European travelers (Turnifor, Chardin) and city plan and description drawn by Prince Vakhushti in 1735.

Town-Fortress Rustavi

391. The town-fortress is located within the park of culture and recreation of modern t. Rustavi.

392. Town-fortress Rustavi, the center of historical province Kukheti, is one of the oldest towns of Georgia. Rustavi had be the royal domain throughout the entire political-administrative development of the feudal epoch, which is confirmed by the ancient name of the town-fortress – Bostan-Kalaki (in Persian Vostan means royal court, while Kalaki is town in Georgian) and the fact that construction of a channel from r. Kura in the area is assigned to King Trdat in the second half of IV c. Due to the channel the town was called "Rus Tavi" (Ru is a stream, Tavi – head, start). In V c. Vakhtang Gorgasali founded bishop cathedra in Rustavi.

393. According to written sources and archeological data, since IV-V c.c. till the second half of XIII c. Rustavi had be one of the most significant political, religious and trade-economic centers of Georgia. In 1265 the town was plundered by the Golden Horde Khan Berqa, as a result of which the town transformed into a smaller size village.

Archeological research of Rustavi clearly revealed its complex and difficult history. Archeological excavations have been undertaken since the 40s of the past century.

394. As a result of excavations remnants of fortification structures, gates, palaces, bathes, residential and economic buildings with communications and high quality consumption items of the early and developed middle ages (IV-VIII, IX-X and XII-XIII c.c.) have been found; burial mounds of early and developed middle ages; burial mounds of late bronze age and antiquity have been discovered as well.
Intensive urban life and close economic link with the remaining world is proved by Georgian and foreign coins (from Kupuri, Byzantium, Khorezm, Daruband, etc.) discovered as a result of excavations of the remnants of fortress and town.

395. The development of Rustavi into an urban center of the middle ages was greatly favored by the proximity to two significant caravan routes – Tbilisi-Bardavi and Southern Georgia-Kakheti-Hereti roads.

According to Arab and Persian geographers, Tbilisi-Bardavi trade road followed r. Kura gorge and passed through towns of Rustavi, Gardabani, Khunani, Shamkori, Ganja. From Bardavi the road divided into several directions.

396. Rustavi was built in the area, which could not be avoided if one was travelling to the heart of Kartli and of course the enemies invaded it first too. Excavations confirm numerous falls and revivals of the city.

5.5.2 Cultural Heritage in Project Area

397. It should be noted that the above described historical route does not coincide with the modern road of Tbilisi-Rustavi at all. According to the written sources, the old route – from Rustavi to Tbilisi crossed m. Iaghluja slope towards Kumisi lake, then entered Tbilisi from Tabakhmela-Shindsi. Remnants of route have been archeological confirmed on m. Iaghluja, it has been preserved till now and researchers have no doubts that it is the trace of the old route. Remnants of settlements and burial mounds dating back to antiquity and early middle ages have been discovered on m. Iaghluja as well.

398. As regards the18 km project section of Tbilisi-Rustavi road to be reviewed; special scientific literature does not contain indications towards any cultural monuments within the section. I have received verbal information from the archeologists, who are surveying remnants of Rustavi town and Tbilisi districts during various construction works. According to the information provided by them, the areas of the main and alternative alignment and adjacent territories have not been subject to special research until now. They have not heard about accidental discovery of archeological items in the area.

6. ANALYSIS OF ALTERNATIVES

399. **"No-project" Alternative**. No-project variant means the conservation of the poor situation along Tbilisi-Rustavi section of Red Bridge-Tbilisi connection road, in particular, insufficient road capacity and low traffic safety will be maintained what will accordingly hamper the full application of the international transit potential of the country. Thus, No-project variant was ignored right at the early stage of the project development.

400. **Alternative Routes.** Route selection has been conducted in 2012, at the stage of preliminary Studies. 4 alternative routes provided on the map below have been analyzed. The options 3 and 4 considered as preferable at the FS stage, appeared to be underestimated. Revaluation at the early stage of Detailed Design revealed that: a) this option requires huge amount of filling materials to construct proposed embankments and costs twice more than envisaged in FS. b) the curve parameters do not fit international standards for Safety. In terms of environmental impacts, the study area is not sensitive (semi urban landscape with not used agricultural lands). However the large amount of needed filling materials was related with the additional environmental impacts. These options have been rejected at the early stage.

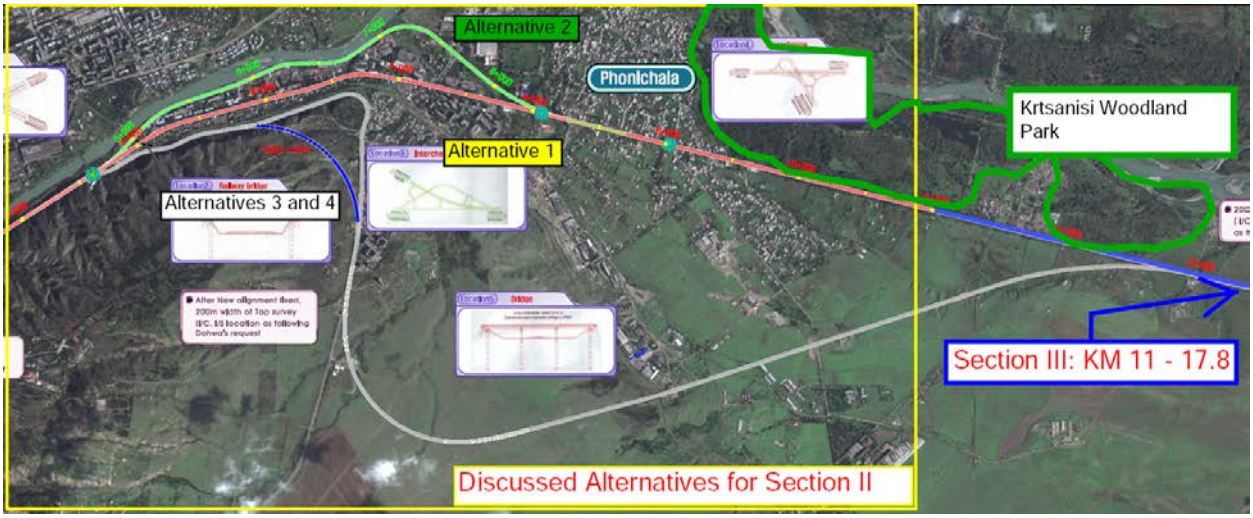


Fig. 6.1.

401. The options 1 and 2 were considered as a subject for real choice during the Detailed Design and IEE preparation. The subsections from KM 8+200 to Km 10+800 are similar for these alternatives. Accordingly the comparison of environmental impacts is given for subsections Km 4+00 – Km 8+200;

402. The Alternative 1 is crossing densely populated urban area. No sensitive receptors of natural environment are presented here. The landscape is urban. Surface water receptor (r. Mtkvari) is located at a distance of about 1km from the road and is separated by a block of apartment buildings.

403. The Alternative 2 is environmentally more sensitive. The layout follows the river bank in close vicinity. The river is main environmental receptor under the impact. However the major issue is not a protection of river (common mitigation measures could be applied, as usually in such cases), but protection of the road from potential risks of flooding. Design of a revetment has been included as a special component in ToR for Detailed Design. Construction of revetment increases need of filling materials. 291,230 m^3 of filling materials should be transported from quarries and borrow pits to meet the project requirements. The road alignment crosses orchards and floodplain areas and certain amount of trees should be felled. However, no endangered or red data species occur here and no sensitive habitats are presented. The area is typical urban version of the river bank terrace.

404. Despite the fact that the alternative 1 is environmentally preferable, the alternative 1 is not unacceptable. The alternative 2 is also associated with minor, manageable and temporary impacts. The residual impacts are not significant. Thus during the site selection resettlement issues appeared to present more important criteria, rather than environmental.

405. Below in the table you can see preliminary comparison of resettlement impacts. The Alternative 2 appears to be much favourable in terms of minimizing the resettlement impacts, although it will cost about 25% more than alternative 1.

406.Finally Alternative II has been selected as preferable.

407. **Alternative Solutions for Design and Construction Methods.** Alternatives of underpass tunnel and overpass bridge have been considered. The underpass tunnel does have the advantages of harmony with surrounding area, as the structure is nearly not to be seen. This option is economically feasibile. Therefore, The underpass tunnel can be adopted herein as the structural plan to cross the railway at **STA. 4+975.68km** (see more details in chapter 2.10 p.39). Different methods for constructing bridge piles have been assessed and compared: cast -in -place and pile driving. Pile driving has been rejected as a method associated with high noise and vibration/seismic impacts that could be severe for some of the adjacent apartment buildings.

Table 6.1.

#	Items	Section II											
		Alternative I	approximate area of single-story buildings	approximate cost of single-story buildings	The total cost	Alternative I Modification	approximate area of single-story buildings	approximate cost of single-story buildings	The total cost	Alternative II	approximate area of single-story buildings	approximate cost of single-story buildings	The total cost
1	Total number of affected land plots	337	168736			231	177422			199	194941		
2	Registered land plots	282				169				129			
3	buildings located in buffer area	538 2storey-18 3storey-1	29629			266 2 storey -12 3 storey -1	35388			213 2 storey - 7	30929		
4	Residential buildings	457	22222	500	11111000	116	7396	500	3698000	77	5856	500	2928000
5	Legal persons buildings located in buffer area	77 3storey-1	7317	700	5121900	137 2 storey -5 3 storey -1	27686	700	19380200	127 2 storey - 5	24857	700	17399900
6	Partnership land plots	3	120	30	3600	7	1552	30	46560	3	475	30	14250
7	Partnership buildings (Garages)	4	90	300	27000	13	306	300	91800	9	216	300	64800
8	State land plots	36	57274	-	-	20	51954	-	-	17	58351	-	-
9	Private land plots	298	111342	30	3340260	204	123916	30	3717480	179	136115	30	4083450
#	plots whose buildings located in buffer area	202				128				109			
	TOTAL				**19603760**				**26934040**				**24490400**

7. ENVIRONMENTAL IMPACTS

7.1. Summary of Activities and Anticipated Impacts

408. The project was screened for environmental impacts and a summary of activities and anticipated impacts is provided below in relation to project phases. In the case of the design phase the analysis describes how these potential impacts have been and will continue to be incorporated in the project design process.

Table 7.1 Environmental Impacts – Design and Pre-construction Phase

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site	☐	√	Neither protected area or its buffer zone, nor any ecologically sensitive area (mangrove, wetland, estuarine or special area for protecting biodiversity) is located within the project impact zone. The only environmental sensitivity is the r. Mtkvari (Kura): 2.5km of the new road alignment passes along the river bank. The river water quality could be affected by increased silt load as a result if erosion, as well as by accidental spillages of fuel. The hydrological effects of the planned river bank revetment should be carefully analysed (erosion of non-protected sections of the river bank, channel stability.
▪ Protected Area	☐	√	
▪ Wetland	☐	√	
▪ Mangrove	☐	√	
▪ Estuarine	☐	√	
▪ Buffer zone of protected area	☐	√	
▪ Special area for protecting biodiversity	☐	√	
B. Potential Environmental Impacts Will the Project cause…			
Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	√	☐	Embankments will change the existing landscape. However, the landscape is not distinguished by scenic value or ecological sensitivity. No quarries are located within the project area;
Encroachment on precious ecology (e.g. sensitive or protected areas)?	☐	√	

SCREENING QUESTIONS	Yes	No	REMARKS
Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	√	☐	The river bank protection revetment is considered by the project. In case of improper design the lateral scouring in other places (especially, upstream from the revetment) could be triggered.
Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	☐	√	
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	√	☐	Filling works during the construction of embankments will have temporary impact on local air quality due to dust generation;
Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological and radiological hazards during project construction and operation?	☐	√	
Noise and vibration due to blasting and other civil works?	√	☐	No blasting is expected. Temporary noise disturbance caused by the work of heavy machinery should be considered.
Dislocation or involuntary resettlement of people	√	☐	Resettlement impacts are significant – mainly on land plots, orchards and some businesses. Limited physical relocation also will be required.
Disproportional impacts on the poor, women, and children, Indigenous Peoples or other vulnerable groups?	☐	√	
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	√	☐	Temporary impact on local air quality due to dust generation during construction works, as well as certain increase of traffic related emission should be considered. However, these impacts are not envisaged as significant, as the local relocation of the highway from one place to another will only cause certain redistribution of emissions: slight increase in some places and slight decrease in other places.
Hazardous driving conditions where construction interferes with pre-existing roads?	☐	√	

SCREENING QUESTIONS	Yes	No	REMARKS
Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	☐	√	
Creation of temporary breeding habitats for mosquito vectors of disease?	☐	√	
Dislocation and compulsory resettlement of people living in right-of-way?	√	☐	Resettlement impacts are significant – mainly on land plots, orchards and some businesses. Limited physical relocation also will be required.
Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?	√	☐	The accidents on the new highway are possible and mitigation measures should be considered, although the probability is not high. The project impact in general will be positive, as the main goal of the project is to improve technical characteristics of the road and lower risks of accidents.
Increased noise and air pollution resulting from traffic volume?	√	☐	This could be significant impact for 3 or 4 apartment buildings and planning of mitigation measures will be required.
Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	√	☐	The 2.5 km of the new road alignment passes along the r. Mtkvari. In case of accidental spills or runoff water entering the river, pollution is possible. This is a manageable issue that should be addressed through proper organization and design of the drainage channels and oil/grease separating simple water-treatment installations.
Social conflicts if workers from other regions or countries are hired?		√	
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		√	
Risks to community health and safety due to the transport, storage and use and/or disposal of materials, such as explosives, fuel and other chemicals during construction and operation?		√	

SCREENING QUESTIONS	Yes	No	REMARKS
Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to the members of affected communities or where their failure could result in injury to community throughout project construction, operation and decommissioning.	√		Minor issue: Design and construction works should be in compliance with the technical standards. Proper traffic management should be ensured during construction and operation.
Impacts related to borrow pits and quarries	√		Significant amounts of filling materials will be required. This may have impact on borrow pit sites and quarries, as well as impose noise and dust disturbances and traffic safety issues along the transportation routes.

Climate Change and Disaster Risk Questions	Yes	No	REMARKS
Is the project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate change?	√		Whole Georgia is within the 8-9 grade earthquake zones and the project area is not exclusion. Design and construction standards relevant to seismic risks should be applied.
Could changes in temperature, precipitation, or extreme events patterns over the project life span affect technical or financial sustainability (eg., increased erosion or landslides could increase maintenance costs, permafrost melting or increased soil moisture content could affect sub 0-grade)	√		Flooding control is required matched with the regime of water discharges from the HPP located upstream. However, in principle the water regime is regulated and no cases of flooding due to operations of HPP ever occurred. More important problem is proper functioning of the storm-water drainage networks discharging surface water streams from the surrounding hills.
Are their any demographic or socio-economic aspects of the project area, that are already vulnerable (eg., high incidence or marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	
▪ Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by encouraging settlements in areas that will be more affected by floods in the future, or encouraging settlement in earthquake zones)?		√	

7.2. Specific Environmental Impacts

409. Under the specific environmental impacts reviewed in this chapter we mean most significant impacts characteristic particularly for this road project. While the overall summary of project impacts is given in p. 7.1 and more generic impacts associated with the construction activities are described in p. 7.3, here we focus on those issues, which are more specific for this particular project and some of them require not only qualitative but also quantitative analysis.

7.2.1 Air Emissions

410. The impact related to the emissions in the atmospheric air and relevant mitigation measures are among the important issues typical to the road projects. The quantitative analysis and modeling of the emissions related to the road traffic is presented in details in Annex 3. Below we provide brief summary of constraction stage and road operations stage emission impacts.

Construction related emissions

411. Construction activities are related to exhaust emissions produced by vehicle and heavy machinery operations, emissions related to construction of asphalt pavement, and dust generated by construction material transportation and storage, excavation works etc.

Mitigation Measures

412. Vehicle maintenance and control procedures will be established to ensure compliance of the machinery emissions with standards. Regular maintenance of diesel engines will be undertaken to ensure that emissions are minimized, for example by cleaning fuel injectors. Routine maintenance will be to a high standard to ensure that vehicles are safe and that emissions and noise are minimized.

413. All plant used on site will be regularly maintained so as to be in good working order at all times to minimize potentially polluting exhaust emissions. For crushers and concrete plants – Inventory of Emission Sources and Admissible Limits (Norms) for Emissions will be developed and these documents will be delivered to MoEPNR. In case of installing asphalt plant – appropriate EIA covering emission issues will be prepared and environmental permit obtained.

414. Vehicle refuelling will be undertaken so as to avoid fugitive emissions of volatile organic compounds through the use of fuel nozzles and pumps and enclosed tanks (no open containers will be used to stored fuel).

415. If deemed necessary in dry conditions or where significant quantities of dust are being or are likely to be produced mitigation measures will be arranged with the Construction Manager. Mitigation measures will include:

- Damping down using water bowsers with spray bars or other technical means; Minimum 2 browsers will be required for that purpose. However, the constructing contractor should not be limited by this figure, and if required additional browsers should be engaged.
- Sheeting of construction materials and storage piles; and

- Use of defined haulage routes and reductions in vehicle speed where required. Materials will be transported to site in off peak hours.
- Materials transported to site will be covered/ wetted down to reduce dust. The construction site will be watered as appropriate. Protective equipment will be provided to workers as necessary. All vehicles will be checked and repaired in case of need to eliminate increased emission due to damaged parts

416. Such measures will be used, where human or animal receptors lie within 300 m of the ROW

Traffic Related Emissions (Operation Stage)

417. The hourly intensity of traffic within Tbilisi-Rustavi highway rehabilitation according to observation data in 2011 is characterized with the below parameters: cars - 507 units; minibuses - 201 units; autobuses - 21 units and trucks - 18 units; dispersions calculated from this data [1] are given in the form of a table in Appendix #1.

418. According to 2016 estimates, intensity of traffic was assessed with the following parameters: cars - 724 units; minibuses - 286 units; autobuses - 30 units and trucks - 25 units; dispersions calculated from this data [1] are given in the form of a table in Appendix #2.

Air Pollution caused by Traffic under the Rehabilitation of Tbilisi-Rustavi Motorway

419. The hourly traffic determined on the basis of the 2011 survey conducted for the rehabilitation of Tbilisi-Rustavi Motorway is as follows: light-duty vehicles – 507 units, minivans – 201 units, buses – 21 units and trucks – 18 units.

420. The 2016 forecast suggests the following hourly traffic: light-duty vehicles – 704 units, minivans – 286 units, buses – 30 units and trucks – 25 units. The details of emission modeling estimated on the basis of this data [are given in Annex 3

421. Air quality modeling was carried out based on the emissions data estimated for 2016 traffic forecast in two sections: Section 1 – 1,500m (km 4+200 – km 5+700) and Section 2 – 1,250m (km 8+500 – 9+ 750) . Section 1 comprises 16 control points and Section 2 – 20.

422. The analysis of the results show that within the RoW only the limits of nitrogen dioxide are exceeded 1-1.5 times, while the concentrations of other pollutants vary within the permissible limits between 0-15%. The modeling determined the minimum distance of 40m from central line, where the concentration of nitrogen dioxide will be within the permissible limits.

423. In Section 1 the maximum concentration of nitrogen dioxide is 1.56 MPC (maximum permissible concentration). In Section 2 it is 1.66 MPC. This is caused by the proximity of residential buildings to the motorway.

424.In control points which are located ≈ 35-40m from the motorway center line, the maximum concentration of nitrogen dioxide is within the permissible limits.

425. In order to determine the relation of nitrogen dioxide concentration with the distance a test involving various vehicles and volumes of traffic was conducted with 5 m spacing from the center line of the motorway (i.e. the same data as used in other calculations). This approach was chosen as it is difficult to determine the exact distances to residential buildings and the test is helpful is estimating concentrations.

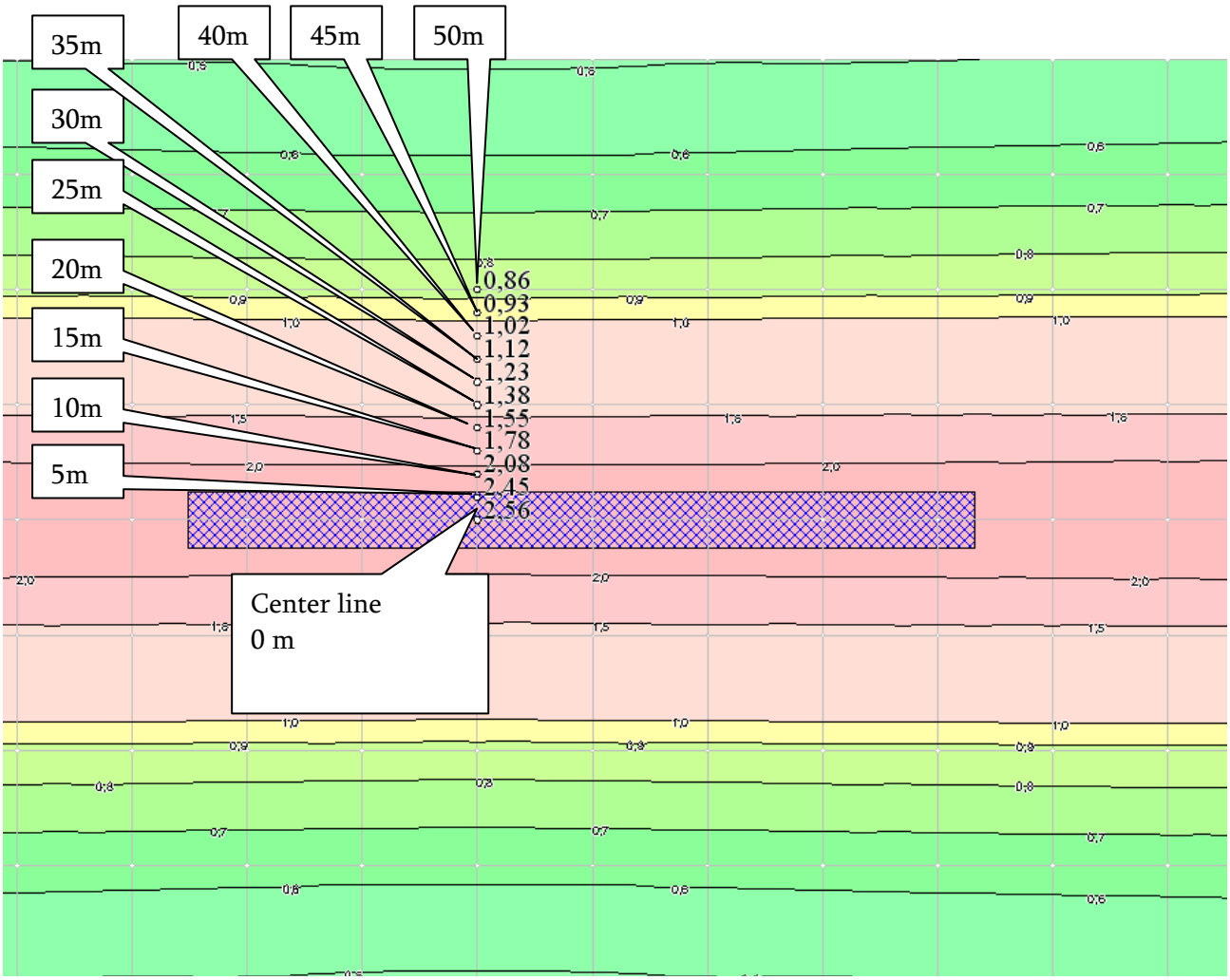


Fig. 7.1.

426. The dynamics of nitrogen dioxide concentration changes perpendicularly to the motorway center line (5m spacing).

Perpendicular direction to the motorway center line	Meter	Nitrogen dioxide concentration (MPC)
Motorway center line	0	2,56
from motorway center line	5	2,45
-//-	10	2,08
-//-	15	1,78
-//-	20	1,55
-//-	25	1,38
-//-	30	1,23
-//-	35	1,12
-//-	40	1,02
-//-	45	0,93
-//-	50	0,86

Note: the distance to a residential building should be calculated from the center line of the motorway (0m)

427. Considering the cross-section of the designed road, 40m from the central line means 24m from the edge of the road for section1 and 15m for section 2. For section 1 only the residential buildings, which are subject for demolition under the LARP, are falling within the zone of increased NOx emissions. For

section 2 few apartment buildings are falling within the zone of slight exceedence of NOx emissions (1.1 MAC). At the same time, it should be stressed, that relocation of the road towards the river will have overall positive impact on most densely populated central part of Ponichala rayon, where the currently operational central road is located.

Mitigation Measures

428. This negative impact is not considered as significant or dangerous for health (in most places in Tbilisi the NOx level is much higher – see chapter 4). However, planting of trees and landscaping should be considered as a local measure, which should be implemented as a part of project. Planting of broad-leaved trees will help to minimize concentrations of NOx. The other local measures are speed limitation to 60km/hour and traffic congestion management.

429. More general issue, to be addressed at the country policy level is improvement of the control over the fuel quality and vehicle maintenance. Measures to be implemented at the City and Nationwide level should comprise: prohibition of ethylated fuel, improving fuel and vehicle maintenance standards and control mechanisms, define and approve procedures and responsible bodies for vehicle maintenance control.

Summary

430. Traffic related emissions are not considered as major environmental issue. Only limited and local effect of NOx emissions within the RoW and area adjacent to several apartment buildings will not have impact on health of local residents. The level of emissions is much lower than in central rayons of Tbilisi. The mentioned minimal impacts should be minimised through improved landscaping, tree planting, traffic congestion management and speed limitation.

7.2.2 Noise Factor Related to Construction and Operation of the Road

7.2.2.1 Construction Noise Related Impacts

431. 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 7.2.

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

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

Table 7.3.

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

433. Synthetic noise was calculated with supposition from the simultaneous input of three construction units. E.g. noise generated by each of machinery separately - backhoe, excavator and bulldozer – is around 75dB(A), while synthetic noise has been calculated as 80.6 dB(A). 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").The construction noise impacts of this particular project is analysed in details in the report "Review of Noise and Vibration", which is supplemented as Annex 4. Below we provide summary conclusions.

Table 7.4. Noise level at different distances from working site

Synthetic	Noise level at each distance (m, dB(A))							
	15	30	50	**100**	150	200	250	300
80.6	80.6	74.5	70.1	**64.1**	60.6	58.1	56.1	54.5

Table 7.5. Expected Construction noise impacts at different residential locations

Investigation point	Investigation area	STA.NO	Distance between boundary of construction site and facility(m)	Expectation level (dB(A))	Required Noise standard (dB(A))
①	Apt(2floors)	Right side) 5+300	3.0	94.5	65
②	Apt(2floors)	Right side) 5+360	16.7	79.6	65
③	Apt(2floors)	Right side) 5+480	13.7	81.3	65

Investigation point	**Investigation area**	**STA.NO**	**Distance between boundary of construction site and facility(m)**	**Expectation level (dB(A))**	**Required Noise standard (dB(A))**
④	Apt(6floors)	Right side) *5+660*	23.9	76.5	65
⑤	Factory(2floors)	Right side) 6+300	7.2	86.9	70
⑥	Hospital	Right side) 6+500	44.2	71.2	65
⑦	Apt(5floors)	Right side) 6+780	22.6	77.0	65
⑧	Pharmaceutical company	Left side) 8+060	37.1	72.7	70
⑨	Auto repair-shop	Right side) 8+060	14.0	81.2	70
⑩	House(1floors)	Both side) 8+500~EP	5.0	90.1	65

Mitigation Measures

434. Mitigation measures could be subdivided on managerial and engineering components.

435. Managerial measures include:

- Apply good equipment maintenance practice
- Prevent work of engines in idling regime
- Prohibit usage of vehicle horns
- Manage optimal combination of simultaniously working machinary
- Do not locate high noise machinary, like crushers in residential area. Crushrs are not needed at thr working site and could be located at a distance exceeding 500m from residential areas.
- Limit construction activities to day-time and prohibit night works

436. However, the mentioned traditional measures are not sufficient in this particular case and it is recommended to apply **temporary noise barriers** during construction.

Table 7.6 Plan of noise reduction on construction and noise level after reduction.

No.	Investigation area	STA.NO	Distance (m)	Expected noise level (dB(A))	Height of temporary soundproof walls (m)	Reduction value by temporary soundproof walls (dB(A))	Noise after noise reduction (dB(A))	Standard noise level (dB(A))	Restriction of working time and Management of input period
①	Apt(2floors)	Right side) 5+300	3.0	94.5	7	13.7	80.8	65	◎
②	Apt(2floors)	Right side) 5+360	16.7	79.6	7	14.0	65.6	65	◎
③	Apt(2floors)	Right side) 5+480	13.7	81.3	7	13.7	67.6	65	◎
④	Apt(6floors)	Right side) *5+660*	23.9	76.5	6	11.8	64.7	65	
⑤	Factory(2floors)	Right side) 6+300	7.2	86.9	7	14.5	72.4	70	◎
⑥	Hospital	Right side) 6+500	44.2	71.2	3	10.9	60.3	65	
⑦	Apt(5floors)	Right side) 6+780	22.6	77.0	6	12.6	64.4	65	
⑧	Pharmaceutical company	Left side) 8+060	37.1	72.7	3	12.1	60.6	70	
⑨	Auto mechanic	Right side) 8+060	14.0	81.2	3	12.4	68.8	70	
⑩	House(1floors)	Both sides) 8+500~EP	5.0	90.1	7	14.6	75.5	65	◎

437. Mitigation of this minor 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 deploy high noise devices, like crushers, outside the residential zone and exclude the night-time works

438. All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people. Near the settlements, the rehabilitation activities will be limited to daylight working hours to reduce impacts. All vehicles will be checked and repaired in case of need to eliminate increased level of noise due to damaged parts.

Summary

439. Construction noise impacts is a temporary nuisance and is not considered as a major issue. However, so far as many residential buildings are located quite close to the construction corridor, specific mitigation measures are required in addition to those envisaged by common "good construction practices". 6-7m height temporary noise barriers should be applied during construction activities carried out at a distance less than 50m from the residential or public buildings.

7.2.2.2 Traffic Related Noise Impacts (Road Operation Phase)

440. The noise standards for residential areas is given below: maximum admissible noise levels are given for averaged values (Noise equivalent Level - La.eq. dBA) and for maximum (peak) noise levels- La max dBA). It should be noted that according to existing data noise levels generally in Tbilisi exceed the admissible maximum levels in many places and, as it has been demonstrated during the field measurements, the noise level in the project area is also at the edge of admissible maximum (from 58 to 63dBA, while maximum admissible noise level near the roadside is 65 dBA). The background noise near the existing road (La eq. 65 dBA, site 4) is slightly higher than at the locations of the planned new road.

441. HW-NOISE model developed in Korea has been used for assessing expected traffic noise impacts and compliance with the noise standards. The model takes into consideration traffic capacity, speed, pavement type, vehicle type etc. The noise modelling report is attached to this IEE as an Annex 4. Here below the summary is provided, where the traffic volume expected after 10 and 20 years is demonstrated for different residential locations along the project road (residential and public buildings located as a first row of buildings closest from the new road). This data relates to limited speed 60km/hour and 80km/hour. According to the modelling outcomes, the expected equivalent noise levels exceed the standard values at least in 6 residential sections and specific mitigation measures are required. The noise values for 80km.hour speed case is even higher (see Annex 4and also fig 2.2, where location of buildings is shown on the layout).

Table 7.7. Georgian Noise Standards in Residential Areas: Maximum Admissible Noise Levels

Time	Noise equivalent Level La.eq. dBA	Maximum Noise Level La max dBA
Generally for the residential area (in the vicinity of residential buildings)		
7am – 11 pm	55	70
11pm – 7am	45	60
In the vicinity of the first row of residential buildings located adjacent to motorways and railways*		
7am – 11 pm	**65**	80
11pm – 7am	**55**	70

*Note. The La.eq and La max for the noise originating in the area due to the car and railway traffic, distanced from the construction isolating the first echelon of sound-protected residential houses, hotels, hostels by 2 m, directed towards the common city and regional mains and railway, is admitted to be 10 dB more (precision = +10 dB; see values in brackets) than the basic admissible value.

442. The tables below (7.8 and 7.9) demonstrate predicted noise levels without noise barriers and height of the barrier required for noise abatement. Table 7.8 reflects noise impacts for speed limit of 60km/hour and the table 7.9 refers to speed limit 80km/hour.

Table 7.8. Height of Noise Barriers for Noise Abatement - Speed Limit of 60km/hr

① Application of traffic volume expected after 10 years

Facility	STA.NO	Distance (m)	Estimated result		In case of application of the standard level		
			Day time dB(A)	Night time dB(A)	Height of soundproof wall (m)	Noise after reduction dB(A)	
						Day time	Night time
Apt.(2 floors)	5+300	5	74.3	67.2	6.0	61.1	54.0
Apt.(2 floors)	5+360	16	69.0	61.9	4.0	61.6	54.4
Apt.(2 floors))	5+480	14	69.4	62.3	4.5	60.8	53.7
Apt.(6 floors)	5+660	25	67.4	60.3	6.5	62.0	54.9
Factory(1floor)	6+300	6	72.5	65.4	3.0	61.1	54.0
Hospital	6+500	54	57.1	50.0			
Apt.(5 floors)	6+780	28	68.6	61.5	9.5	61.8	54.7
Pharmacy company	8+060	47	56.6	49.5			
Auto repair shop	8+060	44	57.4	50.3			
House (1 floor)	8+500~right & left	32	57.5	50.4			

Hatched area point is exceeding the standard in spite of installment of a soundproof wall

② Application of traffic volume expected after 20 years

Facility	**STA.NO**	**Distance (m)**	**Estimated result**		**In case of application of the standard level**		
			Day time dB(A)	**Night time dB(A)**	**Height of soundproof wall (m)**	**Noise after reduction dB(A)**	
						Day time	**Night time**
Apt.(2 floors)	5+300	5	75.2	68.0	**6.0**	62.0	54.8
Apt.(2 floors)	5+360	16	69.6	62.4	**4.5**	60.9	53.7
Apt.(2 floors)	5+480	14	70.3	63.0	**4.5**	61.7	54.5
Apt.(6 floors)	5+660	25	68.2	61.0	**7.5**	61.8	54.6
Factory(1floor)	6+300	6	73.4	66.2	**3.0**	62.0	54.8

Facility	STA.NO	Distance (m)	Estimated result		In case of application of the standard level		
			Day time dB(A)	Night time dB(A)	Height of soundproof wall (m)	Noise after reduction dB(A)	
						Day time	Night time
Hospital	6+500	54	58.0	50.8			
Apt.(5 floors)	6+780	28	69.5	62.3	**10.0**	61.1	53.9
Pharmacy company	8+060	47	57.5	50.3			
Auto repair shop	8+060	44	58.3	51.1			
House (1 floor)	8+500~right & left	32	58.4	51.2			

Hatched area point is exceeding the standard in spite of installment of a soundproof wall

Table 7.9 Height of Noise Barriers for Noise Abatement: - Speed Limit of of 80km/hr

① Application of traffic volume expected after 10 years

Facility	STA.NO	Distance (m)	Estimated result		In case of application of the standard level		
			Day time dB(A)	Night time dB(A)	Height of soundproof wall (m)	Noise after reduction dB(A)	
						Day time	Night time
Apt.(2 floors)	5+300	5	75.5	68.4	6.5	60.4	53.3
Apt.(2 floors)	5+360	16	70.0	62.9	4.5	61.3	54.2
Apt.(2 floors)	5+480	14	70.6	63.5	5.0	60.4	53.3
Apt.(6 floors)	5+660	25	68.6	61.5	8.0	60.6	53.5
Factory(1floor)	6+300	6	73.8	66.7	3.5	60.9	53.8
Hospital	6+500	54	58.3	51.2			
Apt.(5 floors)	6+780	28	69.9	62.8	10.0	61.5	54.4
Pharmacy company	8+060	47	57.9	50.8			
Auto repair shop	8+060	44	58.7	51.6			
House (1 floor)	8+500~right & left	32	58.7	51.6			

Hatched area point is exceeding the standard in spite of installment of a soundproof wall

② Application of traffic volume expected after 20 years

Facility	STA.NO	Distance (m)	Estimated result		In case of application of the standard level		
			Day time dB(A)	Night time dB(A)	Height of soundproof wall (m)	Noise after reduction dB(A)	
						Day time	Night time
Apt.(2 floors)	5+300	5	76.4	69.2	**6.5**	61.3	54.1
Apt.(2 floors)	5+360	16	70.9	63.7	**5.0**	60.6	53.4
Apt.(2 floors)	5+480	14	71.5	64.3	**5.0**	61.3	54.1
Apt.(6 floors)	5+660	25	69.5	62.3	**8.0**	61.5	54.3
Factory(1floor)	6+300	6	74.7	67.5	**3.5**	61.7	54.5
Hospital	6+500	54	59.2	52.0			
Apt.(5 floors)	6+780	28	70.7	63.5	**10.5**	61.4	54.2
Pharmacy company	8+060	47	58.8	51.6			
Auto repair shop	8+060	44	59.6	52.4			
House (1 floor)	8+500~right & left	32	59.6	52.4			

Hatched area point is exceeding the standard in spite of installment of a soundproof wall

443. Summary of Traffic Related Noise Impact Estimations:

According to international approach (e.g. Federal Highway Administration of USA – FHWA) two criterions are usually used to estimate project related impacts: It is accepted that traffic noise impacts occur when:

- **Criteria 1:** when the predicted noise levels with the project substantially exceed the predicted noise levels without the project, or
- **Criteria 2:** the predicted noise levels approach or exceed the Maximum Admissible Levels (NAC in case of FHWA)

444. According to FHWA criteria:

- Substantial Increase is defined as a predicted 12 dB, or greater, noise increase over the existing worst-hour noise level resulting from the proposed highway project.
- Severe Traffic Noise Impact is defined as a predicted increase of noise from a project of 30 dB or an absolute predicted level of 75 dB or greater

445. As it is seen from the fig. 7.8 and 7.9, applying only criteria 1, we can consider that the project impact is not significant as the existing baseline noise will be increased only by 3-4 dBA for 60km/hour

and 5-6dBA for 80km/hour speed limits. However, applying criteria 2, it is clear that the predicted noise level exceeds the Maximum Admissible Levels and noise abatement measures are necessary.

Mitigation Measures

446. Options of Mitigation Measures Discussed before PC meeting held on August 17

- First mitigation is speed limitation. As it is demonstrated on fig. 7.8 and 7.9 speed limit to 60km/hour enables to reduce noise level by 1.3dB(A), as compared with 80km/hour and by 2.2 dB(A) against 120km/hour. However, this is a minor improvement affect and additional mitigation measures are required, as even for 60km/hour speed limits the predicted noise level exceeds admissible values. Besides, speed limits cannot be lower than 80km/hours according to technical requirements set forth by the City Hall based on traffic management considerations. For such a speed limit, MDF and the City Hall committed to adopt adequate road safety measures (according to international best practice) that will include but not be limited to: adequate signals and signage, pedestrian crossings slightly raised, serving also as speed breakers, and pedestrian refuge islands in the median separator. These elements will be incorporated in the technical detailed design.
- Installation of noise barriers is an option for noise abatement. Noise barriers should be installed for approximately 1.6km section (km 5+200 – 6+800). The height of noise barrier will vary at different locations. On fig. 7.8 and 7.9 the height of the noise barriers is shown, which is required for noise abatement at different locations and different speed limits. The noise barriers would provide necessary pedestrian crossings to enable the nearby population to access the river bank.
- The other option of noise abatement is additional insulation of the residential buildings using double glassed windows. The target here should be noise reduction from 35 to 40% (to meet the admissible noise values inside the apartment). The additional effect of insulation will be efficient inside the residence building (and this is important achievement), but will not improve the noise level outdoors, on the adjacent territories.

447. Planting of trees is considered as being not very efficient in terms of noise reduction, however useful for landscaping and mitigating visual impacts of noise barriers.

- **Highway traffic noise barriers:** can reduce the loudness of traffic noise by as much as half;
- do not completely block all traffic noise;
- can be effective, regardless of the material used;
- must be tall and long with no openings;
- are most effective within 61 meters (200 feet) of a highway (usually the first row of homes);
- must be designed to be visually appealing;
- must be designed to preserve aesthetic values and scenic vistas;
- substantially reduce noise levels for people living next to highways.

448. Some information on applicable noise barriers (source: U.S. Department of Transportation; Federal Highway Administration):

449. Noise barriers are solid obstructions built between the highway and the homes along a highway. They do not *completely* block all noise they only reduce overall noise levels. Effective noise barriers typically reduce noise levels by 5 to 10 decibels (dB), cutting the loudness of traffic noise by as much as

one half. For example, a barrier which achieves a 10-dB reduction can reduce the sound level of a typical tractor trailer pass-by to that of an automobile.

450. Barriers can be formed from earth mounds or "berms" along the road, from high, vertical walls, or from a combination of earth berms and walls. Earth berms have a very natural appearance and are usually attractive. They also reduce noise by approximately 3 dB more than vertical walls of the same height. However, earth berms can require a lot of land to construct, especially if they are very tall. Walls require less space, but they are usually limited to eight meters (25 feet) in height for structural and aesthetic reasons.

Pic. 7.2 Noise Barriers

Pic. 7.3. Noise Barriers

451. A major consideration in the design of a noise barrier is its visual impact on the surrounding area. A tall barrier near a one-story, single family, detached residential area can have a negative visual effect. One solution to addressing the size relationship in visual quality is to provide staggered horizontal elements to a noise barrier to reduce the visual impact by planting landscaping in the foreground. Native plantings are preferable. Graffiti on noise barriers can be a potential problem. One solution is to use materials that can be readily washed or repainted. Landscaping and plantings near barriers can also be used to discourage graffiti, as well as to add visual quality.

Fig. 7.4 Noise Barriers - Landscaping

Fig. 7.5. Noise Barriers- Landscaping

Noise Reduction with Double Glazing

- Double glazing simply means that a window has two glass panes instead of just one. Also called IGUs (Insulated Glass Units), the panes are separated by an air or gas pocket. This space between the panes of glass is the key to their ability to dampen noise. According to research, standard double glazed windows (3mm thick glass panes with a 6mm gap between them) offer great thermal insulation, but do

not effectively dampen noise. To achieve this, a combination of thicker glass and a wider gap between panes is necessary. The following examples give you an idea of what's necessary to reduce outside noise levels:
4mm glass panels with a 12mm gap between them can reduce voice levels (such as children playing in the street) by as much as 19 percent.

452. A 10mm glass/12mm gap/6mm glass combination can reduce voice levels as much as 34 percent.

453. Using laminated glass (two thin layers of glass with a special laminate between them) can help reduce noise even further:

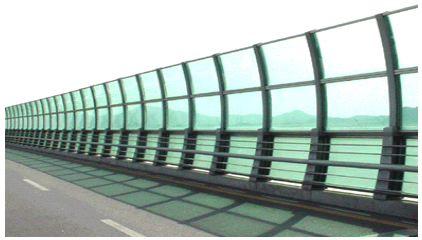
6.38mm laminated glass combined with 4mm standard glass and an 8 mm gap can dampen voice noise by up to 46 percent.

A 10mm glass/12mm gap/6.38mm laminated glass combination can reduce traffic noise as much as 57 percent.

- In order to improve acoustics significantly, the windows must be tightly sealed. Their effectiveness decreases dramatically if noise can enter through air gaps around the windows.

454. Another way to reduce noise levels is to have a double window system installed. Also called retrofit double glazing, these systems can be thought of as "windows on top of windows." They don't require the removal of your old windows. Instead, new windows are fastened to your existing windows, usually using magnets, leaving a 100mm gap between panes. According to many sources, this can result in a perceived decrease in noise levels of up to 75 percent. Manufacturers and suppliers claim that double window systems are particularly effective at reducing traffic noise.

Alternative Options of Noise Abatement

Description		Soundproof wall(Aluminium)	Soundproof wall(Clear polymer)		Double Glass window + Air Conditioning
Picture					
Installation Location		STA. 5+160~5+740 (L=580m)	STA. 6+240~6+670 (L=430m)	STA. 6+730~6+820 (L=90m)	10 Buildings (212 flats) and 1,543 Windows (3,740 m^2)
Height of Soundproof wall	**V=60km/h**	H = 4.5 ~ 7.5m	H = 3.0m	H = 10.0m	—
	V=80km/h	H = 5.0 ~ 8.0m	H = 3.5m	H = 10.5m	—
Total cost	**V=60km/h**	3,002,000 GEL (1,824,000 USD)	3,708,000 GEL (2,254,000 USD)		1,115,000 L – 1,650,000 GEL (700,000 -1000,000 USD)
	V=80km/h	3,276,000 GEL (1,991,000 USD)	4,054,000 GEL (2,464,000 USD)		1,115,000 L – 1,650,000 GEL (700,000 -1000,000 USD)
Characterization		✓ Effect of noise reduction is good. ✓ Meet the required standards. ✓ Constructability condition is good. ✓ View for local resident is bad. ✓ Medium construction cost.	✓ Effect of noise reduction is good. ✓ Meet the required standards. ✓ Constructability condition is good. ✓ View for local resident is good. ✓ High construction cost.		✓ Effect of noise reduction to be achieved 35-40%. ✓ Meet the required standards. ✓ Constructability condition is bad. ✓ No need soundproof wall. ✓ Low construction cost.

455. During the public consultation meeting held on August 17 following points have been raised by the residents of the apartment buildings located along the design road;

- Impacts of vibration on the old building structure (this issues is addressed in section 7.2.3)
- High noise barriers (6.5 m and more) are considered to be unacceptable due to adverse visual impact.
- Combination of lower (3.5m to 4m) noise barriers and installation of double glazed windows is considered as optimal option for traffic related noise abatement, it would also serve as protection of the recreational area located between the building and the road and increase safety of pedestrians and protection from the road. However, the wall should not isolate the inhabitants from the river bank and the proposed wall should include necessary pedestrian accesses.

456. **Detailed Design for Noise Abatement.** Results of preliminary estimations and modelling provided in IEE demonstrate that in principle the satisfactory noise abatement could be achieved by combined application of double glazing of windows in adjacent apartment buildings and construction of relatively low (4.5m in height) noise protective wall. 4.5m height protective wall is sufficient for reducing noise to acceptable standards in a public area adjacent to the apartment buildings and apartments of 1st, 2nd and 3rd floors (see the modelling data: tables 7.8 and 7.9). In case if only the wall of 4.5m height is applied, the apartments of higher floors (4 – 9) are not protected. However, combined use of two methodologies - 4.5 height protective wall and double glazing of windows solves both problems: the wall ensures noise reduction within the outdoors public space and the double glazed windows ensure protection of the inside space of the apartments. The combined option is cheaper and aesthetically more acceptable than construction of 10 – 12m height noise barriers. Details of design (height of wall at different subsections; combination of transparent polymers with concrete at some locations; final selection of window models and glass characteristics etc.) should be determined during completion of the DD. The studies should be supported by calculation of noise reduction efficiency compared to the standards. If the final outcome of the best selected option still does not meet the standard, then further reduction of speed limit is required. The DD solutions should be based on evaluation of following aspects:

- Final list and layout plan of buildings that are subject for noise abatement (The picture will be clear when analysis of structural integrity and vibration impacts is completed)
- Physical modelling of different options of double (or triple) glazed windows to select the acceptable one for each apartment building
- Height and other parameters of the concrete wall for each subsection
- Visual aspects: appearance of facade; exterior decor of concrete wall; combination of concrete with transparent elements;

457 .The design of the noise barriers will be conducted in conjunction with the vibration study and related design solutions in regard with the protection of apartment buildings from vibration and noise. Particular issues will be solved, when vibration studies are finished. Based on above considerations and feedback received from the affected residents, MDF decided to adopt following scheme for noise abatement:

- **Preconstruction Phase:** The detailed design of noise barrier and specifications for double glazed windows will be provided before completion of the detailed design and issuance of bidding documentation.
- In order to mitigate traffic noise impacts it is necessary to limit speed to 80km/hour, or even further reduction depending on the efficiency of noise reduction measures resulted from

combining double glazing windows and noise barriers. According to preliminary assessment, these mitigation measures should be sufficient; However, monitoring after the project implementation is required to check efficiency of applied measures.

- Install double glass windows for the residents of the apartment buildings living along the road. The double glazed windows could be matched by their specifications to ensure 40% reduction of noise in apartments. In different cases the technical details of windows sufficient for 40% reduction of noise may vary (glass thickness, double or triple glass, replace old windows or install new frames in addition to old etc.) , but the goals definitely could be achieved applying standard options proposed by suppliers within the price range discussed below. The double glazed window solves the problem of noise inside the building (this is only matter of price variation within the acceptable range). However, it does not solve the noise problems in the outdoors public area. In addition to the double gazing windows conditioners should be installed in affected flats, as in summer time possibility of opening windows for ventilation will be limited by noise protection needs. Therefore cooling could be achieved by additional installation of air conditioning systems. Costs of these mitigation measures is estimated roughly as 1,000,000 USD (1,650,000 GEL). This includes costs of conditioners 254,400 Gel (212 flats x 2 rooms x 600 Gel) and cost of purchase and installation of double glazed windows able to reduce noise by 40%. The price of windows vary from 180 to 370 Gel per sq.m. Excessive price for installation of windows – 1,395,600 GEL. In total, together with price for air condition systems 1,650,000 Gel is estimated as sufficient amount
- Install 4.5m height noise barriers along the design road -(km 5+200 – 6+800 (Height and other parameters will be specified during preconstruction phase studies). Construction of aluminium barrier of 4.5 height and 1.6km in length will cost around 2,184,000 GEL (1,323,636 USD) and of polymer – around 2,702,000 Gel (1,637,500 USD). The latest data obtained from suppliers shows that option of concrete noise protective wall provides lower prices: construction of wall using specific sound proof concrete slabs (height 4.65m and length – 1.6km) will cost round 1,000,000 GEL. The analyzed option reflects costs of structure constructed by concrete slabs specifically designed by specialized manufactures as a traffic noise protective barrier. This structure is certified and is proved to meet noise standards of Ex-USSR countries, including Georgia. No one of suppliers available on market has proposed brick walls of specific design and proven characteristics that ensure compliance with standards. In general, wall constructed using bricks costs 1.3 times higher than concrete wall of similar size. In order to meet the aesthetical requirements, different models of the concrete slabs could be supplied by manufacturers of noise barriers, imitating bricks, stone wall etc. **Total cost of noise abatement measures including double glazed windows and concrete noise barrier is around 2,650,000 GEL**

Fig.7.6., 7.7. Noise Barriers Mounted Using Concrete Slabs

7.2.3 Vibration Impacts

458. The backgroumd vibration along the design road section is much less than the maximum admissible threshold (21 – 25dbV against 69-74dbV). Vibration on the ground adjacent to the existing road (on the sidewalk, 2m from the edge of the road) has been recorded to be 65dbV, which is also below the critical threshold. Vibration attenuates sharply with the distance. The maximum Admissible Threshold for vibration is a criterion for estimating health impacts of vibration. The closest apartment buildings (2

storey building, Km 5+480) will be located at a distance of 14m from the design road. At this distance the traffic related vibration impact should be considered as negligible. The same should be valid for regular type vibration impacts related to routine engine operations during the construction activities.

459. However, there is an irregular type of construction related elastic waves ("seismic type impacts" , shock, concussion, sometimes also referred as vibration), which may have impact on structural integrity of the adjacent buildings. In general, this can be problematic if the new construction involves high levels vibration generating activities (i.e., pile-driving or heavy traffic loads), deep excavation, or dewatering. Vibration damage occurs when construction activity, such as pile driving or soil compaction, produces waves in the ground that travel outward from the source to adjacent properties. Construction typically produces traveling ground deformations known as Raleigh waves. While these waves decrease in intensity (attenuate) with distance from the source, depending on soil type or the fragility of the adjacent property, the waves may still be sufficiently strong to cause discomfort, if not damage. There are two fundamental mechanisms for vibration damage—1) distortion from intertial loads, and 2) settlement of the soils supporting the foundation. If the soil settlement is not uniform, distortion and damage can occur. Such differential settlement can also be due to deep excavations adjacent to existing foundations, or to changes in groundwater levels due to dewatering to keep the construction site dry. In case of existing buildings in near distance from the future road and construction site, this risk can be mitigated through adoption of necessary construction methods that minimizes the vibration during construction. Protection of the buildings can be included in the project if found necessary after deep survey of current condition of existing building structures. Underpinning of adjacent foundations is often done to prevent damage from excavations or dewatering. Because few structures begin free of distress, it is often difficult to differentiate between preexisting damage and possible new damage caused by adjacent construction. To help differentiate, preconstruction surveys of adjacent properties need to be conducted to map the cracking and foundation elevations prior to the beginning of construction. It is often possible to resolve construction damage from other sources by comparing post-construction and pre-construction photographs and elevation surveys.

460. At this stage, the structural integrity of adjacent buildings, within the section km 5+200 – 6+900, has not been surveyed and some of structures appear to be in poor condition. In order to mitigate the risks, an action plan including refinement of the design and construction methods has been defined by MDF (see below, mitigation measures), and will be fully conducted before finalization of the details design.

Mitigation Measures

461. The blasting operations are not envisaged and should be prohibited.

462. The cast -in -place construction method has been chosen for construction of bridge piles, instead of pile driving method, which is associated with high level noise and vibration.

463. Crushers and high noise and vibration producing machinery, which are not necessary at construction site, will be located at a distance more than 500m from residential areas.

464. **However, these are minor mitigation measures.** The major issue is to determine level of vibration/shock impacts on the emergency buildings, seismic stability (structural integrity) of buildings and in case of immitigable impacts and/or risks of the building failure due to the project impacts (including risks of remote effects in future) include these buildings in LARP and plan physical relocation of households to ensure as minimum similar conditions of residing.

465. At this stage the Executing Agency takes responsibility to conduct during the next two months additional engineering studies related to this issue. This vibration study will be completed before

finalisation of technical detailed design and issuance of bidding documents. Based on the outcome of the study, supplementary environmental management plan (EMP) will be developed for updating this IEE report. As minimum following program of additional engineering studies is required to assess vibration/seismic risks and elaborate appropriate mitigation/offset program, which will cover, but not limited to: **refinement of the detailed design (if needed), construction methods, monitoring during construction, foundation and embankment compaction, possible reinforcement of existing structures and any other appropriate measure.** The same will be fully addressed in the final detailed design of the project.:

Table 7.10. Proposed SoW for Vibration Studies

Item for measurement	Location of measurement	Purpose of measurement	Degree of precision
Inventory of buildings	Apartment building, all apartments	Inventory of existing cracks and other damages; Baseline condition of premises;	
Subsidence of ground	Ground on Apt	· Subsidence of ground and expectation of structure caused by embankment and cutting of ground	Precision
Measurement of Underground Displacement	Ground near construction site	· Measurement of underground displacement and stability near construction site	Precision
Strain rate/stress check	Apt outside wall	· Measurement of earth pressure in backside · Measurement of Deformation and stress of Apt	-
Measurement of Underground parallel Displacement	Ground near construction site	· Measurement of lateral movement near construction site · Influence Expectation of structure	Precision
Working vibration /noise or vibration during piling	Decision according to priority	· Input of construction machinery, based on environment influence	Usually
Structure crack	Right/left side on crack	· Measurement of structure crack to be caused by works.	-
Soil formulation	Surroundings of the buildings, road sites, and riverbanks		

Table 7.11. Tasks and Responsibilities regarding Vibration Survey

Task	Responsibility	Timing
Draft TOR for ADB review and No Objection to contract variation	MDF	Sep 2013
Conducting survey	EPCM consultant	Oct-Nov 2013

Task	Responsibility	Timing
Final draft report	EPCM consultant	Dec 2013
Supplementary EMP and finalise the IEE before DD and issuance of bidding document	EPCM consultant	Jan 2014
Incorporation in Detail design and bidding documents	EPCM consultant	End of Jan 2014

466. Additional Studies of vibration and seismic impacts on the apartment buildings should be conducted before construction start up and preferably before finalization of the Detailed Design and final LARP.

7.2.4 River Bank Protection Related Issues

467. The detailed hydraulic studies have been conducted (see Annex 8 where water-bed levels, velocities and discharge rates and other hydrological parameters are shown for different flooding regimes. The options with expanded retaining wall and current situations are described). Operations of the nearest Ortachala HPP dam has been considered. Potential impacts of the design on erosion of adjacent unprotected sections of the river bank have been assessed. The conducted studies provided data on water discharge rates and flooding levels for different cross-sections and on both river banks. General scour depth has been defined for 1000 year recurrence period. This gave the engineers basis for proper design of revetment and ensuring its stability.

468. The changes of hydrological parameters due to the expansion of revetment are negligible (see fig.7.1.A below demonstrating hydrological parameters for cross-sections 1 and2 located upstream the retaining wall and for more details - annex 8. Appendixes 1 -3; and). At the same time, geotechnical studies demonstrated that the river channel at this location is formed by bed-rocks and no risks of lateral erosion of the river banks or local scouring risks occur upstream and downstream due to the revetment construction. Only at the last 300m subsection of 1km section downstream the retaining wall, the floodplain and the right bank are structured with alluvial cobble/gravel soils. During the river-bed variation process, on local site the river causes insignificant lateral erosion, which vanishes soon and the process then develops in another direction. Hydrological studies demonstrated (see flooding water-bed levels in annex8, appendix1 and 3) that construction of the revetment at the right bank will not cause flooding of the left bank or some additional areas on the right bank. **Flooding Zones with and without retaining wall are demonstrated below on Fig 7.5 More d**etailed geological description of the river channel and comments of hydraulic engineers is given below:

469. Lithological and Geodynamic Situation in the Kura River-bed and its sides within Tbilisi-Rustavi Motor Road (km0+000 km7+200) Adjacent Segment. In terms of possible geoecological changes due to construction of the road's project bank wall, the river Kura segment under consideration should be divided into 3 parts:

1. River-bed segment from the project wall start (km5+100) along 1 km upstream;
2. River-bed segment within the project wall (km5+100 – km6+760)
3. River-bed segment from the project wall end (km6+760) along 1 km downstream.

470. Below separately follow: a brief description of lithologic structure of the said segments and the geodynamic state within the segments. Attached to these textual explanations are characteristic cross-sections of each segment, 6 sections in total.

1. River-bed segment from the project wall start (km5+100) along 1 km upstream;

471. Within the 1 km segment from the start of the project wall (km5+100), the river-bed is completely formed and entrenched in rocks – weak and moderately weak sandstones and argillites, moderately strong and strong, medium-bedded and coarsely-stratified, polymictic and tuffaceous sandstones. The right bank of the river-bed represents a slope of a high terrace. On the bank of the river-bed, the river has denuded basic hard rocks almost everywhere. Rock material is denuded on the terrace slope too, at great height, almost everywhere. The river valley is asymmetric within this segment, and the left bank is not as high as the right bank, though, the bed is deeply entrenched in rock material on the left bank too. The height from

the river-bed bottom is 10-12 meters here and on the side, rocks denude everywhere. The riverbed bottom is also represented here by rock materials. Thus, the river-bed having formed in the basic rocks is stable within this segment and there are no active geodynamic processes observed, including erosion processes.

2. River-bed segment within the project wall (km5+100 – km6+760)

472. The Kura river-bed, within the project wall segment has formed in rock materials too. The morphology of the left bank is practically the same as on the first segment, i. e. the rock side of the river terrace continues within this segment too. As for the right bank, within this segment it lowers considerably compared with the upper segment. The right side is also represented by rock materials. Rock materials denude on the river-bed bottom as well, but on some sites a thin layer of alluvial cobbles is observed with thickness not more than 2-3 m presumably. On the whole, the river-bed is stable within this segment; no active physical/geographical processes are observed, including deep or lateral erosion.

3. River-bed segment from the project wall end (km6+760) along 1 km downstream.

473. From the project wall end (km6+760), the road alignment turns to the right and considerably distances from the river. The left bank again represents a high rocky side and is reliably protected, while the right bank gradually becomes lower and transfers into the first above floodplain terrace. The latter, in its turn, also becomes lower and gradually merges with the floodplain. The floodplain is wide here and its natural variation line width is great, which promotes broad spreading of water during floods and energy dissipation. On this segment, both the floodplain and the right bank are structured with alluvial cobble/gravel soils. During the river-bed variation process, on local site the river causes insignificant lateral erosion, which vanishes soon and the process then develops in another direction. There is no significant deep erosion in the floodplain.

474. Thus, on the whole it can be said that the Kura river valley bottom is stable within the whole described segment. The greatest part of the river-bed is entrenched in rock material and is stable against erosion processes; only on a small final segment the right bank lowers and is covered with cobbles/gravels, where sometimes lateral erosion occurs, though these processes do not gain wide scale. During small and medium stream rises, no essential changes occur in the river-bed, though in exceptional cases, great floods (during which water level may exceed the basic rocks eave level on the sides) can cause water overflow in some places on the banks and inundation of certain sites.

475. Hydrological calculations (maximum water discharges, relevant level indices, medium velocities of the river flow etc.) are fulfilled for three cases – in the existing conditions of the Riv. Mtkvari, in case of constructing unilateral and bilateral retaining walls. **According to the table of the hydraulic elements of the river (see tables 1 and 3 of the Appendix 1 in Annex 8 and abstracts from these tables given**

as tables 7.12 and 7.13 below), in case of maximum water discharges, velocity of the river flow downwards the project section never exceeds 4-5 m/sec. This means, that in the existing conditions, in case of constructing unilateral and bilateral retaining walls at the riverbed, the velocity of the flow will not change, accordingly, in case of constructing a retaining wall at the riverbed, the flow will not cause any negative influence on the river banks. There is a possibility that only the right low bank of the river is flooded, that happens during every flood in the existing conditions.

Table 7.12. Hydraulic elements of Mtkvari River in existing conditions (cross-sections located usptream the retaining wall)

indicators m.abs.	Cut elements	Cut area ω m^2	Flow width B m	Average depth h m	Flow indination i	Average speed v m/sc	Water Discharge Q m^3/sc
Cross №2 L=250 m							
364.88	River bed	128	87.0	1.47	0.00190	1.76	225
366.00	River bed	229	94.0	2.44	0.00148	2.18	499
367.00	River bed	327	101	3.24	0.00152	2.68	876
368.00	River bed	432	108	4.00	0.00162	3.18	1374
369.00	River bed	546	119	4.59	0.00172	3.60	1966
370.00	River bed	668	124	5.39	0.00180	4.10	2739
371.00	River bed	795	129	6.16	0.00182	4.51	3585
Cross №1 L=300 m							
365.26	River bed	136	66.0	2.06	0.00127	1.81	246
366.50	River bed	224	76.0	2.95	0.00135	2.37	531
367.50	River bed	306	88.0	3.48	0.00160	2.88	881
368.50	River bed	398	96.0	4.14	0.00175	3.39	1349
369.50	River bed	497	101	4.92	0.00185	3.91	1943
370.50	River bed	600	105	5.71	0.00195	4.43	2658
371.50	River bed	706	109	6.48	0.00205	4.95	3495

Table 7.13. Hydraulic elements of Mtkvari River in conditions of one sided wall conditions (cross-sections located usptream the retaining wall)

indicators m.abs.	Cut elements	Cut area ω m^2	Flow width B m	Average depth h m	Flow indination i	Average speed v m/sc	Water expencse Q m^3/sc
Cross #2 L=250 m							

indicators m.abs.	Cut elements	Cut area ω m^2	Flow width B m	Average depth h m	Flow indination i	Average speed v m/sc	Water expencse Q m^3/sc
364.88	River bed	128	87.0	1.47	0.00190	1.76	225
366.00	River bed	229	94.0	2.44	0.00148	2.18	499
367.00	River bed	327	101	3.24	0.00148	2.64	863
368.00	River bed	432	108	4.00	0.00152	3.08	1331
369.00	River bed	546	119	4.59	0.00165	3.52	1922
370.00	River bed	668	124	5.39	0.00175	4.04	2699
371.00	River bed	795	129	6.16	0.00178	4.46	3546
Cross №1 L =300 m							
365.26	River bed	136	66.0	2.06	0.00127	1.81	246
366.50	River bed	224	76.0	2.95	0.00135	2.37	531
367.50	River bed	306	88.0	3.48	0.00157	2.86	875
368.50	River bed	398	96.0	4.14	0.00168	3.32	1321
369.50	River bed	497	101	4.92	0.00179	3.84	1908
370.50	River bed	600	105	5.71	0.00190	4.38	2628
371.50	River bed	706	109	6.48	0.00200	4.89	3452

476. The same situation is upwards the project section, where the velocities and levels of the river flow differ insignifically in all of the three cases. According to the geological survey, the riverbed in the project section and upwards consist of base rocks and the flood cannot cause erosion or any other negative influence on it in the short period of time (maximum 48 hours). From the information above we can conclude, that a retaining wall to be constructed at the riverbed, will not cause any negative influence on the banks downwards and upwards the project section.

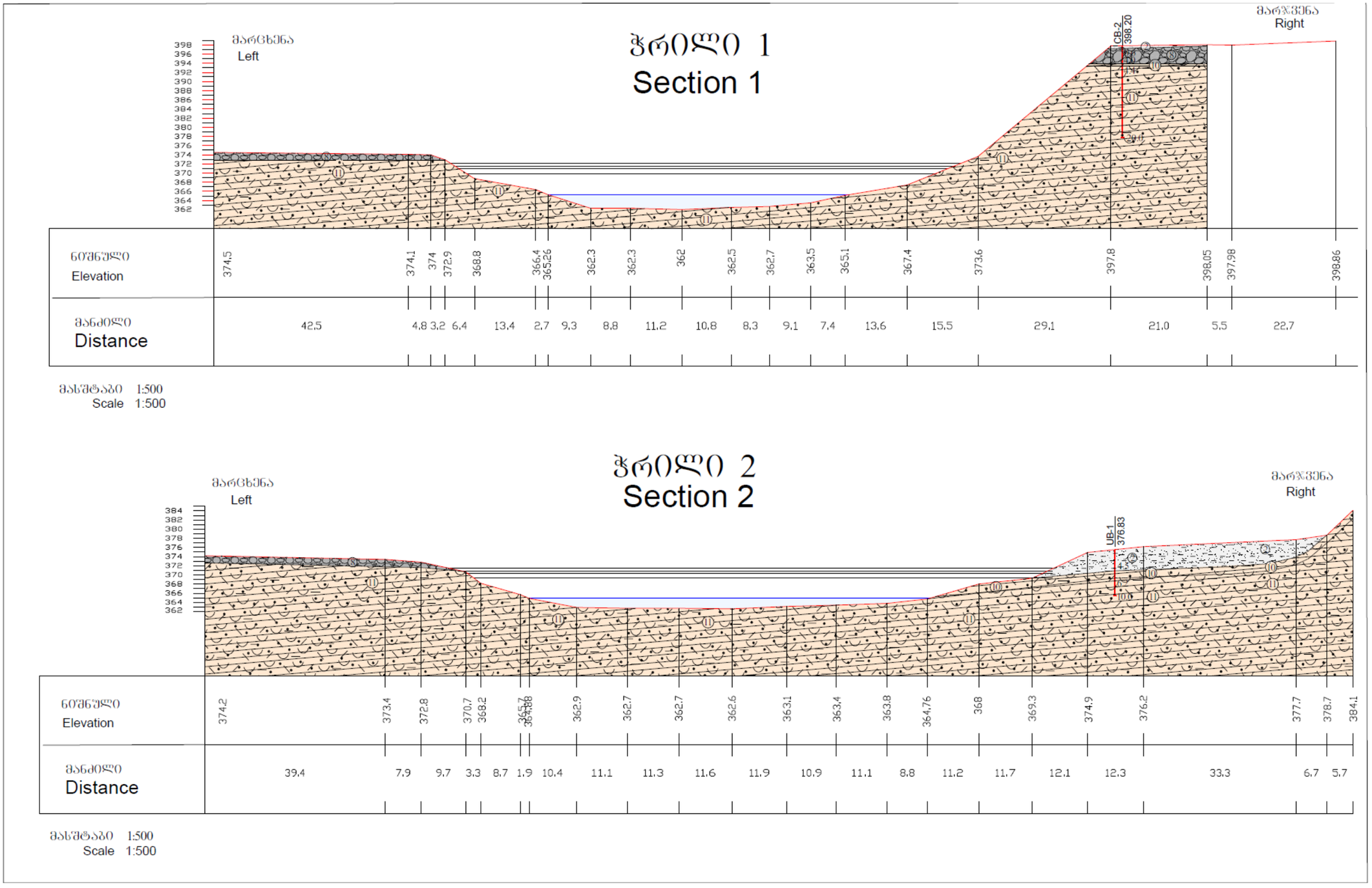


Fig.7.8 Different Crossections of the river-bed channel 1km upstream from the retaining wall

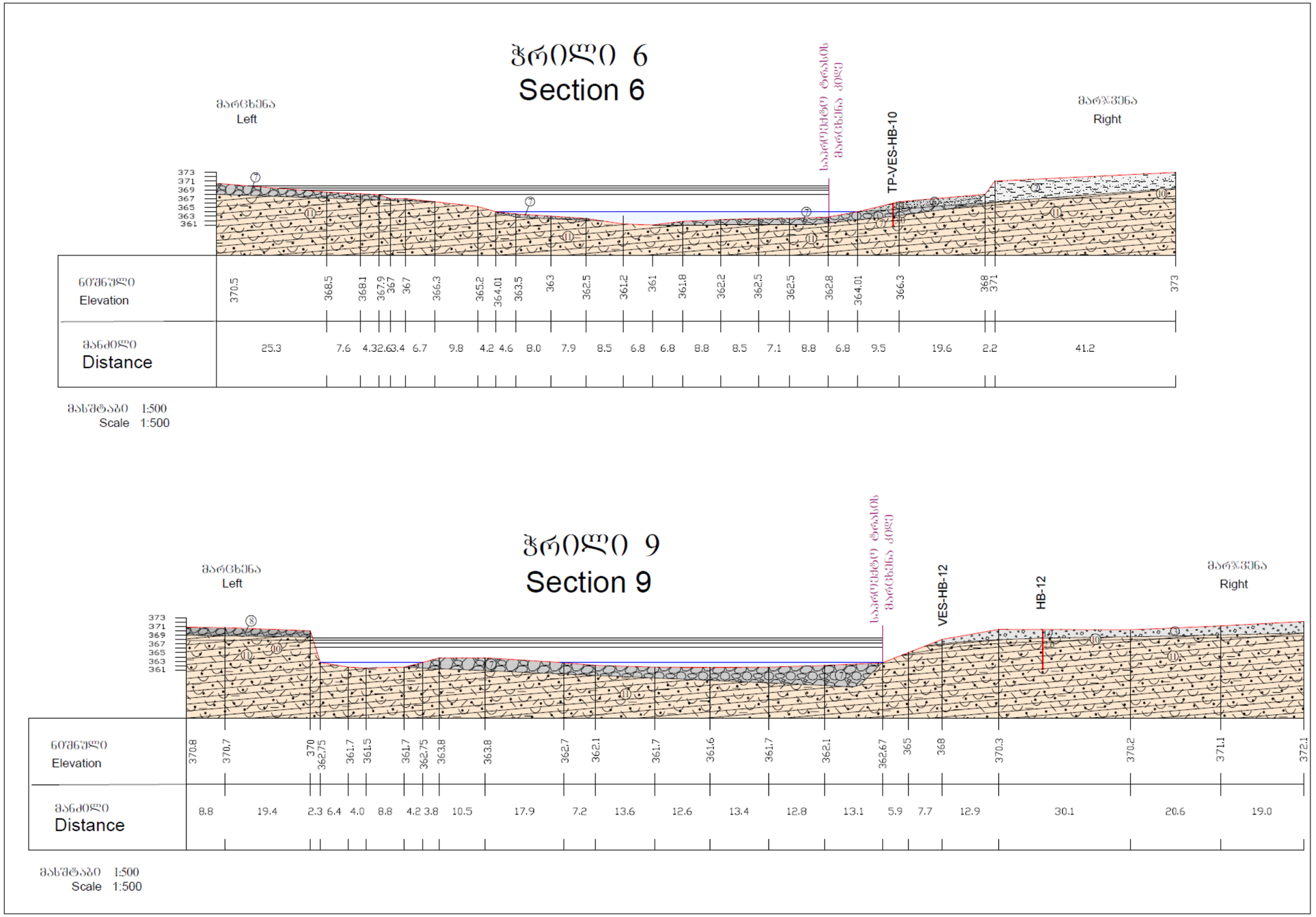


Fig7.9. Different Crossections of the river channel within the section of the retaining wall

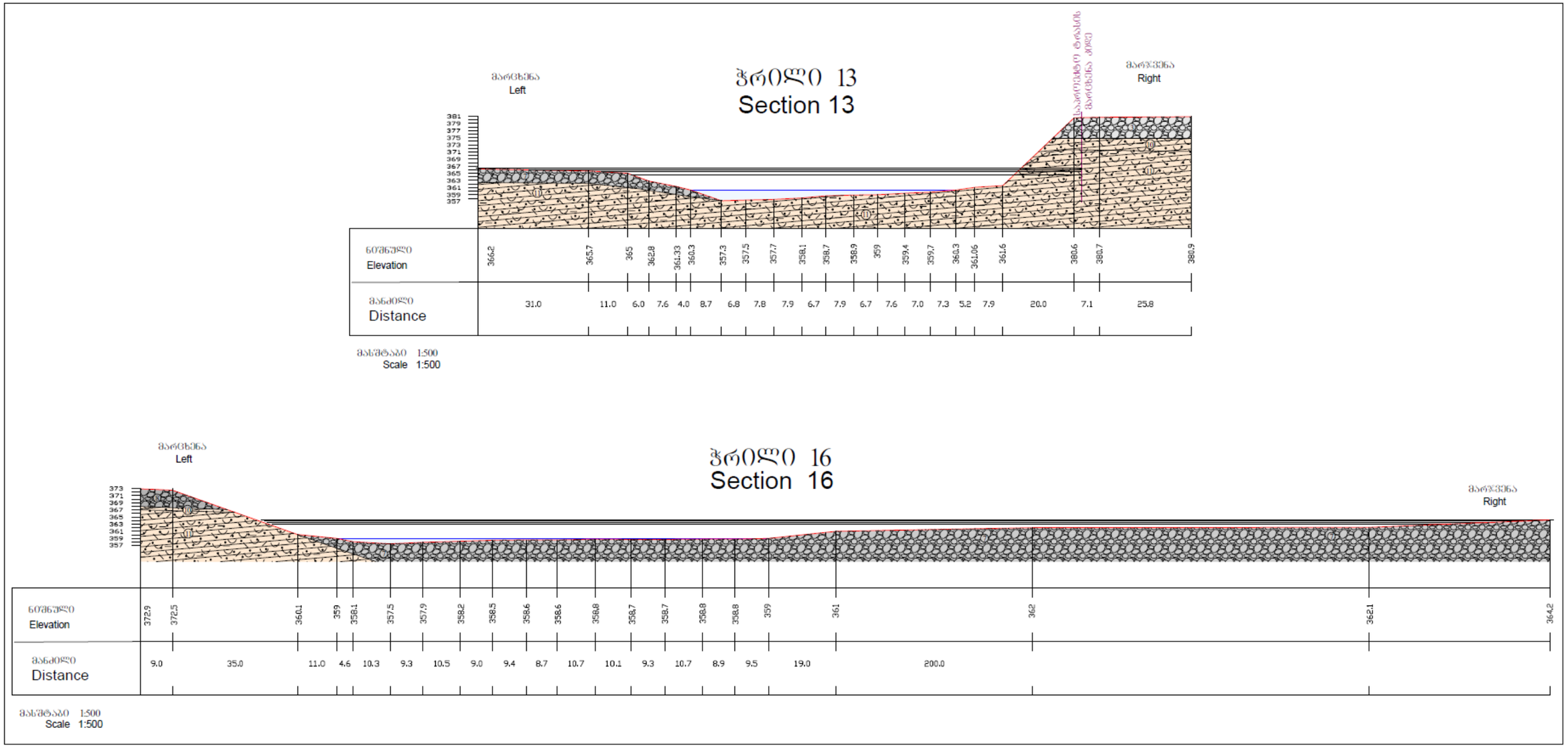


Fig.7.10. Different Crossections of the river-bed channel 1km downstream from the retaining wall

Classification of soils observed at road segment - as per the British Standard

SOILS:

Soil Group	Genotype	Symbol and Geological Index	Layer No.	Description (according to the BS)
FINE SOILS	Made Ground	tQIV	2	Moist, dark gray-blackish, silty, slightly sandy, slightly gravely, very stiff and stiff , intermediately plastic CLAY with cobbles, construction debris and household waste content
COARSE SOILS		tQIV	3	Slightly moist, slightly sandy, angular GRAVEL with low plastic sandy clay matrix, with angular boulders inclusions, with construction debris content
COARSE SOILS	Alluvial Deposit	aQIV	6	Moist, gray, loose, silty SAND
		aQIV	7	Saturated, loose, sandy, rounded GRAVEL with rounded cobbles and boulders inclusions
		aQIV	8	Slightly moist, light brown, very dense, slightly sandy, silty, rounded GRAVEL with cobbles inclusions

ROCKS:

Genotype	Symbol and Geological Index	Layer No.	Description (according to the BS)
Marine Sedimentary	Pg_2	10	Highly and moderately weathered, yellowish-brown, weak and moderately weak SANDSTONE and ARGILLITE
	Pg_2	11	Slightly weathered, brownish-gray and greenish-gray, moderately strong to strong, medium and thickly bedded, polymictic and tuffaceous SANDSTONE

Classification of soils observed at road segment and their - as per the GOST Standard

SOILS:

Group	Sub-group		Symbol and Geological Index	Layer No.	Description (according to the GOST)
Man-made	Fill		tQIV	2	Clay dark gray-blackish, solid and semisolid, with cobbles, construction debris and household waste content
			tQIV	3	Rounded cobbles and rounded gravel with loamy sand filler, boulder inclusions and construction debris content, slightly moist
Noncoherent Sedimentary	Sandy	Alluvial	aQIV	6	SAND silty, gray, loose, moist
	Macro-fragmented		aQIV	7	Cobbles with sand filler and with up to 10% boulder inclusions, saturated, loose
			aQIV	8	Gravely soil with cobbles inclusions, with sand filler, moist

ROCKS:

Group	Symbol and Geological Index	Layer No.	Description (according to the GOST)
Coherent Sedimentary	Pg_2	10	Sandstones yellowish-brown, highly weathered, moderately weak and weak
	Pg_2	11	Sandstones polymictic and tuffaceous, brownish-gray and greenish-gray, medium and thickly bedded, slightly weathered, moderately strong and strong

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Fig.7.11.

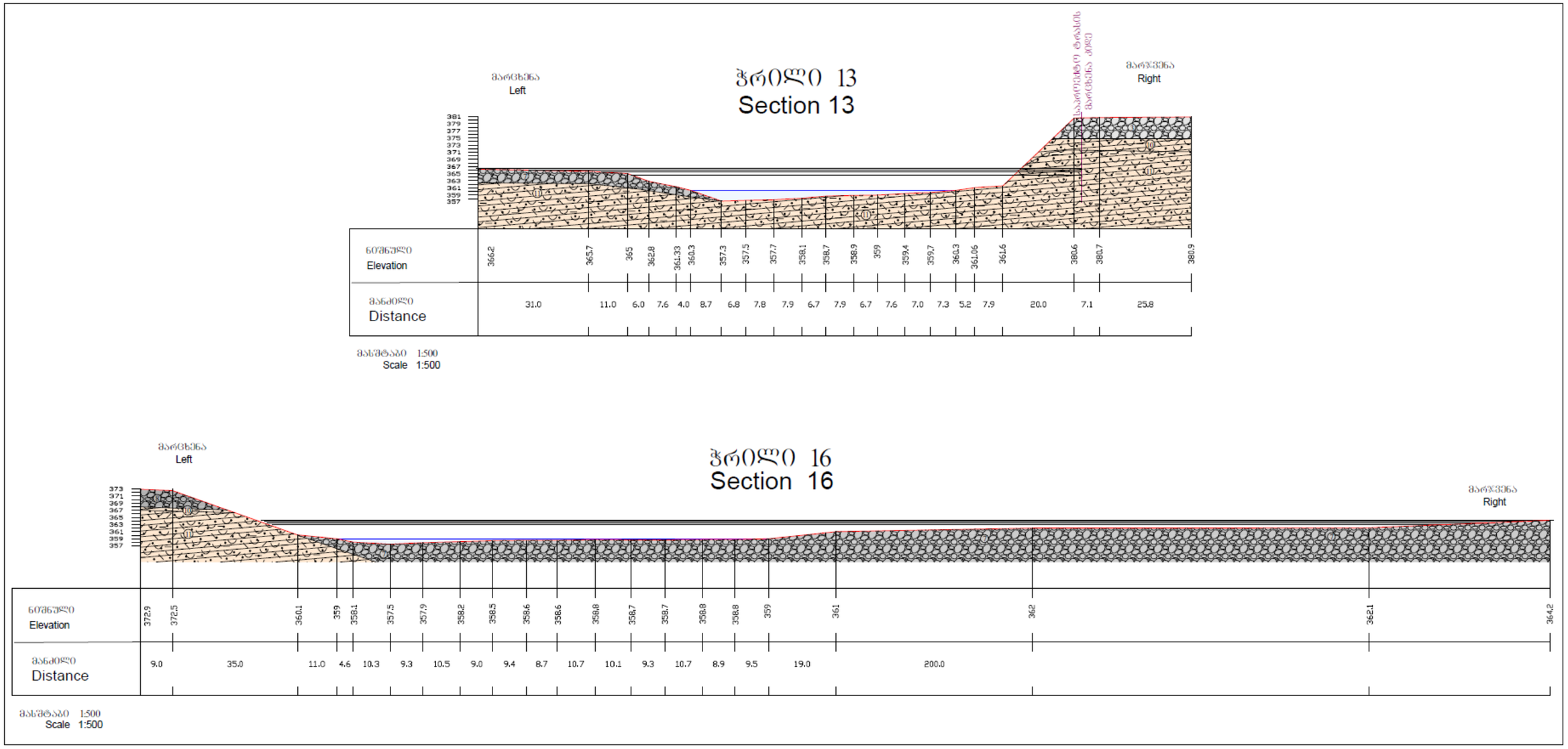

Fig 7.12. Legend

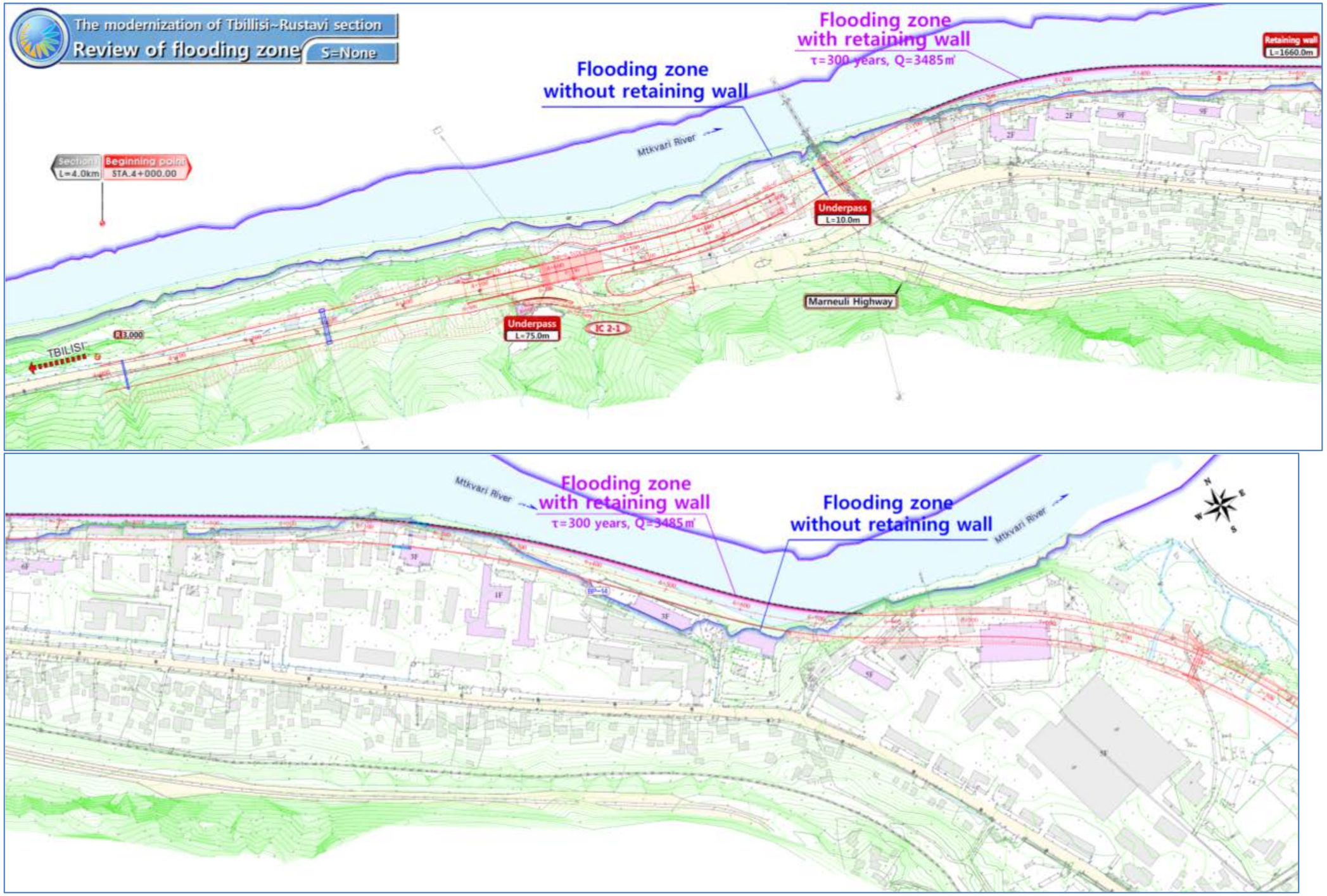

Fig 7.13 Flooding Zones with and without retaining wall

Mitigation Measures

477.. No additional mitigation measures are required within the project frames. In general, the old plans of the government related to river training and construction of the revetments along the both banks of Mtkvari river till Rustavi should be supported as a measure of flood control.

7.2.5 Quarries and Material Transportation

Impacts

478. Capacity of filling materials to be transported from quarries and borrow pits for arrangement of the embankments is equal to 254,000 m3. For the construction of the retaining wall 190,000 m³ of filling materials will be needed. Identification of qauerries and borrow pits is responsibility of the Civil Works Contractor (Contractor). Before start up of construction activities the Contractor has to define the quarries and borrow pits to be used and reflect this in the description of construction works and in work plans and specifications. However, in chapter 2.16 some licensed quarries have been proposed as potential source of material supply. All of these quarries are located in the r. Mtkvari floodplain within 2km strip of floodplain adjacent to the project area. Use of these quarries will minimize material transportation related risks. No new access roads are required and the existing short access roads from quarries to the project sites do not pass close to any of the settlements.

479.The construction contractor has to check residual capacity of the mentioned quarries and decide need of arranging supply from other quarries and borrow pits.

Mitigation Measures

480. So far as licensed quarries and borrow pits are supposed to be used by construction contractor, the limits for exploration and environmental requirements are fixed in license and expected impacts are mitigated by appropriate operations of the license-holder. The main requirement of this IEE in that case is to use only licensed suppliers of construction materials.

481. In case if CW Contractor decides to explore its own borrow pits and quarries, the Contractor has to obtain the license from the Environmental Agency. The license is issued for certain limited capacity and those limits should be met not to damage the river floodplain. In that case the natural sediment flow enables natural regeneration of the quarry site. After completion of the exploration works Contractor is obliged to reinstate the borrow pit site and quarry: arrange stabile and conforming with surroundings relief, cover it with stored topsoil and plant grass and bushes. In case of need, implement anti-erosion measures: arrange surface water drainage system, install berms, embankments etc, plant anti-erosion vegetation. Contractor has to develop detailed quarry management and reinstatement plan.

482. So far as, it is not excluded, that the construction contractor will prefer to obtain licenses for operating its own borrow pits and quarries, For that case this IEE provided general requirements to be met during the exploration of quarries and borrow pits.

483. Generally quarry sites are the major sources of environmental impact due to dust and noise pollution, loss of biodiversity, and generation of spills. Operation of the quarries above the approved limits may cause change of floodplain hydrology and trigger erosion and landscape degradation. The operating procedure for borrow pits shall consider following principles: (i) maximize the amount of fill that can be effectively used from the pit, (ii) minimize erosion and sedimentation, (iii) preserve the water quality of the rivers, (iv) protect air quality during excavation, (v) prevent wildlife from falling into the pit, and (vi)

reinstatement of the site after construction. Only approved borrow and quarry sites will be used by the contractors and produce copy of necessary government licenses to the client before procurement.

484. The mitigation plan to be followed by the Contractor at the borrow sites is: (i) only borrow areas approved by the environmental authority will be used for the project; (ii) pits management, (including restoration if it will follow the completion of certain works) shall be in full compliance with all applicable environmental standards and specifications; (iii) the excavation and restoration of borrow areas and their surroundings, in an environmentally sound manner to the satisfaction of the MoE and RD; (iv) borrow pit areas will be graded to ensure drainage and visual uniformity or to create permanent tanks/dams. Additional borrow pits, if necessary, will not be opened without the restoration of those areas no longer in use, and without the approval of MoE. Topsoil from the opening of borrow pits will be saved and reused to re-vegetate the pits to the satisfaction of the MoE.

485. General principles recommended for borrow pit and quarries management:

- Do not use borrow excavation until all suitable roadway excavation is used. Use select borrow and select topping as shown on the plans.
- It is accepted to used only licensed material suppliers
- Develop and restore Government located and provided borrow sources as approved by the Engineer.
- Do not excavate beyond the established limits.
- The borrow pit shall be landscaped after the excavation.

486. After the closure of the borrow pits, reinstatement and landscaping plan should be implemented by Construction Contractor.

487. Local roads will be damaged during transportation of borrow materials and by the construction equipment. In order to reduce impact on all borrow sites and local roads, contractors will water the local roads close to the settlements used by the borrow trucks and rehabilitate the local roads to their original conditions.

488.The measures aimed on mitigation of the dust and emission impacts, as well as potential river contamination due to improper fuelling and vehicle operation, should be the same as above described pollution prevention measures, but control on this sensitive site should be more strict. Road Department and Constructing Contractor's environmental personnel should pay more attention to the quarrying site during monitoring.

489.The MoE and Environmental Inspectorate are in charge to control compliance of the quarrying company's performance. The Road Department will control the licenses of Construction Contractors in case they are exploring some quarries and borrow pits.

7.2.6 Asbestos Containing Waste

Impact

490. The project implementation envisages demolition of many buildings, including residential houses and ancillary buildings and business facilities. Many of these building are covered by asbestos containing roofing. Demolition of the buildings of 6 business entities will generate in total 7000m^2 of asbestos containing waste. Demolition of 49 buildings of private households (mostly roofing of the ancillary

buildings), will generate about 2000 m^2 of asbestos waste. Improper management of these residual materials may cause significant environmental impact.

Mitigation

491. Usually, according to LARPs and RAPs implemented in Georgia during the recent years under the different IFI financing, the owners are allowed to use materials after demolition of structures. Accordingly, demolition works are carried out mostly by the owners and they mange the residual materials. However, in this particular case the project proponents and Civil Works Contractor should take responsibility for the asbestos waste management. MDF as an EA will incorporate in Civil Works Contract requirement that Civil Works Contractor hires appropriate certified waste operator who will ensure proper and safe disposal of asbestos waste according to good international practices. Costs for asbestos disposal, should be considered during the project budgeting during the bidding process. **To get the permit on disposal of asbestos waste, preparation of separate specific EIA is required. According to Contract with MDF Civil Works Contractor will ensure preparation of appropriate EIA, obtaining Environmental Impact Permit and disposal of asbestos waste according to the conditions of the Environmental Impact Permit.**

492. There are limited companies in Georgia, who has experience and passed special trainings in relation with asbestos material handling. One of such companies is Gamma Ltd. Other company is "Sanitari Ltd", who has general license on hazardous waste disposal. CW Contractor has to request waste operators demonstrating appropriate experience, licenses and certificates.

7.2.7 Demolition of Gas Fuelling Stations

Impacts

493. The project implementation will require demolition of 9 gas fuelling stations owned by 6 companies. Socar Georgia Petroleum, who owns 2 of affected stations and Gulf, who owns 3 of affected stations, are large companies managing a network of gas filling stations all over the Georgia. They will dismantle all movable equipment, including fuel reservoirs and transport them to their fuel storage yards located within Tbilisi suburbs. ring The companies posses skimmers, absorbent pads and sandbags for spillage management. The risk of contamination due to unmanaged spillages are not high.

494. The rest 4 companies are smaller entities. One of them is not operational. Their businesses are affected permanently and they do not plan to re-establish the same business at new site. Thus these companies do not intend to relocate movable equipment to the new sites of deployment. In such circumstances it is not clear who will dismantle their equipment: City Hall services, MDF or CW Contractor. The risk of unmanageable spillages is higher.

Mitigation

495. MDF as an Executing Agency has to take overall control over the process. MDF will hire special operating company or will request CW Contractor to hire such specialized company (e.g. Seacor Environmental Services), who will supervise the demolition, transportation and storage of equipment and management of spillages. The compensation for the equipment will be given to private owners at replacement cost and if they will decide to leave their equipment at site, MDF has to agree with the Georgian Oil and Gas Corporation regarding allocation of storehouse for the mentioned equipment. Ministry of Economics and Sustainable Development has to make final decision on ownership of the

abandoned equipment. However, the reservoirs and other equipment could be at least temporarily stored and washed at the warehouses of GOGC.

7.3. Potential Impacts Related To the Construction Activities

7.3.1 Pollution and Waste

496. Improper handling, storage, use and disposal of construction materials and wastes could pose a risk of water/ soil contamination at the construction site and storage site. Improper maintenance and fuelling of equipment could also lead to the potential contamination of soil/ water.

7.3.1.1 Construction Related Wastes

497. Various wastes will be produced throughout the construction process. The main waste producing areas are: construction sites and construction camps. Small amounts of waste are expected along the access and heavy equipment movement routes with ground and soil pollution.

Waste Classification

498. During the construction of the bypass the following types of waste will be produced:

1. Household;
2. Hazardous industrial;
3. Non-hazardous industrial;

Inert Waste

499. The road construction mainly produces inert construction waste, excavated soil, loose rock and debris – construction materials which have not been used and need to be disposed. The total amount of inert waste produced during the construction of the design road section is less compared with the other road sections.

- milled pavement - 11,880 m^3 (must be placed as a reserve and further used for asphalt pavement or repairs of other road sections)
- Only some of excavated soil will be used fro fills. At least 95,330 m^3 of excavated and loose soil will be dumped in the disposal area.

500. The inert waste disposal areas will be selected by the contractor a nd agreed with the local authorities. The disposal areas suggested by the EIA team are discussed in 8.1.1.3 Paragraph below.

Hazardous Industrial Waste

- Polluted soil;
- Polluted rags and oil absorbing fabric;
- Polluted water;
- Polluted industrial equipment in disrepair;
- Paint vessels and brushes;
- Lubricant vessels;

- Empty vessels of packaging;
- Polluted personal safety equipment and clothing.

Table 7.14 Types and Estimated Quantities of Waste

Waste Type	Waste Category	Estimated Quantities (with unit of measurement)	Waste Management	Alternatives	Responsibility Issue(s)
Domestic waste	**non-hazardous**	**80-100 m^3 annually**	**to be transferred to the Contractor for disposal**	**Waste can be separated on site and some of it (paper, glass, plastic) can be transferred to the Contractor for recycling or reuse.**	**Contractor**
Office waste (sweepings, glass and plastic bottles, stationery)	**non-hazardous**	**10-15 m^3 annually**	**to be transferred to the Contractor for disposal**	**Waste can be separated on site and some of it (paper, glass, plastic) can be transferred to the Contractor for recycling or reuse.**	**Contractor**
Sewage	**hazardous**	**1500 m^3 annually**	**Sewage is discharged into the sewer network based on the contracts**		**Contractor**
Burned-out bulbs	hazardous	**50-70 pieces**	**to be transferred to the contractor for disposal**	**1. returned to the manufacturer 2. transferred to the licensed contractor for recycling**	**Contractor**
Printer cartridges	hazardous	**2-3 pieces annually**	**Recharged 3-4 times and then transferred to the contractor for disposal**	**1. returned to the manufacturer 2. transferred to the licensed contractor for recycling**	**Contractor**
Medical waste	hazardous	**0.1kg annually**	**to be transferred to the contractor for disposal**	**to be transferred to the contractor for incineration**	**Contractor**
Damaged or outdated tools	non-hazardous	**1-2m^3 annually**	**to be transferred to the contractor for disposal**		**Contractor**
Personal protection and clothes	non-hazardous	**1 m^3**	**to be transferred to the contractor for disposal**		**Contractor**

oil soaked rags and absorbents	hazardous	**The quantities depend on the oil spill scale 1m^3 annually**	**2. to be collected in plastic or metal containers and temporarily stored**	**1. to be transferred to the contractor for incineration 2. to be transferred to the contractor for storage**	**Contractor**
Cut trees	non-hazardous		**to be transferred to the local authorities**	**to be transferred to kindergartens and schools**	**Contractor**

7.3.1.2 Soil Pollution

501. Potential pollutants from a project of this nature include the following:

- Diesel fuel, lubrication oils and hydraulic fluids, antifreeze, etc. from construction vehicles and machinery
- Miscellaneous pollutants (e.g. asphalt, cement and concrete)
- Construction wastes (packaging, stones and gravel, cement and concrete residue, wood, etc.)

502. Extremely small amount of hazardous wastes (e.g. waste oils, oily rags, spent filters, contaminated soil, etc) constituting about 0.1% of total amount of the wastes.

7.3.1.3 Surface Water and Groundwater Pollution

503. Water pollution may result from a variety of sources, including the following:

- Spillages of fuel, oil or other hazardous substance, especially during refueling
- Silt suspended in runoff waters ("construction water")
- Washing of vehicles or equipment or disturbance of watercourse banks and bed during watercourse crossings by heavy machinery
- Exposure of contaminated land and groundwater

504. Spillages etc may travel quickly downhill to a watercourse or water body. Once in a watercourse, it can be difficult to contain the pollution which can then impact over a wide area downstream. It is therefore vital that prompt action is taken in the event of any potential water pollution incident.

505. Once the working width has been stripped of topsoil, the subsoil becomes exposed. During earthworks in a wet weather this may result in uncontrolled release of suspended solids from the work area. River Iori is the major receptor sensitive to the increased sediment load.

7.3.1.4 Biological Recontamination

506. Recontamination by infectious biological materials (e.g. Anthrax) is a potential threat during earth works near the pest holes (i.e. not registered Anthrax sites). The risks are related to the fact that a large amount of the spontaneous burial sites is not registered by the relevant authorities.

7.3.1.5 Topsoil losses due to topsoil stripping

- Topsoil washout due to improper storage and reinstatement
- Silt runoff to watercourses and water bodies

507. Exposure of contaminated land

7.3.2 Impacts on Flora.

508. The design area is located in the urban and adjacent transformed landscape. There are no protected territories, wetlands, forests or other sensitive habitats and ecosystems. However, potential negative impact on vegetation should be taken into account.

509.The design project envisages cutting of trees (the amount and type of trees will be specified during further studies). The vegetation mainly comprises a green belt along the highway, trees in orchards and riparian vegetation. Detailed botanical studies showed that no sensitive floodplain forests, wetland habitats or red data species are under the impact. There are also rare, endangered and vulnerable species in the project area, including the silver berry *Elaeagnus angustifolia* (rare species), the Turkish Pine *Pinus eldarica* (endangered species), etc. The results of the botanical studies conducted prior to the construction need to be verified and detailed figures and descriptions, required for calculation of compensation planting will be added when the RoW is finally rectified.

7.3.3 Impact on Fauna

510. The project is not expected to have significant impact on the Fauna. The only species to be affected by the construction is bats. The impact can be mitigated by checking old buildings and hollow trees prior to their demolishing or cutting. A simple acoustic method can be used to scare off bat colonies.

7.3.4 Protected Areas

511. The design road does not lie in the vicinity of the protected territories.

7.3.5 Landscape.

512. The project does not envisage any impact on the valuable natural landscape.

7.3.6 Water use.

513. Water will be required for maintenance works and for dust protection measures (water bowsers). The amount of required water is not high and the sources exist in the vicinity of the project sites (river Rioni; groundwater resources). Water intake for construction works and particularly for the camp operations could be made from surface water sources or from groundwater sources (wells). No Water Intake Permit is needed for surface water intake, however special form should be filled to demonstrate that the terms of surface water intake (including indication of intake volumes) are in compliance with the Technical Regulations (Technical Regulations approved by the Order No 745 of MoE, issued on 13.11.2008). Intake of the groundwater for camp operations does not require obtaining of License for Use of Groundwater (according to the Law on Licenses and Permits, 2008). Wastewater discharge in surface water objects needs development of special document – Maximum Admissible Discharge Limits, which should be agreed with MoE and which determines limits for discharging wastewater with given concentrations of pollutants. The agreed values (Limits) are determined for each particular facility in order to comply with the Sanitary Norms for surface water. Sanitary Norms for Surface Water is the generic regulation issued by the Ministry of Labor, Health and Social Protection, while the Discharge Limits are calculated for each polluter of the surface water objects.

7.3.7 Impacts on Archaeological Sites.

514. Land clearance works, grading and excavations are associated with the risks of damaging underground archaeological remnants. There is no sufficient data on archaeological status of the project corridor. No aboveground monuments or known archaeological sites and visible signs of potential archaeological remnants have been identified during the baseline studies conducted by the IEE team The not evaluated sites could be as sensitive as already known archaeological sites. During construction of the roads in Soviet times some archaeological artefacts have been destroyed. Therefore, special care should be taken not only at the new construction sites, but also at the sites where the existing motor road will be upgraded and widened. It should be understood that only undiscovered archaeological relics could be an issue and chance finds procedure proposed in chapter 8 is accepted as sufficient mitigation measure at the stage of planning.

7.3.8 Transport related impacts

515. Heavy trucks are required to deliver required amount of inert materials to the needed sites within the construction corridor. Selection of supplier is the prerogative of the construction contractor. However, the closest licensed quarries and borrow pits are located in the immediate vicinity to the highway and the highway is the main transportation route for delivering construction materials. No new access roads are required and the existing short access roads from quarries to the highway do not pass close to any of the settlements. Different types of impacts are anticipated in that regard:

- Noise & Vibration Impacts
- Traffic congestion (nuisance)
- Air pollution (dust; emissions)
- Mud on roads
- Refuelling, maintenance and vehicle cleaning and related risks of soil and water contamination

7.3.9 Traffic Disruption.

516. Intensive runs of heavy trucks are required to deliver required amount of inert materials amount of materials to the needed sites within the construction corridor. The construction sites impose certain safety risks for the population and, therefore, compliance with safety rules is important. Local traffic can be impacted by transport activities related to the project. The mentioned impact is temporary, insignificant and manageable. Long-term impact on local traffic should be beneficial.

517. However, the main risk of the traffic disruption is related to the fact that the construction related to the widening of the road is to be carried out at the existing and functional road. Construction of remains may affect traffic on existing road. Proper organization of construction activities is crucial to mitigate these risks.

7.3.10 Construction Camp-related Impacts

518. The experience of constructing other sections of E-60 shows that temporary works, e.g. a construction camp for accommodation of 200 workers (approx. 1.5 ha area), a yard for 100 vehicles and 150 units of heavy construction machinery like bulldozers, excavators, cranes, etc. (approx. 2 ha) and concrete plant (approx. 3 ha) need to be constructed.

519. The exact location will be selected by the Contractor. The potential impacts of the camp construction and operation are summarized below:

- potential damage to the humus topsoil;
- pollution caused by fuel storage and vehicle fuelling;
- waste and sewage management.

520. The design and operation procedures and conditions and optimum location options of the camp are detailed in 8.1.1.13 Paragraph of the EIA regarding the mitigation measures.

7.3.11 Construction Related Impacts at the Asphalt Plant and Gravel Crushing Facilities

521. The road will be a asphalt pavement. The CW Contractor has a choice to use asphalt supplied by specialized suppliers or to construct own asphalt mixing plant. In case, if the Contractor decides to install own plant, separate EIA should be prepared and positive conclusion of the Ecological Expertise obtained. The EIA should address all impacts related to asphalt plant, focusing on air emission (dust, aromatic hydrocarbons, zoot etc.) and soil/water pollution matters (bitumen contamination).

522. Dust emission and noise is characteristic impact associated with the operation of crusher facilities.

8. MITIGATION

8.1. Mitigation of Construction Related Impacts

8.1.1. Prevention and Mitigation of Geo-hazardous Processes

523. The design is prepared considering 8 degree seismic zone and is relevant to existing seismic risks.

524. There are no landslide prone areas or other high risk geological processes developed within the RoW.

525. As we have discuses earlier, there is no risk of lateral erosion induced by the revetment construction upstream and downstream the revetment and at the opposite bank. The design of the revetment is based on conservative estimations for general scour (1000 year recurrence flooding levels are considered during calculations) and stability of the revetment should beguaranteed.

8.1.2. Pollution Prevention Measures:

526. Water/ Soil Pollution. Specific mitigation measures should be implemented at the construction site for prevention of water and soil pollution:

527.Water/ Soil Pollution. Specific mitigation measures should be implemented at the construction site for prevention of water and soil pollution:

528. Prevent operation of vehicles in the river and if there is no alternative, inspection of vehicles will be required to ensure that there is no leakage of fuel and lubricating materials.

529. Contractors will ensure the proper handling of lubricants, fuel and solvents. Fuel and lubricant storage tanks will not be located within 50m of any watercourse, well or dry gorges. All tanks will be placed in a bund of at least 110% of the tank's maximum capacity. If more than one tank is stored within the bund, the system must be capable of storing 110% of the biggest container's capacity or 25% of their total capacity, whichever is greater. The bund will be impermeable (e.g. concrete-lined), without drainage points or other breaches. Accumulated rainwater in bunds will be pumped out of the bund to either drains or the ground if uncontaminated. In case of fuel spillage the spilled fuel should be recollected and contaminated bund treated by the absorbents: sawdust, sand or straw.

530.All fuel / hydrocarbon dispensing nozzles are to be of a drip control design and securely locked when not in use.

531. No fuel storage or refuelling of vehicles or equipment will be allowed within 50m of any watercourse, water body, well, dry gorge or within any designated wetland area or aquifer. Vehicles will not be left without supervision during refuelling process. All refuelling operations on the working sites will use absorbent pads and/or straw to minimize spills, which will be put in place prior to the commencement of refuelling operations. Ground water and surface water pollution risk will be reduced or eliminated in case of immediate removal of polluted ground. Soiled ground and absorbents will be removed, stored and treated as hazardous waste. In case of significant spill authorized and responsible person will be informed, works will be stopped till the elimination of pollution risk refuelling will always be carried out with the correct equipment (i.e. nozzles of the appropriate size), and only by suitably trained and experienced refuelling Operators. Fuel supply equipment will be regularly revised to prevent leakage due to inappropriate condition of refuelling equipment. Equipment and storages will be isolated and guarded to prevent pollution due to cases of stealing or vandalism. All mobile plant, including but not limited to cranes, compressors, generators, bulldozers, excavators etc. and storage tanks will be

maintained and operated such that all leaks and spills of materials will be minimized. Daily plant checks (Vehicle Maintenance Procedure) will be undertaken to ensure no leaks or other problems are apparent. Vehicle maintenance, cleaning, degreasing etc will be undertaken in designated areas of hard-standing, not over made unstable ground (embankments etc.). Water Tanks with sprinklers are envisaged for watering roads and machinery maintenance. Maintenance points will not be located within 50m of any watercourse, well or dry gorge. The storage of potentially polluting materials, refuelling and maintenance of mobile plant within 50m of all watercourses/water bodies, dry riverbeds and within designated wetlands and aquifers will be prohibited.

532. Erosion control measures will be applied during construction activities to prevent increased runoff into the watercourses.

533. Contractor will plan all excavations, topsoil and subsoil storage so as to reduce to a minimum any runoff. Contractors will be required to organize and cover material storage areas and to isolate wash down
534. Where any area of the spread is at risk from silt pollution washing off into a watercourse of water body, effective measures will be put in place to ensure that such pollution does not occur. Such measures may include:

- Use of silt fences
- Use of straw bales to deflect and filter water
- Use of a system of bunds and grips to prevent water from entering watercourses, etc.
- Use of holding/settling lagoons to store water running off the spread. It is intended to use natural settling rather than flocculants to facilitate sedimentation following which clean water can be disposed

535. Wet cement and/or concrete will not be allowed to enter any watercourse, pond or ditch.

536. Significant impacts on groundwater are not envisaged as no blasting operations and deep cuts are planned. Ground water pollution risk related to fuel leakages is minimal and will be eliminated in case of immediate removal of polluted ground

537. Erosion control and pollution prevention measures are planned for the site of crossing the dry gorge with seasonal stream, in the area of planned bridge. Slope landscaping and vegetation are envisaged and in addition installation of temporary berms and sediment traps could be required, in case if during construction erosion will be stimulated. No fuelling operations will be allowed near the dry gorge.

8.1.3 Construction Waste Management

Inert construction waste handling

538. Generally, it is recognized that the best option has always been the avoidance of waste generation resulting in minimizing the quantities and hazard. Then it is recognized that it is better to reuse, restore and recycle the waste rather than to process it, and the placement is the last resort.

539. The total amount of inert waste produced during the construction of the aforementioned road section is less compared with the other sections construction.

540. The quantities of the milled pavement is – 11,880 m3. The reuse of milled pavement is possible and advisable. The milled pavement is stored in the borrow pit and reused in pavement construction or road section repairs.

541. Only some of excavated soil will be used for fills. at least 95,330 m3 of excavated soil and loose rock should be placed in soil deposit areas. It is worthy of note that the designed road is located in the vicinity of non-functional Iagluja disposal area, which is due to be closed. We recommend to transport inert construction waste (spoil) to Iagluja disposal area and use it for its closure and conservation.

Hazardous Construction Wastes

542. According to local legislation (Order #36/N of the Minister of Labour, Health and Social Protection of 24.02.2003) small amounts of listed types of hazardous wastes could be disposed on municipal landfills. Disposal of the most part of hazardous wastes should be agreed with the MoE and local authorities. Constructing Contractor shall collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at the temporary storage sites and further at the locations approved by MoE or pass it to the licensed operator (e.g. Sanitari Ltd), having environmental permit on operation of the hazardous wastes.

8.1.4 Topsoil Protection and Erosion Control Measures

543. Contractors will be encouraged to minimize usage of productive agricultural land and convert them to their original state after completion of civil works. Embankments should be monitored during construction for signs of erosion; long-term material stockpiles will be covered to prevent wind erosion.

544. The storage of topsoil in stockpiles, no more than 2m high with side slopes at a maximum angle of 45^0, will take into consideration the following:

- Segregation of the topsoil from the subsoil stockpiles
- Dedicated storage locations that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials;
- Segregation from subsoil stockpiles;
- No storage where there is a potential for flooding;
- No storage at less than 100 m from river/streams, subject to site specific topography.

545. Contractor will protect the stockpiles from flooding and run-off by placing berms or equivalent around the outside where necessary. Topsoil stockpiles will be monitored and should any adverse conditions be identified corrective actions will include: (i) anaerobic conditions - turning the stockpile or creating ventilation holes through the stockpile; and (ii) erosion - temporary protective silt fencing will be erected;

546. Topsoil removed from the construction sites will be used for reinstatement of the topsoil on the embankments or in the adjacent construction corridor affected by the project activities. Topsoil will be reinstated separately from subsoil, with care taken to avoid mixing of the materials. The topsoil reinstatement will be sufficient to restore the fertile depth to the initial conditions as judged by the topsoil strip during visual observation and comparison of the reinstated site and adjacent land. When replacing the topsoil Contractor will program the works such that the areas farthest away from the stockpiles are reinstated first with reinstatement getting progressively closer to the stockpiles, thus reducing the number of vehicle movements over the reinstated topsoil. The reinstated topsoil will then be harrowed, where practical, to protect the stability and promote vegetative growth.

8.1.5 Subsoil Storage

547. The storage of subsoil in stockpiles, no more than 3m high with side slopes at a maximum angle of 600, will take into consideration the following:

- Dedicated storage locations where the stockpiles will not be compacted by vehicle movements or contaminated by other materials; and
- Segregation from topsoil stockpiles.

548. In the event that the subsoil stockpiles experience significant erosion Contractor will institute corrective action such as installing erosion matting over the stockpiles.

8.1.6 Temporary Erosion Control Measures

549. The measures, by which Contractor will address the protection of "slopes" adjacent to the highway against erosion before permanent reinstatement, are outlined in this section. Temporary erosion control measures will be introduced as necessary, paying special attention to:

- Construction activities that increase the potential for erosion from the slope sides and/or sediment mobilization in watercourses;
- Straw bale barriers in locations requiring small volumes of sediment interception;

550. Temporary erosion control measures will be left in place until the slopes are stabilized to the approval of Road Department. The purpose of temporary erosion control measures is to:

- Interrupt surface water run-off;
- Slow the velocity of water runoff to the extent practical;
- Divert water off exposed check dam areas;
- Prevent and minimize sediment transportation off the construction sites.

8.1.7 Final Reinstatement and Long-term Anti-erosion Measures

551. All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). So far as very limited bush clearance and no woodcutting is required for the highway upgrading, preservation of top-soil is sufficient for reinstating the natural grass vegetation cover as well. Replanting of bushes and trees is considered below in a section "Landscaping and planting of greenery".

8.1.8 Landscape Reinstatement and Protection of Flora

552. The most part of the RoW belongs to strongly transformed urban landscape and has no ecological value. The project does not affect forestry fund land.

553. In order to protect the sensitive habitats and endangered flora species, following actions are needed:

- pre-entry survey in these sensitive zones prior to construction start up, in order to quantity assess the red data species presented within the zone and all trees to be felled.
- Exact demarcation of those trees that are subject for felling (to exclude cutting of other trees)
- Detailed taxation of the trees to be felled needed to comply with the procedure of Excluding the Project Land parcels from the Forestry Land Fund.

554. All these actions should be incorporated into the Construction Contract as part of the Environmental Management Plan.

555. The construction Contractor and MDF, based on the pre-entry survey data, should apply all efforts to minimize the impacts on the red list species and accordingly refine the route. Inventory of each single specimen of the red data tree species remaining under the impact after the route refining should be conducted. The extraction of the red data tree species from the natural environment should be conducted according to the requirements of the Georgian Law on Red List and Red Book. Tree felling should be conducted in accordance with the procedures requiring change of category of lands attributed to the Forestry Fund. In case of building an object or infrastructure with a special state designation, the plant species included on the Red List can be removed from the nature only if the Ministry of Environment makes a decision on the removal of the Red-listed plant species from the nature. The request for obtaining such a decision by the Ministry of Environment can be made by the ministry envisaged by the Law of Georgia "On the Structure, Authority and Rules of Operation of the Government of Georgia". According to the latest field survey data (June 2013) greenery plantation trees (mostly pines) are to be felled at the starting section (rm 4.100 – 4.700, about 28 trees) and at the border of the Krstanisi Forest Park some artificially planted trees are under the impact (pines, some cedars and mulberry trees). Total amount of trees to be felled is roughly estimated as 1000 timber trees and about 4000 fruit trees. Fruit trees are compensated to affected households. However, the overall input of these fruit trees as ecological factor supporting "green status" of the affected area (which is considered as recreational zone) could not be neglected. During landscape planning restoration of green mass and planting of greenery plantations will be important. We propose to consider planting of 10000 trees to offset the project damage, improve aesthetic and recreational value of the area. Landscape plan should be elaborated by MDF in collaboration with the City Hall environmental services and MoEPNR. Specialised company should engaged for that purpose and consultation with the local residents is also desirable.

556. Trees can be cut down by observing the following rules under the law: **Law of Georgia "On special protection of green plantations and state forest fund within the boundaries of Tbilisi and its environs"**

557. The standards to use the areas with the status of a special recreational zone with a special regulation, the necessary requirements for improving and building the given areas, the plant species to be grown on the areas as well as the boundaries and area of the areas are determined by the decree of the President of Georgia.

8.1.9 Protection of Fauna

Construction Phase

558. The project is not expected to have significant impact on the Fauna. The only species to be affected by the construction is bats. The impact can be mitigated by checking old buildings and hollow trees prior to their demolishing or cutting. A simple acoustic method can be used to scare off bat colonies.

559. Pits, trenches and similar should be limited by some barrier to prevent falling of animals into them – i.e. large band of colour distinctive to the species, any flat material for small animals: tin, polyethylene, etc. Long boards or logs should be put in pits and trenches at night so that small animals are able to get out. Pits and trenches should be checked prior to land filling

560. Noise, emission and dust minimization actions, as well as prevention of poaching by the workers should be included in the EMP as mitigation procedures.

561. The plants will be covered with dust, which will impact the feeding base and reproduction of vertebrate and invertebrate species (Яблоков, Остроумов 1985); The impact is limited to the territories

in the immediate vicinity (adjacent to) of the road. Dust minimization measures as described above should be implemented (watering; covering fine materials etc.)

8.1.10 Protection of the cultural heritage

562. Despite the fact that the project footprint is mostly limited to the existing road and construction sites are not located near any known subterranean monuments or areas of an archaeological interest, destruction of archaeological layers during the construction process is possible (although unlikely). To avoid this risk, archaeological supervision during the earth-works is necessary. Supervisory procedures and all other necessary measures should be agreed with the Ministry of Culture when obtaining the construction permit, in accordance with the rules of the permit issuance. According to the article 14 of the Law on Cultural Heritage, Permit on conducting quarrying activities in Georgia, as well as construction of an object of a special importance as it may be defined under the legislation of Georgia, is issued by a competent authority based on the positive decision of the Ministry of Culture, Monument Protection and Sport of Georgia. The basis for the conclusion is the archaeological research of the proper territory to be carried out by the entity wishing to accomplish the ground works. The entity wishing to do the earth-works is obliged to submit the Ministry the documentation about the archaeological research of the territory in question. The preliminary research should include field-research and laboratory works. In case of identifying an archaeological object on the territory to study, the conclusion of the archaeological research should contain the following information: (a) a thorough field study of the archaeological 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 archaeological research. According to the established practice, the archaeological studies are conducted under the detailed design contract at the stage of obtaining the Construction Permit.

563. At the construction stage archaeological monitoring ("Chance Finds Procedure") should be ensured by the constructing contractor under the supervision of the Ministry of Culture, Monument Protection and Sport of Georgia. The budget necessary for the archaeological supervision and other agreed works should be fixed under the construction works appraisal.

Chance Finds Procedure:

564. Construction Contractor engages 1 especially dedicated archaeologist (archaeological supervisor) for conducting daily supervision activities during the earthwork operations. Good practice is to agree the candidature of person assigned for that task with the Ministry of Culture and Monument Protection.

565. The Ministry of Culture and Monument Protection may also assign a person or company for periodical supervision of construction works, although this is practiced only in exclusive cases of sensitive projects.

566. Archaeological supervisor conducts daily monitoring at all construction sites, where the earthworks (land clearance; grading; excavations etc.) are planned according to the schedule.

567. Besides that, archaeological supervisor instructs the workers to report him immediately in case of any chance finding of potential archaeological relics.

568. In case of finding any artefacts of potential archaeological value, following steps are taken:

1. Construction workers are obliged to stop works and immediately report to the Archaeological Supervisor.

2. Archaeological supervisor reports to the Chief Engineer at site and requests to stop activities at the site of finding. Archaeological supervisor executes first checking of the finding and the site where finding was made

3. In case the finding has no potential archaeological value, the Archaeological Supervisor reports to the Chief Engineer and the works are restarted. Appropriate record regarding the case is made in record book.

4. In case if the finding is estimated as potential archaeological relic, the Archaeological Supervisor reports to Chief Engineer of the Construction Contractor and to MDF Environmental Specialist (and supervising company / Engineer) requesting to stop construction activities and to inform the Ministry of Culture and Monument Protection about the incident.

5. Chief Engineer of the Construction Contractor also reports to MDF informing about the stopped operations and requesting immediate engagement of the Ministry of Culture and Monument Protection.

6. Ministry of Culture and Monument Protection will assign expert or group of experts and conduct necessary archaeological works at the site to identify the problem.

7. In simpler cases, after removal of the movable artefacts, fixing materials and conducting other required works, the experts of the Ministry of Culture and Monument Protection will issue decision on recommencement of stopped construction works.

8. In exclusive cases of valuable and spatially spread findings, the Ministry of Culture and Monument Protection may issue request to relocate the RoW shifting it on a safe distance from the archaeological site.

8.1.11 Protection of the Infrastructural Elements

569. During the mobilization and preconstruction stage required activities are planned to remove the existing transmission lines, water supply pipelines and local gas pipelines to the safe sites. All of these infrastructural systems should be uninterruptedly functional during and after completion of construction activities. Permanent monitoring is required to avoid damage of the infrastructure systems, which are not removed. All the damaged systems should be reinstated. The complete list of the utilities and infrastructure to be relocated or affected specifically is provided in section 2.9 “Utility Relocation”.

570. Relocation, replacement and rerouting of all utilities located on the Project:

- The contractor is responsible for working closely with any utility company having their infrastructure located within the public right-of-way.
- Before any construction is begun the Contractor shall notify the utility companies of the proposed work area and request that they mark the location of any types of equipment in the area.
- The Contractor shall establish the position of existing services such as pipelines, sewers, surface water drains, cables for electricity and telephones, overhead lines and water mains, before starting any excavation or other work likely to damage them.
- The Contractor shall be responsible for arranging in liaison with the appropriate Authority, the moving of or alterations to services such as pipelines, power and telephone lines, water mains, sewers and surface water drains which are affected by the Works. The arrangements for such moving or alteration shall be subject to the agreement of the Engineer and the appropriate Authority.
- The Contractor is responsible for any and all damage caused to any utility during construction and shall repair them with his equipment or, if the utility company desires, they shall be allowed a free use of his equipment and personnel as required in order to complete repair works.
- Should the utility company chose to repair the damaged utility themselves costs incurred shall be the responsibility of the Contractor.

- If any utility equipment is encountered in the proposed work area the Contractor shall submit to the Engineer for approval his proposal to relocate the utility outside the construction limits in writing. This proposal shall include, but not be limited to the proposed duration of the works, plans and details of a new utility route, materials to be used, together with any required certification that the material meets the utility company's specification and details of protection methods to be used for any utility materials to be left in place. After the utility has been rerouted the interested utility company shall be notified to inspect the work prior to commencing the backfill operation.

571. The affected infrastructure and the owners are listed in p. 2.9 .

572. The main infrastructure to be crossed is the international mainline oil and gas pipelines operated by BP. Special design for crossing the RoW of the mentioned strategic pipelines has been elaborated by BP and Detailed Design contractor in close collaboration. The specific design complies international safety and engineering standards and BP has accepted this technical decision

573. The other affected infrastructure elements are of local significance and less complex. In consultation with the listed owners, the DD Contractor has elaborated specific relocation and design plan for each particular infrastructure system. Agreement has been achieved with all stakeholders. Safety and environmental issues have been considered, as all relocations are made for few meters, within the same environment. All these infrastructure elements are located within the low sensitivity environmental zones.

8.1.12 Health and Safety

574. It is required to observe safety measures, industrial sanitation and fire precaution measures and instructions whilst performing the works, as well as to train the staff. The Contractor is required to instruct the staff on safety measures prior to the commencement of works.

575. Road vehicles shall have small turning radius, equipped with sound signals and light signals which should be in good operating conditions. Parking place shall be fenced with barriers and equipped with red signals of emergency stop during the day and with red signal floodlight at night.

576. Roadmen shall be provided with special uniforms and special footwear. It is required to observe overall safety measures such as fencing of work site, various safety activities. The Contractor should ensure special shelter for protecting workers from unfavourable weather conditions.

577. Alternate access will be provided for vehicles and pedestrians. Appropriate lighting and signs will be employed.

578. The Contractor is responsible to perform the works in accordance with labour protection and safety requirements as well as industrial sanitation requirements.

8.1.13 Complex of Ancillary Facilities (Concrete Plant, Camp, Vehicle Fleet)

579. In order to efficiently organize the works, it is necessary to build the auxiliary buildings and premises to be designed and built by the contractor. The current project design does not include these facilities. Design and location of these facilities is within the competence of the Construction Contractor. Accordingly, the present IEE is not covering project-specific mitigation measures in that respect, but provides only generic recommendations on legal procedures and mitigation measures, as well as standards applicable for the project.

580. The decision regarding the concrete plant will be taken by the Construction Contractor. He may chose to use existing suppliers of the concrete operating in the region. In this case the requirement to be met is that only licensed suppliers having all required permits are used. The other option is that Contractor decides to install his own concrete plant. In this later case, the Construction Contractor is obliged to be compliant with the Technical Regulations adopted by Moe.

581. In line with the legislation of Georgia, the other facilities (construction camps. vehicle fleet etc.) are not subject to the environmental permit. However, the Construction Contractor has to comply with certain standards and regulations. Designing and the selection of territory must be undertaken under the following normative documents effective in Georgia:

- Resolution No. 57 of the Government of Georgia of March 24, 2009 "About the rule of issuance of a building permit and terms of permit".
- Decree No. 1-1/1254 of the Minister of Economic Development of Georgia of July 8, 2009 "Relating the approval of the principal provisions to regulate the use and accommodation of the territories with settlements".
- Decree No. 1-1/251 of February 18, 2010 of the Minister of Economics and Sustainable Development of Georgia "On the use of the norms, rules and other of documents of technical regulation in the field of technical supervision and construction on the territory of Georgia effective before 1992".
- SNiP2.07.01.–89 Urban planning
- SNiP2.08.02.–89 Public buildings and premises
- SNiP2.09.03.–85 Premises of the industrial enterprises
- SNiP2.09.04.–87 Administrative and domestic buildings.
- Decree No. 745 of the Minister of Environment Protection and Natural Resources of Georgia of November 13, 2008 "On the technical environmental regulation"

582. The complex of auxiliary buildings includes a living camp, fleet and concrete plant.

583. The propose traffic management scheme solves the traffic disruption problems within each of the subproject (section 1 and section 3). However, the simultaneous execution of civil works on Tbilis-Phonichala and Phonichala-Rustavi subsections may create additional traffic problems. To minimize these risks we propose to split construction schedules in a way that intensive works on critical sites are carried out at one section at the same time.

The Worker's Camp

584. The camp has an office, living, domestic and catering units.

585. When building the living camp, drinking and domestic water-supply should be considered. A pipe or pit well can be made on the selected territory and the camp can be supplied with fresh underground water. In line with the effective legislation, an underground water intake license is necessary for this purpose.

586. A reserve reservoir will be arranged on the territory supplying the camp units with water by gravity.

587. The waste waters will be collected in the sewage system on the camp territory and discharged via a common collector from the camp area.

588. The waste waters will be polluted with organic substances and therefore will need biological treatment. A technically relatively simple premise, a septic is to be provided to treat the waste waters. A septic is a premise, where the mechanical and biological treatment of waste waters and sludge mineralization take place at the same time. After the septic, the waste water will be disinfected and discharged into the surface water facility or environment (dry gorges etc.). The proposed site for camps is located far from the r. Mtkvari and discharge could be arranged in dry gorge. However, the Construction Consultant will agree discharge mode with MoE and develop, if requested by Moe, the normative document "Admissible Maximum Discharges into the Surface Water Bodies".

589. A waste container for domestic waste will be placed on the camp territory. The waste will be removed from the camp site under the agreement concluded with local services.

590. The requirements of the following normative documents must be considered when arranging the unit:

- Georgian Law "On water";
- Georgian Law "On ore deposits"
- Georgian Law "On permits and licensing"
- Decree No. 745 of the Minister of Environment Protection and Natural Resources of Georgia of November 13, 2008 "On the technical environmental regulation"
- Construction Regulation Standards Building Code (MTS 07.01-09) - "Water supply and sewerage outer networks and premises"
- Construction Regulation Standards Building Code 2.1.4. 000 – 00 "Drinking water and water-supply of settled areas"
- Construction Regulation Standards Building Code 2.04.01–85 "Internal water pipeline and sewerage norms"
- Construction Regulation Standards Building Code 3.0.01–85 "Internal sanitary-technical systems"
- Construction Norm 496–77 "Temporal instruction to design the surface waste water treatment plants".

Vehicle Fleet Depot

591. The fleet includes a car park and repair boxes for construction techniques.

592. The tanks to collect the broken-down car parts will be placed on the territory of the repair boxes, in particular the metal boxes for oily parts, reservoirs for amortized tires and other polyethylene or rubber parts; the given remains will be removed from the territory under the agreement with local services. Plastic reservoirs will be placed for used oils and other oil product residues, and the contractor will be made responsible for their removal from the territory and rendering them harmless.

593. In order to avoid the expected risk of pollution of the soil or water reservoirs with oil products, the territory of the fleet will be flattened and a storm water collection system will be provided.

594. There is a risk of the storm waters pollution with suspended materials and oil products and therefore, the oil products retaining unit for the collected storm waters will be provided.

595. The amount of storm waters is calculated by the following formula:

$$Q=10 \times F \times H \times K$$

where Q is the volume of storm water, m^3/day (m^3/year)

F is the area of the territory, ha

H is the amount of precipitations, mm and is taken from the existing literary sources

K is the coefficient, which depends on the type of the cover.

According to the volume of storm waters, the treatment plant calculations will be made.

596. When building the unit, the requirements of the following normative documents must be taken into account:

- Georgian Law "On water"
- Building Norm 496-77 "Temporal instruction to design the surface waste water treatment plants"
- SNiP 2.11.04.–85 – "Underground reservoirs for oil, oil products and liquid air"
- Decree No. 1-1/2935 of the Minister of Economic Development of Georgia of December 8, 2008 "On gas filling stations and approving the rules of safety of gas filling complexes".

Selection of territories

597. In order to ensure the efficient work organization, the sites for the camps are to be selected carefully.

598. The selection of the location and size of a camp is the contractor's prerogative and responsibility, but the interaction between the construction staff and the environment and local population must be considered.

Fig. 8.1 Proposed Camp Site

Waste Management Plan for Construction Camp is given in annex 7. Here below we provide brief summary.

599. 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.

600. 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.

601. 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.

602. Wooden packaging material shall be passed to the local population for further re-use.

603. 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 principles, procedures and rules described in Annex 7

8.1.14 Resume

604. Commitment of Construction Contractor to adhere the environmental management requirements described in the present EIA should be incorporated into the contract (e.g. the present EIA or only EMP could be attached as annex and essential part of the contract).

605. The Constructing Contractor is obliged to assign environmental specialist for managing environmental issues and produce Contractor's Implementation Plan (based on the present EMP) with further description of details (schedule, involved personnel, required resources etc.).

606. The offset tree planting project (if required and as requested by MoE) should be elaborated by constructing contractor and relevant costs should be reflected in the overall construction budget. Offset tree planting Plan should be included in the final EMP (Contractor's Implementation Plan). The final version of the plan should be agreed with the Road Department

607. Only legally registered suppliers having all required permits and licenses will be used**.** This is relevant to the borrow pit operators, as well as to the other material suppliers. Checking of compliance with the permit and license requirements is the only way that the project may have influence and mitigate impacts related to the suppliers' operations. In case if the constructing company decides to explore borrow pits, appropriate licenses should be obtained from the MoE. The constructing contractor may take decision to install concrete mixing plants to produce concrete for their operations. In that case special EIA

and obtaining of the Environmental Impact Permit is not required, however the contractor should be in compliance with the Technical Regulations.

8.2 Mitigation of Long-term and Operation Related Impacts

608. Here we would mention the mitigation measures to be implemented at operational stage. Most of these measures (predominantly maintenance works) should be implemented by Road Department utilizing funds from the state budget, lawns, grants and other financial sources.

609. Erosion and land stability control and landscaping. Road Department should ensure permanent erosion and land stability control and monitoring of landscape restoration after completion of construction works, as well as timely implementation of corrective actions. Corrective actions include, but are not limited to maintenance of drainage systems and implementation of anti-erosion measures (berms, vegetation cover etc.) whenever required.

610. Roadside litter and fuel pollution. RDMRDI should coordinate with the local Governmental institutions and private companies and facilitate arrangement and proper functionality of supporting facilities and services (fueling stations, waste management services)

611. Air emissions, noise and pollution during the maintenance works. RDMRDI should ensure incorporation of environmental considerations in the maintenance contracts and monitor implementation.

612. Landscaping and planting of greenery. In a long-term perspective and in relation with the entire length of highway RDMRDI should plan development of the roadside zone applying proper landscaping and greenery planting strategies. Visual and aesthetic, as well as emission screening aspects should be taken into consideration.

613. Prevention and mitigation of accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials injuries or loss of life Emergency preparedness. RDMRDI in conjunction with the Ministry of Interior (Department for Managing Emergency Situations) should facilitate development of legislation and emergency response plans regulating transportation of hazardous materials. The system of measures may include but not limited to:

- Design and implement safety measures and an emergency plan to contain damages from accidental spills.
- Designate special routes for hazardous materials transport.
- Regulation of transport of toxic materials to minimize danger.
- Prohibition of toxic waste transport through ecologically sensitive areas.

614. The abovementioned measures and plans should be elaborated in accordance with the Law of Georgia on Hazardous Substances and Regulations of the MoE on “Norms of Usage of Chemicals in the Environment and Rules of Transportation, Storage and Usage of Chemicals”. Regulations of other countries (e.g. Order of the Minister of Transport of Russia # 73 issued 08.08.1995 as amended in 1999) could be used as supporting materials.

615. Prevention of Proliferation of Human, Animal and Plant Diseases.

616. The Customs Services, the National Center for the Disease Control and Medical Statistics (NCDC) and the “National Service for the Foodstuffs Safety, Veterinary and Plant Protection” of the Ministry of the Agriculture are responsible entities to prevent proliferation of human, animal and plant diseases due to transportation of people and goods.

9. ENVIRONMENTAL MANAGEMENT PLAN

Introduction

617. The Environmental Management Plan (EMP) documents the impacts identified in the EIA report, the actions required to mitigate those impacts to acceptable levels in accordance with the Georgian legal requirements and the ADB safeguard policy, and the monitoring activities that are to be undertaken as part of the project to confirm that the mitigation actions have been effective in achieving their objectives or to initiate corrective actions required.
618. The EMP also details the institutional arrangements and capacities that currently exist, or that will be put in place as part of the project implementation, to ensure that the environmental due diligence (including the EMP) has comprehensively considered both the national and ADB requirements for environmental protection, has identified all likely environmental impacts and proposed appropriate mitigation measures, and has the systems in place to ensure that effective procedures for environmental monitoring and control of the project impacts and mitigation measures are implemented throughout the life of the project.

619. The environmental impacts associated with project have been detailed above in the chapter 7 of this EIA. Mitigation measures required to address the impacts identified in the EIA have been summarized in each of the relevant sections covering the physical, biological and socio-economic environment affected by the project (chapter 8). The impacts identified and the specific mitigation measures proposed to address them have been consolidated into the environmental mitigation plan presented in p. 9.3 in a form of matrix, which includes time frames, responsibilities and where applicable, estimated costs for each measure.
620. The environmental mitigation plan specifies the need for the civil works Contractor to provide its own detailed Site Specific Environmental Managemen Plan (SEMPs,) based on current EMP, but supplemented with the descriptopn of the schedule of planned activities, persons responsible for implementation of EMP and monitoring, as well as with method statements for spillage control and construction waste management.
621. An environmental monitoring plan is presented in p. 9.4, which outlines the activities and responsibilities associated with monitoring the effectiveness of the proposed mitigation plan and ensuring compliance with the recommendations of the IEE.

9.1 Implementation arrangements and responsibilities

622. The main institutions that will be involved in implementation of the SEMP and monitoring are the executing agency (EA), the Supervision Consultant (SC) the Contractor and to a lesser extent the Ministry of Environmental and Natural Resources Protection and Municipal Authorities. EA and SC are responsible for ensuring monitoring of the project implementation at the construction stage, while RDMRDI for monitoring at the road operation stage. Ministry of Environmental and Natural Resources Protection has the authority for periodic audits but should not be considered as a party responsible for monitoring according to this IEE and EMPs.
623. MDF as the executing agency will be responsible for the day to day management of the project including implementation of the SEMP. The EA currently has one Environmental and Social Specialist and one Resettlement Specialist, who are responsible for management of the environmental and social aspects associated with development of all donor funded projects for which MDF is the responsible Executing Agency (EA).
624. The MDF's Environmental and Social Specialists responsibilities in respect of implementation of the SEMP are as follows:

(i) Ensure that all relevant SEMP requirements (including environmental designs and mitigation measures) are duly incorporated into the project bidding documents.

(ii) Obtain necessary permits and/or clearance, as required, from MoEPNR and other relevant government agencies, ensuring that all necessary regulatory clearances are obtained before commencing any civil work on the project.

(iii) Ensure that contractors have access to the EMP and IEE report.

(iv) Ensure that contractors understand their responsibilities to mitigate environmental problems associated with their construction activities and facilitate training of their staff in implementation of the EMP.

(v) Approve the Site-Specific Environmental Management Plan (SEMP) prepared by the Contractor before he takes possession of construction site

(vi) Monitor the contractor's implementation of the SEMP in accordance with the environmental monitoring plan.

(vii) Prepare and submit semi-annual Environmental Monitoring Reports to ADB.

(viii) In case unpredicted environmental impacts occur during the project implementation, prepare and implement as necessary an environmental emergency program in consultation with MoEP, any other relevant government agencies, and ADB.

(ix) Hire specialized companies to manage asbestos waste disposal and safe operations on dismantling, transportation and storage of oil contaminated equipment of gas filling stations. The other choice is to request Construction Contractor to hire the mentioned waste and pollution Management Company and to insert this requirement in Civil Works Contract.

625. The supervisor company (SC) of works commissioned by MDF is responsible to establish strong field presence in the Project area and keep a close eye on the course of works. Along with ensuring consistency with the design and ensuring quality of works, the supervisor is mandated to track implementation of EMP by the contractor, reveal any deviations from the prescribed actions, as well as

626. The SC will include a part time international environmental specialist (6 weeks per year for 3 years) and fulltime site-based national environmental specialist to assist the EA supervise and monitor implementation of the EMP during construction.

627. A Non Compliance Notice will be issued to the contractor if the SC requires action to be taken. The contractor will be required to prepare a corrective action plan which is to be implemented by a date agreed with the SC. Non-compliance will be ranked according to the following criteria:

- Non Compliance Level l: A situation that is not consistent with requirements of the EMP, but not believed to represent an immediate or severe social or environmental risk. Repeated Level I concerns may become Level II concerns if left unattended.
- Non Compliance Level II: A situation that has not yet resulted in clearly identified damage or irreversible impact, but which demonstrates potential significance. Level II requires expeditious corrective action and site-specific attention to prevent severe effects. Repeated Level II concerns may become Level III concerns if left unattended.
- Non Compliance Level III: A critical situation that will result in significant social or environmental damage occurring or a reasonable expectation of very severe impending

damage. Intentional disregard of Non Compliance Notices or specific prohibitions is also classified as a Level III concern.

628. The failure to prepare a corrective action plan or to implement it within the required timeframe will result in the Employer undertaking the work at the Contractor's expense (as will be specified in the Contract).

629. Construction contractor is obligated to follow EMP and good construction practice. In order to meet this obligation, a contractor shall establish environmental management team and procedures.

630. The **Contractor** will appoint a full time **Environmental Manager** (EM) to be a senior member of the construction management team based on site for the duration of the contract. The EM shall have a university degree (preferably at Masters level) in Environmental Science or related discipline and have at least 10 years work experience in environmental management of infrastructure projects. In case if according to CW Contract, the engagement of specialized waste and pollution management company is responsibility of Contractor, they will ensure financing and arrangement of related contracts and supervise the activities of waste operator.

631. Key responsibilities of the Contractor (through the EM) are as follows:

(i) Preparing the Site-specific environmental management plan (SEMP) for approval by the Employer (EA) prior to the Contractors taking possession of the construction site (see below)

(ii) Ensuring the SEMP is implemented effectively throughout the construction period.

(iii) Coordinating community relations issues through acting as the Contractor's community relations focal point (proactive community consultation, complaints investigation and grievance resolution)

(iv) Establishing and maintaining site records of:

- weekly site inspections using checklists based on SEMP,
- environmental accidents/incidents including resolution activities
- environmental monitoring data,
- non-compliance notifications issued by the SC
- Corrective action plans issued to the SC in response to non-compliance notices.
- Community relations activities including maintaining complaints register
- Monitoring reports
- Routine reporting of SEMP compliance and community liaison activities (see below).
- Adhoc reporting to the Employer's Engineer of environmental incidents/spillages including actions taken to resolve issues

Site-Specific Environmental Management Plan (SEMP)

632. Following the award of the contract and prior to construction commencing the Contractor will review the EMP and develop this into a detailed **Site-Specific Environmental Management Plan (SEMP)** that amplifies the conditions established in the EMP that are specific for the project, the tasks involved and schedule of construction activities. The SEMP will identify persons who will be responsible for

supervising the work within the contractor's team. The SEMP will include a matrix of mitigation measures corresponding to specific activities. As a stand alone documents the SEMP will be supplemented with method statements for spillage control and construction waste management. The spillage control method statement includes proper location and organization of fuel storage, filling stations and vehicle washing sites.

633. The SEMP will also include a monitoring plan and a reporting program corresponding to the requirements of the EMP. The SEMP will be submitted to EA for approval at least 10 days before taking possession of work site.

Site Induction

634. Following approval of the SEMP by the EA, the Contractor will be required to attend a site induction meeting with the SC's International Environmental Specialist whereby the SEMP is confirmed with the Contractor to ensure that all compliance conditions are clearly understood. Following confirmation of the SEMP with the Contractor the SC's International Environmental Specialist advises the SC Team Leader that the Contractor is now cleared to take possession of the Site and may commence moving equipment to the Site.

635. The Contractor will be responsible for ensuring that all sub-contractors abide by the conditions of the SEMP.

Reporting

636. Bi-annual Environmental Monitoring reports (EMRs) to be submitted within 1 month at the end of each reporting period. Quarterly project progress reports also should have a section on environmental safeguard compliance. Bi-annual EMRs should be a concise report in respect of compliance with EMP/SEMP requirements that will be submitted by the EA with assistance from the SC. The report will contain the following sections.

(i) Details of any environmental incidents

(ii) Status of all non-conformance identified during audits and inspections that are identified by non compliance notices.

(iii) Complaints from the public and proactive community relations activities

(iv) Monthly Accident Report

(v) Waste volumes, types and disposal

(vi) Details of any contaminated areas that have been identified and rehabilitated.

(vii) Details of any archaeological discoveries.

(viii) Details of any ecological issues.

(ix) Other relevant environmental issues.

(x) Action plan for corrective measures

637. The Contractor will have a duty to immediately report to the SC if any serious environmental breach has occurred during construction e.g. clearing of sensitive areas, serious oil spills etc.

638. The SC provides EA with monthly reports including review of the environmental and social aspects of the Contractor's performance, as well as HSE issues. In case of any serious accident or repeated violation requiring immediate reaction of the EA and authorities, SC sends appropriate notice to EA

immediately.

639. MDF as the Executing Agency will submit monthly reports to ADB reflecting project progress and compliance with the safeguards requirements. The monthly reports will include SC monthly reports and short explanatory not of MDF specialists.

640. ADBs responsibilities in regard to implementation of environmental safeguards requirements for the 7project include: undertaking of occasional auditing of the SEMP implementation and due diligence as part of an overall project review mission; and if required, provide advice to MDF in carrying out its responsibilities to implement the SEMP for the project.

Institutional Capacity Building Requirements for MDF

641. Within MDF, is the environmental and social specialist and several monitoring officers are included in the staff. Current environmental capacity of the MDF needs strengthening to ensure full environmental compliance of the Project. Although day-to-day quality control of works will be outsourced to the engineering supervisor of works, MDF should have in-house human resources to oversee performance of such technical supervisor and to work out decision to address issues which the supervisor may bring up for MDF's attention. The proposed capacity building is provision of training to the MDF environmental specialist and monitoring team on ADB safeguards issues and environmental monitoring. Trainings have been recently provided to MDF Environmental specialist. . Further training is necessary to build capacity within MDF environment unit. Recruitment of an environment specialist (consultant) can be envisaged and financed from SUTIP Project 1 to support the unit and provide training on the job.

9.2 Costs of Implementation

642. The costs of environmental activities associated with the construction (3,371,500 GEL) will be included in the contract for civil works Contractor, and 109,000 GEL in contract with the Supervision Company (Engineer). 103000 GEL will be required for MDF capacity building (additional personnel and trainings). In total the planned environmental activities will cost around **3,583,500 GEL.**

643. Waste Management. The waste management costs will be substantial in its part related to asbestos containing waste management. For disposal of 9000m2 of asbestos containing roofing materials preparation of short EIA and obtaining of relevant permit is required. Services of the specialized (certified) company, who will prepare EIA and dispose the waste appropriately could be estimated as **follows: 20000 Gel will cost preparation of EIA and the cost of waste disposal will be specified in EIA**. **According to rough estimations this price (including wrapping, transportation and burying) may cost around 50000 – 75000 Ge**l. MDF as an EA will incorporate in Civil Works Contract requirement that Civil Works Contractor hires appropriate certified waste operator who will ensure proper and safe disposal of asbestos waste according to good international practices. Costs for asbestos disposal, should be considered during the project budgeting during the bidding process. Costs of spoil and rock disposal is not significant, as the substantial part of the spoil generated in cuts will be used for construction of fills (embankments).

644. Pollution Prevention: The large companies like Gulf or Socar are responsible for removing their facilities to the new locations or storage sites. The smaller gas filling station tha finish their business will receive compensation for facilities and will not remove the remains of facilities, including fuel reservoirs. Construction Contractor has to dismantle the fuel reservoirs, which are not removed by the owners to the

new site or storage. Contractor should be equipped by proper spill containment equipment (skimmer, motor-tank, absorbent pads etc.). Contractor should provide spill containment plan. The preferable solution is engagement of the specialized company for supervising processes of dismantling, transportation and storage of oil contaminated reservoirs and other equipment of the 4 gas fueling stations and application of spillage prevention and response measures, if required. The services of the company will cost around 50000 GEL. 2 Kits of absorbent materials will cost 720 GEL. Construction of local fuel spillage containment systems and oil separators for equipment yards – **5000 GEL.**

645. Noise Abatement. In order to mitigate traffic noise impacts it is necessary to limit speed to 80km/hour, construct 4m height sound proof wall for 1.6km section of the road and install double glass windows for the residents of the apartment buildings living along the road. In addition to the double gazing windows conditioners should be installed in affected flats, as in summer time possibility of opening windows for ventilation will be limited by noise protection needs. Therefore cooling could be achieved by additional installation of air conditioning systems. Costs of double glazed windows and air condition systems is estimated roughly as **1,000,000 USD (1,650,000 GEL).** Installation of 4.65m height noise barriers along the design road (km 5+200 – 6+800): Construction of concrete barrier will cost around 1,000,000 Gel (606,000 USD). **Total cost of noise abatement measures is around 2,650,000 GEL.**

646. These costs could be optimized by applying concrete walls or combination of concrete wall with polymer screen.

647. Ecology. Replanting of trees. We propose to consider planting of 10000 trees to offset the project damage, improve aesthetic and recreational value of the area. Landscape plan should be elaborated by MDF in collaboration with the City Hall environmental services and MoEPNR. Specialised company should engaged for that purpose. Seedlings of 10000 trees will cost around 50000 GEL. Services of the landscaping company for planting and maintenance may cost 100000 GEL in addition. **Thus, approximately 150000 GEL should be considered in budget for tree planting and landscaping**.

648. Topsoil storage. 13,000m^3 of topsoil will be stripped and stockpiled. Cost of these operations equal 13,000m^3 x 4 Gel **= 51,000 GEL**

649. Additional Studies of vibration and seismic impacts on the apartment buildings should be conducted before construction start up and preferably before finalization of the Detailed Design and final LARP**.** The cost of these studies may vary from **300,000 to 350,0000 GEL**.

650. Managerial Expenses. Some not significant expenses are foreseen with respect to the following public consultation on the IEE and EMP and will be borne by the Roads Department. The main expenses are associated with the need to hire environmental and H&S specialists and Cultural Heritage Protection specialist. Cots for hiring local specialists are approximately 100,000 Gel annually for Construction Contractor and 100,000 GEL for Engineer - Construction Supervising Company (SC). SC has to involve also international environmental specialist. The related cost is estimated as 200,000 GEL.

651. Capacity building program for MDF environmental team including training of personnel will cost around **3,000 GEL**.

Table 9.1.

Items	Cost (GEL)	Budget line
Mitigation measures		
Preparation of EIA for asbestos waste disposal	20,000	CW Contractor
Asbestos waste disposal	50000 – 75000	CW Contractor
Pollution prevention measures: supervision of processes of dismantling, transportation and storage of oil contaminated reservoirs; absorbent kits and spillage containment systems in equipment yards;	56 000	CW Contractor
Preparation of Noise Abatement Plan and Detailed Design for Noise Abatement Facilities	20,000	CW Contractor
Implementation of Noise Abatement Plan.	**2,650,000**	CW Contractor
Preparation and Implementation of Landscaping Plan	150,000	CW Contractor
Topsoil storage	51,000	CW Contractor
Additional Studies of vibration and seismic impacts on the apartment buildings	**300,000 to 350,0000**	CW Contractor
Monitoring		
Personnel	100,000	MDF
Personnel	100,000	SC contractor
Vibro-meter	1200	SC contractor
Sound meter	700	SC contractor
Device for dust measurement	2500	SC contractor
Portable device for CO_2 measurement	1700	SC contractor
Turbidity-meter	2500	SC contractor
Training and Capacity Building		
Training of MDF personnel	3,000	MDF management
TOTAL	**3,583,500**	

9.3 Environmental Management Plan

Table 9.2. Mitigation Measures to be Implemented During the Pre-construction Phase

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
Some old apartment buildings located along the planned road close to the RoW have limited residual life and are claimed to be in emergency conditions. There is a risk of damaging these buildings due to vibration and "seismic type" shock-waves and shaking related to construction activities and intensive road traffic.	Km 5+200 – 6+800 Road section adjacent to apartment buildings	**Vibration Study**. Additional Studies of vibration and seismic impacts on the apartment buildings should be conducted before finalization of the Detailed Design to be incorporated in the bidding documents**..**	Before completion of DD and issuance of bidding documents	MDF will expand contract for Detailed Design and include these studies in Contract. The studies will be carried out by DD Contractor.	The cost of these studies is estimated to be around **300,000 to 350,0000 GEL**	MDF
Forecasted noise levels associated with construction activities and road traffic exceed admissible limits for residing area (65dBA daytime and 55dBA night-time at the border of first line of residual buildings adjacent to the road).	Km 5+200 – 6+800 Road section adjacent to apartment buildings	**Detailed Design for Noise Abatement.** Results of preliminary estimations and modelling provided in IEE demonstrate that in principle the satisfactory noise abatement could be achieved by combined application of double glazing of windows in adjacent apartment buildings and construction of relatively low (4.5m in height) noise protective wall. Details of design (height of wall at different subsections; combination of transparent polymers with concrete at	Before completion of DD and issuance of bidding documents	MDF will expand contract for Detailed Design and include these studies in Contract. The studies will be carried out by DD Contractor.	The cost of these studies is estimated to be around **50000 GEL**	MDF

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		some locations; final selection of window models and glass characteristics etc.) should be determined during completion of the DD. The studies should be supported by calculation of noise reduction efficiency compared to the standards. If the final outcome of the best selected option still does not meet the standard, then further reduction of speed limit is required. The DD solutions should be based on evaluation of following aspects: • Final list and layout plan of buildings that are subject for noise abatement (The picture will be clear when analysis of structural integrity and vibration impacts is completed) • Physical modelling of different options of double (or triple) glazed windows to select the acceptable one for each apartment building • Height and other parameters of the concrete wall for each subsection • Visual aspects: appearance of facade; exterior decor of concrete wall; combination of concrete with transparent elements;				

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
9000m2 of asbestos roofing waste will be generated during the demolition of existing buildings.	Residential area along the planed road	Asbestos waste management plan and EIA for waste disposal should be prepared and appropriate Environmental Permit acquired.	Before completion of DD and issuance of bidding documents	MDF will expand contract for Detailed Design and include the preparation of specific EIA in Contract. The studies will be carried out by DD Contractor.	**20000 GEL**	MDF
Speed limitation is a part of noise abatement and safety strategy.	Along the whole road	Road safety signage and speed limit to be included in DD. This task is in principle already included in the DD Contractor's ToR. Here, we just specify that the speed limit parameters adopted by EIA and Detailed Design for Noise Abatement should be reflected in DD.	Before completion of DD and issuance of bidding	DD Contractor		MDF

Table 9.3. Mitigation Measures to be Implemented During the Construction Phase

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
Traffic Related Noise (this impact of operation stage, however the impact mitigation measure should be implemented at the construction stage)	Km 5+200 – Km 6+800	Construct 4m height sound proof wall for 1.6km section of the road and install double glass windows for the residents of the apartment buildings living along the road. In addition to the double gazing windows air conditioners should be installed in affected flats, **(**Installation of 4.5m height noise barriers along the design road (km 5+200 – 6+800): **These costs could be optimized by applying concrete walls or combination of concrete wall with polymer screen.**	Before launching road operations	Construction Contractor	Double glazed windows and air condition systems **1,650,000 GEL** Concrete noise barrier – 1,000,000 Gel In total 2650000 GEL	MDF
Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) in the Right-of-Way occupied by the highway. Activities: land clearance, topsoil stripping and excavations	Whole alignment of road to be widened	Pre-entry survey for preventing damage to fauna will be conducted prior to start up of land clearance (inspection of bat living sites; inspection of nests in RoW) Sticks will be installed in pits and trenches for escaping small mammals. Proper top-soil storage practice, as described below, will be applied and stored topsoil will be used for reinstatement and landscaping; We propose to consider planting of 10000 trees to offset the project damage, improve aesthetic and recreational value of the area. **Landscape plan should be elaborated by MDF in collaboration**	prior to start up of land clearance Excavation period From land clearance – till reinstatement Develop planting plan before construction start up.	Constructing Contractor	Approximately 150000 GEL should be considered in budget for tree planting and landscaping	MDF SC Inspectorate of MoE (has authority for periodical audits)

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		with the City Hall environmental services and MoEPNR. Specialised company should engaged for that purpose.	implement before completion			
Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) on the access roads, in the **borrow pit** sites, **waste dumps**, **construction camps** and **equipment yard**s.	Camp site; Quarry sites; (e.g. mtkvari floodplain). Waste dumps, construction camps and equipment yards.	Pre-entry survey will be conducted for preventing damage to flora and fauna; In unlikely case of unavoidable impact on rare or protected species of flora within the refined and fixed corridor, replanting program aimed on conservation of these species will be planned and executed; Sticks will be installed in pits and trenches for escaping small mammals Proper top-soil storage practice, as described below, will be applied and stored topsoil will be used for reinstatement and landscaping; Landscaping plan will be developed and implemented;	prior to start up of land clearance Excavation period From land clearance – till reinstatement After completion of civil works	Constructing company.		MDF SC Inspectorate of MoE (has authority for periodical audits)
Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands below the road embankements receiving concentrated outflow from	Along the whole section of the road	Permanent and temporary anti-erosion measures will be implemented according to the Detailed Design (temporary drainage, biomatting or geo - textile cover, berms etc.) For mitigation of sedimentation impact following measures will be	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
covered or open drains.		implemented: - Limitation of earth moving to dry periods. - Protection of most susceptible soil surfaces with mulch. - Protection of drainage channels with berms, straw or fabric barriers. - Installation of sedimentation basins For mitigation of induced erosion following measures will be implemented: - Appropriate sized rain-storm-water channels will be constructed. - Drain outlets designed so as to avoid cascade effect. - Provision for cross drainage structures will be made. Water receiving surfaces to be lined with stones, concrete.				audits)
Increased suspended sediment in streams affected by erosion at construction sites and fresh road cuts, fills and waste dumps. Declined water quality and increased sedimentation	Subsections close to the r. Mtkvari	**Mitigation strategy**: prevention through implementing temporary anti-erosion measures – temporary drainage, temporary sediment catchments etc. - Protect susceptible surfaces with r fabric,	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		- Establishment of retention ponds to reduce sediment loads before water enters streams				periodical audits)
Topsoil losses due to improper storage and handling Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development	Whole alignment: the sections of road;	**Topsoil storage.** 13,000m^3 of topsoil will be stripped and stockpiled. The Contractor shall - Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m and with a slope of 1:2 - Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites - Topsoil stockpiles will be monitored and should any adverse conditions be identified corrective actions will include: • Anaerobic conditions - turning the stockpile or creating ventilation holes through the stockpile; • Erosion - temporary protective silt fencing will be erected;	Construction period: starting from topsoil stripping and ending with reinstatement;	Constructing Contractor	Cost of these operations equal 13,000m^3 x 4 Gel = 51,000 GEL	MDF SC Inspectorate of MoE (has authority for periodical audits)
Soil and surface water contamination by oil,	Soil - the whole	Engage the specialized company for supervising processes of dismantling,	Construction period	Constructing Contractor	Company services will	MDF

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
lubricants, fuel and paint in the RoW, bridge sites and equipment yards caused by construction activities and operation of construction equipment; Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	alignment; **River – Mtkvari** ,	transportation and storage of oil contaminated reservoirs and other equipment of the 4 gas fueling stations and apply spillage prevention and response measures. **Provide 2 Kits of absorbent materials will cost 720 GEL.** Construct local fuel spillage containment systems and oil separators for equipment yards. The Contractor shall - Prepare spill control procedures and submit the plan for RD approval. - Train the relevant construction personnel in handling of fuels and spill control procedures. - Store dangerous goods in bunded areas on a top of a sealed plastic sheet minimum 100 m away from watercourses. Do not store any hazardous waste in the in the restricted areas, which include • within 100m from the banks of r Mtkvari or other streams • within 500m from any residential areas, cultural or			cost around 50000 GEL. 2 Kits of absorbent materials will cost 720 GEL 5000 GEL.	SC Inspectorate of MoE (has authority for periodical audits)

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		archaeological sites - All refuelling operations on the working sites will use absorbent pads and/or straw to minimize spills, which will be put in place prior to the commencement of refuelling operations. Ground water and surface water pollution risk will be reduced or eliminated in case of immediate removal of polluted ground. Soiled ground and absorbents will be removed, stored and treated as hazardous waste. In case of significant spill authorized and responsible person will be informed, works will be stopped till the elimination of pollution risk refuelling will always be carried out with the correct equipment (i.e. nozzles of the appropriate size), and only by suitably trained and experienced refuelling Operators.				
Construction waste generation alongside the RoW : - excess soil and rock, demolished structures, packaging materials etc.) - Concrete and metal constructions	Construction sites	Disposal of 9000m^2 of asbestos containing roofing materials and services of the specialized company Agree with Jagluja landfill management and municipalities and transport the spoil (excessive rock and soil) to the landfill and use it to as cover material	Mobilization stage Construction	Constructing Contractor Constructing	**50000 – 75000 Ge**l (will be specified in specific EIA)	MDF SC Inspectorate of MoE (has authority for periodical audits)

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		for closing the landfill. This is proposed actin. In more general terms: Assess and, if required, develop spoil and rock disposal plan Use spoil and excess rocks for construction of embankments and dike with riprap revetment. Provide for disposal facilities agreed with local municipalities; Allow local communities to utilize any excess rock, which may be left following reuse. Transport any further material to the nearest spoil disposal sites agreed with the municipal services. The main purpose is not to damage valuable landscapes or soil deposits and other ecological sensitivities. Demolished metal constructions should be disposed as a scrap. The personnel involved in the handling of hazardous and non-hazardous waste will undergo specific training in: - Waste handling - Waste treatment; and	period Construction period Mobilization	Contractor		

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		- Waste storage. Burning of waste on any construction site is forbidden with the exception of stub and small branches from felled trees and bushes, which is better to be burned in order to avoid pest dissemination.	phase and Construction period			
Emission from Construction Vehicles & Equipments causing air pollution	the whole alignment	- Emission levels of all construction vehicles & equipment will conform to Georgian emission standards. - Any crushing & concrete plants will be away from populated areas. - Adherence to engine maintenance schedules and standards & repair - All vehicles and plants shall be maintained so that their emissions do not cause nuisance to workers or local people. - Regular maintenance of diesel engines will be undertaken to ensure that emissions are minimized, for example by cleaning fuel injectors. Routine maintenance will be to a high standard to ensure that vehicles are safe and that emissions are minimized. - Vehicle refuelling will be undertaken so as to avoid fugitive emissions of	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		volatile organic compounds through the use of fuel nozzles and pumps and enclosed tanks (no open containers will be used to stored fuel).				
Dust generation from construction sites, material stockpiles and access roads. Dust is a nuisance in the environment causing health impacts for workers and local population;	The whole alignment	- All precautions to be taken to reduce dust level emissions from batching plants & portable crushers with spraying of water and containment measures. - During dry conditions material delivery vehicles and haul vehicles carrying sand and fill material will be covered with tarpaulin. The construction site and any local roads will be watered as appropriate. - Protective equipment to be provided to workers as necessary e.g. at quarries, stone crushers. - Use of defined haul routes and reductions in vehicle speed where required with appropriate traffic management planning - Sheeting of construction materials and storage piles; and	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)
Noise pollution from vehicle operation during construction in populated areas traversed	The whole alignment	Use temporary noise barriers at work sites (6-7m height and sufficient length). Permanent noise barriers (1.5km length	Construction period	Constructing Contractor		MDF SC

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
by the highway, notably metropolitan areas or densely settled rural areas. Local noise.		and 4m height) should be constructed. This measure is mitigation for operation stage impacts, but should be implemented at the construction stage. Cost of temporary noise screens – 50,000 GEL Install and maintain mufflers on equipment. Routine maintenance will be to a high standard to ensure that vehicles are safe and that emissions and noise are minimized. All plant used on site will be regularly maintained so as to be in good working order at all times to minimize noise. Prohibit night works				Inspectorate of MoE (has authority for periodical audits)
Infrastructure. The main infrastructure element that could be affected are: 1. power lines 2. Gas mainline and local supply pipelines 3. Optical fiber cable		**Protection of infrastructure.** Implement the individual relocation/reconstruction plan and design as agreed with the owners of infrastructure within the frames of Detailed Design. Replace the affected infrastructure elements • Relocation of overhead power lines within the right of way of the construction site:	Preparatory works before the construction start up	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		• Relocation of gas pipeline Permanent monitoring during construction. Full reinstatement in case of damage.				
Creation of temporary breeding habitats for mosquito vectors of disease e.g. sunny, stagnant pools of water. Creation of stagnant water bodies in borrow pits, quarries, etc. suited to mosquito breeding and other disease vectors.	whole alignment	Remove all created pools till spring-time. Reinstate relief and landscape.	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)
Health hazards by noise, air emissions and dust raised and blown by vehicles during construction activities.	near settlements	Dust control by application of watering. Use as minimum as 2 browsers; Temporary noise barriers, noise control, installation of mufflers on equipment, daytime works; See points 11 - 13	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)
Impacts on archaeological sites and remnants	Whole alignment	Permanent monitoring during land clearance and excavation activities. Stoppage and suspension of construction activities in case of archaeological findings. Completion of required archaeological works before restarting construction activities. Conservation of	Before start up of construction; Construction period	Archaeologist from MoCM Constructing Contractor		MDF SC Archaeologist from MoCM

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		remnants.				
Biological recontamination during earthworks near pest-holes of soil infections (e.g. anthrax);	Whole alignment	Permanent monitoring during land clearance and excavation activities. Stoppage and suspension of construction activities in case of burial site findings. Notification to the local division of Veterinary Department. Veterinary clearance before start up.	Construction period	Constructing Contractor		MDF SC
Hazardous driving conditions where construction interferes with pre- existing roads.	Whole alignment	Provide in design for proper markers and safety signs on roads, including lights. Instruct the drivers	Construction period	Constructing Contractor		MDF SC
Final Reinstatement and Long-term Anti-erosion Measures	Whole alignment	All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover). So far as very limited bush clearance is required for the highway construction, preservation of top-soil is sufficient for reinstating the natural grass vegetation cover as well		Constructing Contractor		MDF SC
Tree cutting and Offset tree planting program.	Sensitive zones	Offset tree planting program should be agreed with the MoE, Tbilisi City Hall and Gardabani Municipality.. Special agreement is required with the Georgian Orthodox Church in relation with trees to be felled at the border of the Krtsanisi Park. Offset mitigation program will include measures on replanting of trees in the park zone and further	Develop before construction start up. Implement before completion	Constructing Contractor	Approximately 150000 GEL should be considered in budget for tree planting and landscaping.	MDF SC

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		improvement of the park ecology, as well as landscaping in residential area.. We propose to consider planting of 10000 trees to offset the project damage, improve aesthetic and recreational value of the area. **Landscape plan should be elaborated by MDF in collaboration with the City Hall environmental services and MoEPNR.** Specialised company should engaged for that purpose.				
Accident risks associated with vehicular traffic and transport, that may result in spills of toxic materials, detonation of explosive load, injuries or loss of life(see WB Environmental Sourcebook: 'Hazardous Materials Management' section), injuries or loss of life (see 'Public Health and Safety section) Accidents due to construction related vehicles and heavy machinery or traffic interference with construction activities.	The whole alignment	- Provide in design for proper markers and safety signs on roads, including lights. Instruct the drivers - Design and implement safety measures and an emergency plan to contain damages from accidental spills. - Designate special routes for hazardous materials transport. - Regulation of construction transport in terms of traffic interference. - Prohibition of toxic waste transport through ecologically sensitive areas and densely populated areas.		Constructing Contractor		MDF SC
Quarrying Sites Taking of Borrow and Quarry	presumably, r.Mtkvari	IEE proposes to use licensed queries located in the vicinity to the project	Construction period	Constructing Contractor		MDF SC

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
Materials for construction of embankments for road, bridge approaches with potential for loss and degradation of land; Potential impact of the increased quarrying activities on ichthyofauna, groundwater and landscape	floodplain	road (see chapter 2) In more general terms: Quarry and borrow pit materials will be obtained from existing operating sites with proper licenses & environmental clearances. Control of validity of licenses. (The license is given with description of exploration limits and reinstatement commitments). In case of need for opening new borrow areas, all required licenses will be obtained from the Ministry of Energy and Natural Resources; Measures will be taken to conserve top soil. At close of use the area to be reclaimed according to licensing conditions. Control of vehicle operations at quarry sites. Avoid traverse of watercourse. Exclude leakage of oil or fuel. Check the condition of vehicles.				Inspectorate of MoE (has authority for periodical audits)
Asphalt plants.	Plant site	Contract only licensed supplier having all required environmental permits. In case if the Constructing Contractor takes decision to install and operate its own plant, specific EIA should be prepared and Environmental Impact	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical

Impacts	Sites	Mitigation Measures/Costs	Timeframe	Responsibility for Implementation	Costs	Responsibility for Monitoring
		Permit obtained				audits)
Construction Camp, equipment yard and Vehicle Fleet Site The potential impacts related to the construction and operation of the camp could be summarized as follows: - Clearance of vegetation cover during camp construction - Potential damage of topsoil - Contamination related to fuel storage and fuelling operations - Sewerage related contamination - Waste related contamination	camp site	- Proper waste management (see appendix XX Waste Management Procedures for Camps) - Apply regulations relevant to the camp sites and referred in p. 8.1.1.13 - Arrange accommodation of personnel in villages. In case if large camp will be constructed for the workers accommodation, organize sewerage according standards. - Pollution prevention measures: proper organization of fuelling, waste management; - Proper storage of topsoil - Reinstatement of topsoil and vegetation cover;	Construction period	Constructing Contractor		MDF SC Inspectorate of MoE (has authority for periodical audits)

Table 9.4. Operation Phase

Impacts	Sites	Mitigation Measures	Timeframe	Responsibility for Implementation	Responsibility for Monitoring and Enforcement
Erosion from road cuts and fills and sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains. **Character of impact**: long-term. Change of relief, drainage patterns, land clearance, may cause gradual but stabile intensification of erosion	Whole alignment	Mitigation strategy: long-term – remediation; reinstatement of relief and landscape; Installation of long-term drainage systems and anti-erosion structures. - reinstatement of relief, soil and vegetation cover - installation of long-term drainage system and permanent monitoring.; - Installation of sedimentation basins, seeding or planting of erodible surfaces as soon as possible - Increase number of drain outlets. - Place drain outlets so as to avoid cascade effect. - Line receiving surface with stones, concrete. - Long-term monitoring and maintenance	Construction stage; Maintenance after completion of construction	Constructing contractor (this requirement is already stated above, in section related to construction phase; Contractor is only liable for results of actions to be implemented during Construction and before hand over). RDMRDI (In long-term perspective, after hand over)	RDMRDI (permanent) Inspectorate of MoE (periodically)
Landscape disfiguration	New cut sites.	- Maintenance and and/or restoration	Construction	Constructing contractor	RDMRDI

by embankments and deep cuts, fills and quarries. Marred landscape (scars from rod cuts, induced landslides and slumps etc.).		of roadside vegetation - Use an architectural design to 'blend with the landscape. - Replant disfigured surfaces.	stage; Maintenance after completion of construction	RDMRDI in long-term perspective	Inspectorate of MoE
Increased suspended sediment in streams affected by erosion at construction sites and fresh road cuts, fills and waste dumps. declined water quality due to increased sedimentation. **Character of impact**: long-term. Change of relief, drainage patterns, land clearance, may cause gradual but stabile intensification of erosion	near the river Mtkvari	**Mitigation strategy:** long-term – remediation; Reinstatement of relief and landscape; Long-term monitoring; Installation of long-term drainage systems and anti-erosion structures. Reinstatement of vegetation cover. Establishment of vegetative cover on erodible surfaces as soon as possible		Constructing contractor RDMRDI in long-term perspective	RDMRDI Inspectorate of MoE
Soil and water contamination by oil, grease, fuel and paint alongside the highway	whole alignment	Install oil traps near bridges; Facilitate installation of standard refuelling stations and repair shops along the highway	after completion of construction	RDMRDI in long-term perspective	RDMRDI
Air pollution from mobile asphalt plants	whole alignment	Install and operate air pollution control equipment.	During Maintenance	RDMRDI supervising works and Maintenance Contractor	RDMRDI

during maintenance works.			Works		
Air pollution from vehicle operation, in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas. Local dust.	whole alignment Most critical starting point near Gulua bridge and end point close to Phonichala;	- Monitoring of air quality and traffic related emissions (including inspection of vehicle emissions) - Development of policy and regulations limiting traffic related emissions (regulations on fuel quality etc.) - Require adherence to engine maintenance schedules and standards (or use alternative fuels) to reduce air pollution. - Plant trees along the roadside to screen and smoothen emission impacts on the close located villages		MoE Constructing contractor RDMRDI in long-term perspective	MoE
Noise pollution from vehicle operation, in populated areas traversed by the highway, notably metropolitan areas or densely settled rural areas.	whole alignment Most critical starting point near Gulua bridge and end point close to Phonichala;	- **Noise Abatement.** In order to mitigate traffic noise impacts it is necessary to limit speed to 80km/hour, construct 4m height sound proof wall for 1.6km section of the road and install double glass windows for the residents of the apartment buildings living along the road. In addition to the double gazing windows conditioners should be installed in affected flats, as in summer time possibility of opening		Maintenance contractor RDMRDI in long-term perspective	MoE

		windows for ventilation will be limited by noise protection needs. Therefore cooling could be achieved by additional installation of air conditioning systems. Costs of double glazed windows and air condition systems is estimated roughly as **1,000,000 USD (1,650,000 GEL).** Installation of 4m height noise barriers along the design road (km 5+200 – 6+800): Construction of aluminium barrier will cost around 2,184,000 GEL (1,323,636 USD) and of polymer – around 2,702,000 Gel (1,637,500 USD). **Total cost of noise abatement measures is around 3,834,000 – 4,352,000 GEL.** - Require adherence to engine maintenance schedules and standards - Plant trees along the roadside to screen and smoothen noise impacts on the close located villages - Enhance public transportation and traffic management capability.			
Roadside litter.	whole alignment	- Provide for disposal facilities. - Encourage anti-littering laws and		Local Government authorities and RDMRDI provide	RDMRDI Inspectorate of

		regulations.		facilities and Regional services of MoE tracks compliance with standards	MoE
Creation of a new pathway for disease vectors affecting humans and animals. Creation of a transmission corridor for diseases, pests, weeds and other undesirable organisms	whole alignment	Establishment of plant ad animal sanitation service and related checkpoints (not locally on the current project but in general, to control the whole highway	Operation period	Customs Services, "Sanitary Supervision Inspection of the MLHSP", and the "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of the Agriculture	RDMRDI
Health hazards by dust raised and blown by vehicles.	whole alignment	Impact is minimal on asphalt paved highway. Dust control by application of water.	Operation period	RDMRDI	RDMRDI
Obstruction of access roads	Crossig of local roads	Proper Design of interchanges have mitigated this potential impact. See in RAP	Design stage	Constructing Contractor	RDMRDI

9.4 Environmental Monitoring Plan (Matrix)

Table 9.5. Construction Phase

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
Material supply	Possession of official approval or valid operating license and permits	Supplier of materials (asphalt, cement and gravel)	Inspection	Before an agreement for the supply of materials is formalized	Assure compliance with HSE requirements	N/a	MDF (occasionally) Supervising Agency (SC) Permanently
Material transport according to the schedule and routes defined for deliveries	Truck loads covered/ wetted Air pollution due to the dust and fumes related to the Material Transport	Construction site and access road	Supervision	Unannounced inspections during work hours	Assure compliance with HSE requirements. Ensure safety, and minimize traffic disruption.	Minimal Included in supervision contracts	MDF (occasionally) Supervising Agency (SC) Permanently
Top-soil stripping stage. Final reinstatement.	Top-soil storage. Reinstatement. Erosion control. Landscape destruction; Visual impacts;	Construction site	Supervision	Periodic (Unannounced inspections during work hours); From top-soil stripping – to completion of the works.	Assure compliance with, construction standards, environmental norms and EMP provisions;	Minimal Included in supervision contracts	MDF (occasionally) Supervising Agency (SC) Permanently

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
Construction work	Noise and vibration levels; Compliance with the noise and vibration standards; Compliance with the recommendations adopted by the additional studies on assessment and prevention of vibration impacts on the structural integrity of buildings. **Admissible thresholds:** Noise – 65dBA Vibration 74 dBV **(Daytime)**	Construction site Near the residential buildings	Inspection; compliance monitoring (engine maintenance, usage of mufflers, night time work limitations and other provisions of EMP.) Monitor noise continuously at a representative residence near construction activities Noise and vibration measuring by device	Periodic (average once per month); Only in case of complaints	Assure compliance with HSE requirements. Good condition of standard construction machinery and limiting the works near settlements to the site-related works is the only way for efficient noise control	Minimal Included in supervision contracts Cost of noise and vibration devices: Vibro-meter 1200 Sound meter 700	MDF (occasionally) Supervising Agency (SC) Permanently MoE SC

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
Construction work	Vibration **Admissible thresholds:** Vibration 74 dBV **(Daytime)**	Construction site Near the residential buildings	Supervision	Unannounced inspections; following complaints	Assure compliance with HSE requirements.	Cost of noise and vibration devices: Vibrometers 1200 (already counted)	Constructing Contractor SC
Construction work	Dust and Air pollution (solid particles, suspended solids, flying heavy metal particles) (dust, CO) Criteria: MAC for dust 0.15mg/m^3 For cement dust – 0.5mg/m^3 And MAC for CO).5 mg/m^3	Near residential buildings	Visually and instrumentally (dust, CO_2)	During material delivery and periodically in dry periods during construction	Assure compliance with HSE requirement, Assure compliance with, environmental norms and EMP provisions.	Minimal Included in supervision contracts Portable device for dust measurement 2500 Portable device for CO_2 measurement 1700	Constructing Contractor MDF (occasionally) Supervising Agency (SC) Permanently

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
Whole construction period.	Traffic safety/ Vehicle/ pedestrian access Visibility/ appropriate signs	Construction site	Observation	Once per week in the evening	Assure compliance	Minimal Included in supervision contracts	Constructing Contractor; MDF (occasionally) Supervising Agency (SC) Permanently
Whole construction period.	Material and waste storage, handling, use Water and soil quality (suspended solids, oils, etc)	Material and waste storage sites; Run off from site; material storage areas; wash down areas	Observation Instrumental measurement of water turbidity upstream and downstream;	During material delivery and periodically during construction (average 1/week), especially during precipitation (rain/ snow/ etc).	Assure pollution abatement; Assure compliance with, construction standards, environmental norms and EMP provisions;	Minimal Included in supervision contracts; Turbidity-meter 2500	Constructing Contractor; MDF (occasionally, visual) Supervising Agency (SC) Perodically, instrumental
Whole construction period.	Waste Management	All construction sites; Camps;	Observation	Once per week	Assure pollution abatement; Assure compliance with, construction	Minimal Included in supervision contracts	Constructing Contractor; MDF

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
					standards, environmental norms and EMP provisions		(occasionally) Supervising Agency (SC) Permanently
Whole construction period.	Equipment maintenance and fuelling Water and soil quality (suspended solids, oils, fuel, etc)	Refueling and equipment maintenance facilities; Run off from site; material storage areas	Observation	During material delivery and periodically during construction (average 1/week), especially during precipitation (rain/ snow/ etc).	Assure pollution abatement	Minimal Included in supervision contracts	Constructing Contractor; MDF SC
Whole construction period.	Impacts on archaeological sites and remnants	All earthwork sites	Observation	Permanent/daily	Assure cultural heritage protection	Minimal	Archaeologist from MoCM Constructing Contractor; SC
Whole construction period.	biological recontamination during earthworks near pest-holes of soil infections (e.g. anthrax);	All earthwork sites	Observation	Permanent/daily	Assure health protection	Minimal Included in supervision contracts	Construction Field officer; MDF (occasionally)

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
							Supervising Agency (SC) Permanently Veterinary Department of the NSFSVPP
Whole construction period.	Protection of infrastructure elements	Crossings of power lines, pipelines;	Observation	During construction activities at the sites of concern	Assure infrastructure protection	Minimal Included in supervision contracts	Constructing Contractor MDF (occasionally) Supervising Agency (SC) Permanently
During Construction period	offset tree planting Program		Observation	During Construction period	Assure offset of damage to flora and landscape	Minimal Included in supervision contracts	Constructing Contractor; MDF (occasionally) Supervising Agency (SC)

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
							Permanently MoE
During Construction period	Reinstatement of work sites	work sites, road alignment, used quarries, camp sites	Observation	During Construction period, after completion of works at concrete site	Reinstatement of work sites not taken by RoW		Constructing Contractor; MDF (occasionally) Supervising Agency (SC) Permanently
During Construction period	Disposal of construction wastes	work sites, road alignment, used quarries, camp sites	Observation	During Construction period, after completion of works at concrete site	Ensure pollution prevention and landscape protection;		Constructing Contractor; MDF (occasionally) Supervising Agency (SC) Permanently

Phase	**What?** (*parameter is to be monitored)*	**Where?** (is *the parameter to be monitored)*	**How?** (is the parameter to be monitored /type of monitoring equipment/?)	**When?** (*is the parameter to be monitored – frequency of measurement or continuously)*	**Why?** *(is the parameter to be monitored (reply is not obligatory))*	**Cost (GEL)**	**Responsible Institution**
Whole construction period.	Personal Protective equipment. HSE issues Organization of traffic by-pass	Construction site	Inspection	Unannounced inspections during works	Assure compliance with HSE requirements	Minimal Included in supervision contracts	Constructing Contractor; MDF (occasionally) Supervising Agency (SC) Permanently

10. PUBLIC CONSULTATION PROCESS

10.1. Conducted Public Consultations and

652. Currently, the process of public consultations is ongoing. One large meeting has been conducted with business representatives (July 18), and the other with the residents of apartment buildings losing their garages (July 12). Meetings in smaller groups (7 – 10 affected households) were conducted during the period of July 7 – July 12. The Survey Team is continuing consultations on individual level with each affected household.

653. The meetings have been held in focus groups (e.g. residents of potentially affected apartment buildings) and one meeting with affected businesses in July 18. The most issues raised up to now were related to resettlement impacts. However, several environmental matters were also addressed. The local residents, as well as representatives of Pharmaceutical Company have expressed their concerns regarding expected increase of emission and noise. The residents also concerned by reduction of greenery. Below we provide only brief abstracts from those protocols, where environmental issues were raised.

Consultations Conducted During July 7 - 18

654. The meeting was attended by:

Keti Dgebuadze – Ltd. "WEG" Expert,

David Baindurashvili, MDF

Revaz Gigilashvili

Otar Nemsadze, MDF

655. The meetings were attended by: the members of affected households, their neighbors and representatives of affected businesses (see attached lists).

656. The presentation was followed by a Q&A session. The questions and comments of different participating parties were replied by the relevant experts of the project: The questions and answers related to environmental concerns are given in Tables provided below.

Table 10.1.

July 8 of 2013; Meeting with Affected Households, Ponichala			
No.	**Question/Comment**	**Author**	**Expert comment**
1.	We live in a quite area with a lot of greenary, close toearth. We do not want to be resettled in apartmets but want similar private house. However, the new road will transform area and increase noise and dust.	Askerova Elmira	Landscaping and noise protection measures, planting of new greenery is planned within the project. Currently pros and cons of noise barriers and double glazing windows are considered. The compensation given for your houses will allow to find a house in similar environment.
6.	How the trees will be compensated?	Aliev Solnmas	Compensation value of fruit trees will be defined according to the cash compensation at market rate on the basis of type, age and productive value of the trees. Planting of greenery is (10000 trees) is planned to compensate reduction of existing greenery.

Fig.10.1 **July 8 of 2013; Meeting with Affected Households, Ponichala**

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1	[illegible]	551198066	
2	[illegible]	595736303	
3	[illegible]	599519513	
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8	[illegible]	595292205	
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Fig 10.2. **July 8 of 2013; Meeting with Affected Households, Signatures**

Table 10.2.

12/07/2013 Meeting with the residents of 5 storey apartment building Km 6+780			
No.	**Question/Comment**	**Author**	**Expert comment**
The residents were strongly opposing the construction of the new road, although the road is located at a distance of more than 18[11]m from the edge of the planned road and no direct impact on the apartment building is envisaged. Affected are only garages. However people have two major claims: (i) traffic will worsen quality of air and noise, and (ii) possible impact on apartment building integrity as they are not in good condition. As the detailed design is still on-going and mitigation measures being developed, the Consultants informed the people about ADB regulations and approaches but no questions/answers session have been conducted. The residents indicated they will raise concerns and send request for clarification to MDF and Mayor's office. MDF informed a consultation meeting will be organized after the first draft detailed design will be available.			

Fig. 10.3. **12/07/2013 Meeting with the residents of 5 storey apartment building Km 6+780**

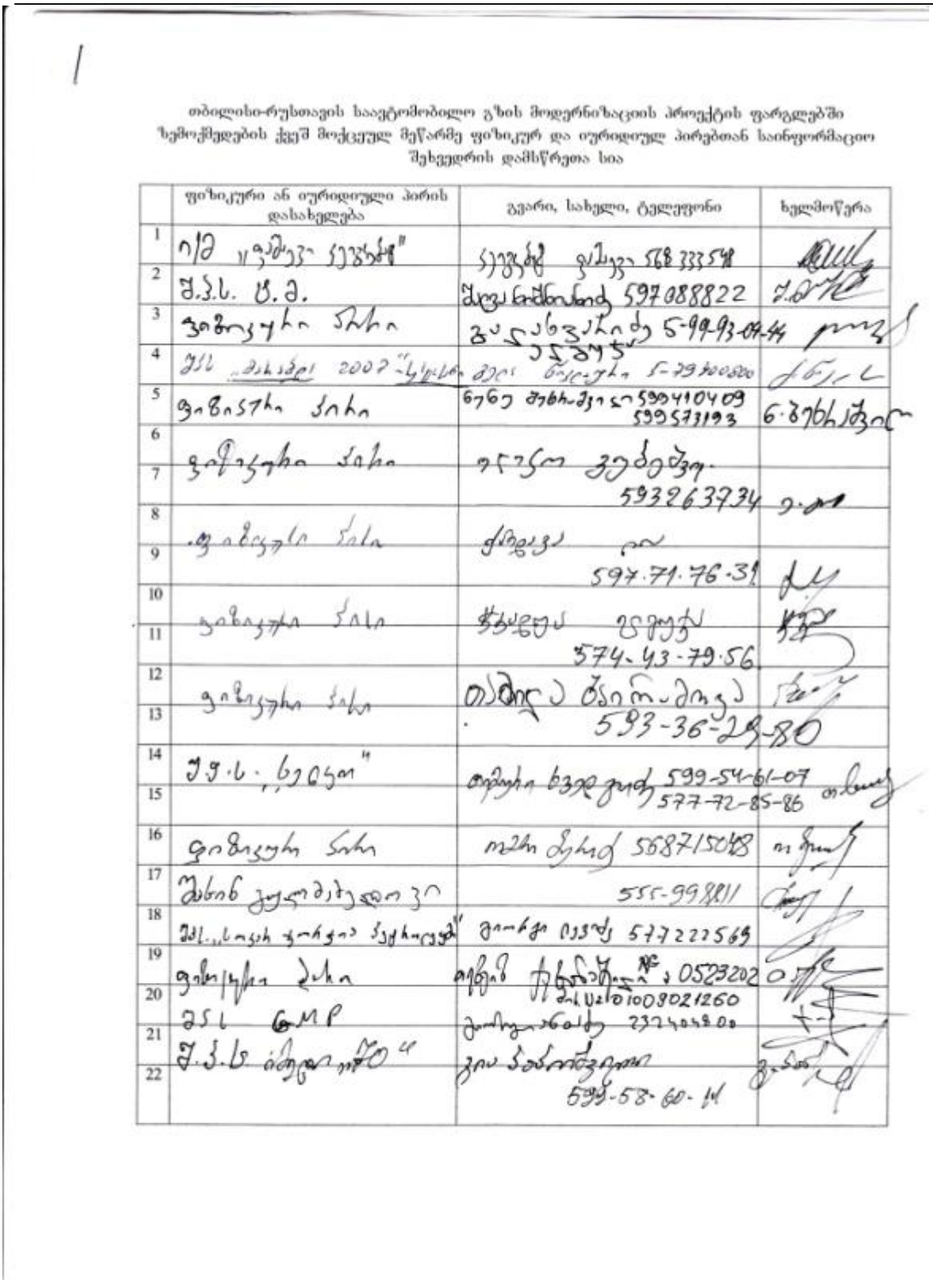
[11] The closest apartment buildings (2 storey building, Km 5+480) will be located at a distance of 14m from the design road.

July 18 of 2013; MDF Office; Meeting With Representatives of Affected Businesses			
No.	**Question/Comment**	**Author**	**Expert comment**
	We have concerns that the air quality and noise will exceed the standards acceptable for technological process related to production of pharmaceuticals.	Representative of pharmaceutical company GMP	The air emission and noise modelling demonstrated no changes within the area of your pharmaceutical plant. The baseline conditions will not be changed. The apartment buildings are within the zone of increased noise impact and here double glazing windows or noise barriers will be applied.
	Our hotel is not affected but the surrounding is changed dramatically and nice green landscape will be destroyed.	Representative of business	Landscaping, planting of 10000 trees is considered as a mitigation measure. Detailed landscaping plan will be elaborated.






Fig.10.4. **July 18 of 2013; MDF Office; Meeting With Representatives of Affected Businesses**



თბილისი-რუსთავის საავტომობილო გზის მოდერნიზაციის პროექტის ფარგლებში
ზემოქმედების ქვეშ მოქცეულ მეწარმე ფიზიკურ და იურიდიულ პირებთან საინფორმაციო
შეხვედრის დამსწრეთა სია

	ფიზიკური ან იურიდიული პირის დასახელება	გვარი, სახელი, ტელეფონი	ხელმოწერა
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Fig. 10.5. **July 18 of 2013; MDF Office; Meeting With Representatives of Affected Businesses *Signatures***

23	[illegible]	[illegible] 593300579	[illegible]
24	[illegible]	[illegible] 599900217	[illegible]
25	[illegible]	[illegible] 599720303	[illegible]
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36	[illegible]	579-44-77-47	[illegible]
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Fig.10.6. **July 18 of 2013; MDF Office; Meeting With Representatives of Affected Businesses** ***Signatures***

657. The 1st public discussion around the draft IEE and Executive Summary have been conducted during the public consultation meeting in MDF premises. The meeting took place on **Saturday August 17.** The advertisement has been announced in mass media. The local residents and interested parties and stakeholders werel informed additionally through the local authorities.

658. The minutes of the meeting are given below .

Public Discussion of Preliminary Environmental Study Report of Modernization Project of Tbilisi-Rustavi Section (2nd Section, Ponitchala) of Tbilisi-Tsiteli Khidi (Red Bridge) Road

Minutes

Municipal Development Fund, Tbilisi

August 17, 2013

659. Public discussion of preliminary environmental study report of modernization project of Tbilisi-Rustavi section (2nd section, Ponitchala) of Tbilisi-Tsiteli Khidi (Red Bridge) road was held in the building of municipal development fund of Georgia on August 17, 2013.

660. The meeting was attended by the below:

1. Irina Asatiani – chairwoman of housing partnership "Madli"
2. Eter Tsintsadze – company "Shtrabavi", representative of the director
3. Anzor Gvishiani – resident of #12 v/g building, Rustavi highway
4. Shorena Machitadze - resident of #12 v/g building, Rustavi highway
5. Aniko Nizharadze – chairwoman of partnership "Sinatle" ("Light")
6. Peride Naskidashvili - resident of #30 building, Rustavi highway
7. Elkhan Bagirov - resident of #28 building, Rustavi highway
8. Ekaterine Jabanashvili - resident of #12 building, Rustavi highway
9. Asmat Naniashvili - resident of #12 v/g building, Rustavi highway
10. Avtandil Gogaladze - resident of #30 building, Rustavi highway
11. Iana Jariashvili - resident of #28 building, Rustavi highway
12. Zurab Dzidzikashvili - resident of #28 building, Rustavi highway
13. Nikoloz Gelashvili - resident of #28a building, Rustavi highway
14. Davit Gelenidze - resident of #28 building, Rustavi highway
15. Vakhtang Abzhandadze - #1 Rustavi highway, owner of land plot
16. T. Kikoleishvili – civil society "Sociology"
17. M. Dekanosidze - #1 Rustavi highway, owner of land plot
18. Paata Tcharakishvili – MDF (municipal development fund), head of department of relationships with international organizations
19. Giga Gvelesiani - MDF (municipal development fund), head of division of relationships with international organizations
20. Revaz Gigilashvili - MDF (municipal development fund), leading specialist of division of relationships with international organizations
21. Alexander Dumbadze - MDF (municipal development fund), head of division of environmental analysis and resettlement
22. Ana Rukhadze - MDF (municipal development fund), leading specialist of division of environmental analysis and resettlement
23. Lela Shatirishvili - MDF (municipal development fund), consultant

24. Medgar Tchelidze – DOHVA, environmental specialist

661. The meeting was opened by the head of department of relationships with international organizations of the municipal development fund – P. Tcharakashvili. He provided brief information on the project to the attendees and spoke of the goals of the meeting. He explained that preliminary environmental assessment of the project will be undertaken at the meeting, while the environmental impact report of the project will be prepared and its public discussion set additionally.

662. Medgar Tchelidze introduced the results of the preliminary environmental assessment, mentioned issues important in environmental terms of the project and mitigation measures.

663. After informing the attendees about the project and environmental measures within the project generally the discussion was started. The attendees asked questions, made comments and expressed opinion to the representatives of MDF and environmental consultant.

664. Mainly the questions and comments were related to possible impact of the road on buildings adjacent to the road during construction and functioning. According to the meeting participants, buildings 12 v/g, 8, 19, 12 and 28a of Rustavi highway are under poor structural condition, building 28 is amortized, and reinforcement of building 28a was already conducted during soviet period. The representatives of residents of all of the mentioned apartment buildings were attending the public consultation meeting. The representatives have delivered following opinion of the residents: population thinks that road construction (intensive movement of heavy vehicles, pile-driving, ground compacting operations and presumably – blasting operations) and further exploitation of road (intensive traffic, heavy trailers) will result in significant deterioration of the situation. Hence, the delegates of population enquired on whether road alignment could significantly changed to avoid passing by these apartment buildings, or whether inhabitant of these apartments might be resettled in new apartment buildings.

665. Regarding the above M. Tchelidze explained that MDF is launching special studies to assess the risks of damaging the apartment buildings during construction or as a result of traffic. He asked the population to submit any document describing existing damages or proving the risk of accident to MDF, as this is important additional information helpful for complex analysis. The planned complex studies will comprise visual inspection and inventory of cracks and damages, as well as instrumental measurements and modeling of risks associated with the construction activities and traffic. Based on the finding of the surveys, design and construction methods will be refined, reinforcement of the building might also be necessary. Close monitoring will be performed during construction. This will be further documented in an addendum to the IEE. Other options or mitigations measures might be envisaged. No construction work will start before these further surveys and studies have been conducted.

666. Besides this main issue, which took major part of discussions, the attendees of the meeting also asked the below questions and made the below comments:

What is the distance between the road in Ponitchala and buildings 12 v/g, 28 and 28a?	M. Tchelidze introduced the project road scheme and provided information on the distance between the residential buildings and the road along with planned green zone landscaping between the residences and the road
Will the garages be dismantled due to road construction?	Some of the garages will be dismantled. Respective compensations will be paid. You can have a look on the maps to clarify this matter. However, all the households that are losing garages should be already informed by the survey team.
Road construction and functioning will result in	The attendees were explained that speed limit will

significant increase in noise and dust. In addition, some of the buildings on Rustavi highway will become located between highways also resulting in significant increase in noise and dust	be introduced on the new road, transit traffic prohibited, the area wetted to reduce dust during construction and special protective "curtains" facilitated. Sound damping barrier will be constructed for noise reduction along with installation of double glass metal-plastic windows and conditioners in the buildings directly adjacent to the road
The price of the residences will significantly decrease due to road modernization	The attendees were explained that the construction of road of urban boulevard type as stipulated by the project will result in improvement of the area, planting of trees, facilitation of resting places and access to r. Kura for people interested in fishing, the buildings in direct vicinity will be provided with metal-plastic windows and conditioners, which will not reduce, but increase the attractiveness of the residential area and thus the market price of the real estate should increase
Is blasting planned along the project road?	Blasting activities are not planned
For reduction of impact on buildings 28 and 28a the road should continue along r. Kura embankment and turn right at the institute of soils	Several alternatives of the highway were discussed for the project. The selected variant was considered as best in engineering and resettlement terms. Due to complex terrain and engineering-geological conditions road route in the indicated direction is technically not feasible

667. The participants of the meeting regarded speed limit to 80km/hour as insufficient mitigation measure. It was mentioned that at lower speed limit might be considered. It was mentioned that on the existing road (not classified as an highway) the limit is are not followed and the traffic moves very speedily almost incessantly throughout the day and night. It was presumed that noise and dust mitigation measures would not be provided sufficiently throughout the construction.

668. The attendees were explained that all mitigation measures as identified by the project as well as speed limit will be strictly followed during both construction and exploitation and the government takes responsibility to install appropriate signs and impose fines in case of violations according to law. In addition to enforcement of speed limit, safety (for pedestrian) is addressed in the design (refuge, speed breakers, street furniture, signage).

669. At the end of the meeting MDF representative P. Tcharakashvili summarized proposals and comments made during the meeting. The participants were asked to appeal to MDF regarding the buildings with risk of accidents in written form. In addition, they should as far as possible present documents proving the risk of accidents, on the basis of which the stability of the building should be studied and reinforcement or resettlement decision made.

670. Signees:

Fig.10.7. **Municipal Development Fund, Tbilisi, August 17, 2013**

თბილისი-წითელი ხიდი (აზერბაიჯანის საზღვარი) საავტომობილო გზის თბილისი-რუსთავის მონაკვეთის (მე-2 სექცია) მოდერნიზაციის პროექტის წინასწარი გარემოსდაცვითი შესწავლის ანგარიშის საჯარო განხილვა

2013 წლის 17 აგვისტო

მონაწილეთა სია

	სახელი გვარი	თანამდებობა და საკონტაქტო ინფორმაცია
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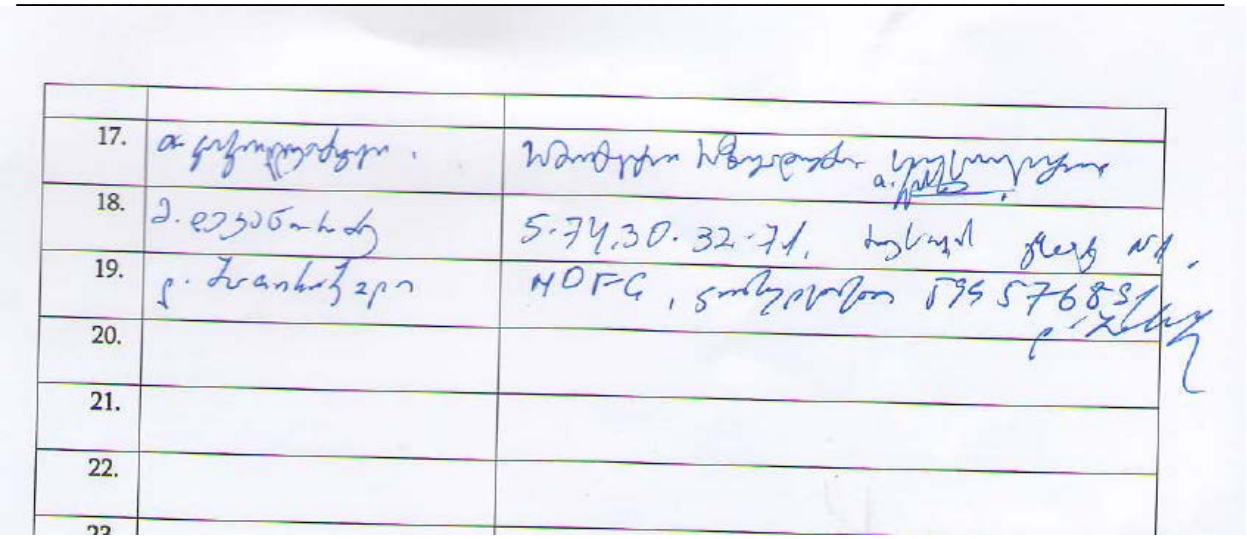

***Fig. 10.8* . Municipal Development Fund, Tbilisi, August 17, 2013; Signatures**

10.2 Planned Public Consultations

671. The main part of public consultations will take place during Augist – October 2013.

The Georgian version of Executive Summary and text of this draft IEE will be disclosed by means of MDF web-resources.

672.Goergian version of the full IEE will be submitted to MoE presumably within the first week of September 2013. This document will be disclosed according to the requirements of Georgial legislation and **the 2nd public consultation meeting** will be planned for the end of **October 2013 (50 days later after disclosure of the Georgian version of IEE)**.

673. Comments on IEE will be collected by MDF and responded with the help of Consultants. The comments and responses will be reflected in the final IEE/EIA and appropriate changes will be introduced, if required.

11. GRIEVANCE REDRESS MECHANISM

674. During implementation of the Project, there might be several issues related to environmental hazards and disputes on entitlement processes may occur due to the Project activities. For example, intensive schedule of construction activities; inappropriate timing of construction vehicle flow; waste; noise and air pollution from construction activities; ecological disturbances; cultural conflicts between migrant workers, are some of the environmental issues that are likely to arise from the Project activities.

675. According to the existing legal and administrative system in Georgia, there are several entities responsible for addressing environmental complaints of population and interested parties. The administrative bodies directly responsible for environmental protection within the project area are MoEPNR, rayonal (Gardabani) municipal offices (gamgeoba) and Tbilisi City Hall. The affected population and stakeholders may send their grievances, related to the project-induced environmental impacts directly to the mentioned administrative bodies responsible for environmental protection.

676. MDF, as EA will deliver grievances to relevant authorities, in case if such grievances are sent to MDF. Agency for Tourism Development has no any regulatory role and capacity for reviewing grievances and no enforcement mechanisms are in place to improve impacts on tourism. Local municipality is the body to be addressed by tourists or persons having any grievance related to tourism.

677. The official administrative bodies are obliged to respond to the grievances that have been received from population or other interested parties in accordance with the requirements of the Administrative Code of Georgia. However, the described system is not flexible and convenient for affected persons and does not provide efficient pre-litigation mechanisms for grievance resolution.

678. In accordance with the ADB SPS 2009 requirements, a Grievance Redress mechanism will be set up for the Project to deal with both the environmental and social issues of the Project. MDF as the Executive Agency (EA) has overall responsibility for project implementation and environmental compliance. MDF as the EA will facilitate the grievance resolution by implementing a project-specific Grievance Redress Process (GRP). Besides that, the requirements of the new accountability policy related to grievances of the adversely affected people should be implemented. Accountability is a mechanism adopted by ADB in 2012, a whereby people adversely affected by ADB-financed projects can express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies. The accountability mechanism replaced ADB's Inspection Function (1995). ADB's accountability mechanism comprises two separate, but related, functions: (i) consultation, led by ADB's special project facilitator, to assist people adversely affected by ADB-assisted projects in finding solutions to their problems; and (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel.

679. MDF will facilitate the establishment of a Grievance Redress Committee (GRC) and Grievance Focal Points (GFPs) prior to the CW Contractor's mobilization to the construction site. The functions of the GRC and GFPs are to address concerns and grievances of the local communities and affected parties as necessary.

680. The GRC will comprise representatives from local authorities, affected parties, and other reputed NGOs or persons, as mutually agreed with the local authorities and affected persons. It will also comprise the Contractor's Environmental Specialist, Supervising Company's (SC) Environmental Specialist and EA Safeguards/Environmental specialist. The role of the GRC is to address the Project related grievances of the affected parties that are unable to be resolved satisfactorily through the initial stages of the Grievance Redress Mechanism (GRM).

681. EA will assist residents of affected territories (Tbilis munici[ality and Gardabani municipality) and affected community to identify local representatives to act as Grievance Focal Points (GFP).

682. GFPs are designated personnel from within the community who will be responsible for:

i) acting as community representatives in formal meetings between the project team (contractor, SC, EA) and the local community he/she represents
ii) communicating community members' grievances and concerns to the contractor during project implementation.

683. The sufficient number of GFPs for the Rustavi-Tbilisi project is – 4-5 persons.

684. A pre-mobilization public consultation meeting will be convened by the EA Environmental Specialist and attended by GFPs, contractor, SC, EA representative and other interested parties (eg. local NGOs). The objectives of the meeting will be as follows:

(i) Introduction of key personnel of each stakeholder including roles and responsibilities,
(ii) Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.) This will include a brief summary of the EMP - its purpose and implementation arrangements;
(iii) Establishment and clarification of the GRM to be implemented during project implementation including routine (proactive) public relations activities proposed by the project team (contractor, SC, EA) to ensure communities are continually advised of project progress and associated constraints throughout project implementation;
(iv) Identification of members of the Grievance Redress Committee (GRC)

685. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below and shown on Figure10.1

(i) affected persons will lodge their environmental complaint/grievance with their respective community's nominated GFP.
(ii) The GFP will deliver the individual's complaint to the Contractor and SC's Environmental Specialist .
(iii) The Contractor and SC will record the complaint in the Environmental Complaints Register (ECR) in the presence of the GFP.
(iv) The GFP will discuss the complaint with the Contractor and SC's Environmental Specialist and try to resolve it;
(v) If the Complaint is not resolved within 2 weeks the GFP will present the complaint to the Grievance Redress Committee (GRC). GRC will notify ADB resident Office in Tbilisi about received complaints and will send a copy of written grievance or summary/minnutes of oral communication to ADB. In case of need (e.g. gross contamination; damage of archaeological remnants) the GRC will inform and involve Ministry of Environmental Protection and/or Ministry of Culture and Monuments Protection
(vi) The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the affected individual or community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.

(vii) Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.

(viii) In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

(ix) EA will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the SC and will ensure that they are resolved in a timely manner.

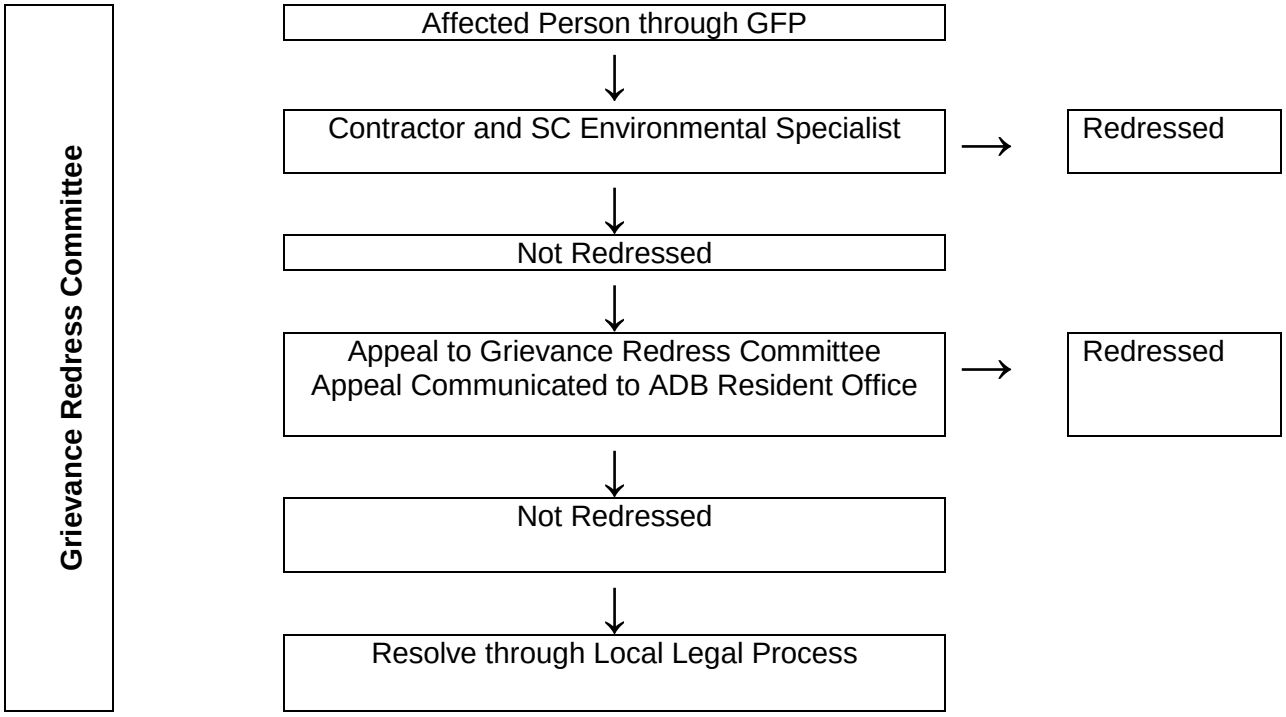

Fig. 11.1 Grievance Redress Mechanism

12. CONCLUSIONS AND RECOMMENDATIONS

686. The present IEE reveals that there will be minor negative and tangible positive impacts due to the construction activities and normal operations of the road section. Recommendations are made to mitigate expected negative environmental impacts. The IEE and included EMP cover all environmental aspects of the Project road. The resettlement aspects are addressed separately in LARP.

687. The major positive outcomes of the Project will be safe driving conditions for transit motor transport flows and local residents, especially for the Phonichala-Rustavi section, and higher carrying capacity of the road. After the further sections of the road are designed and constructed, the capital of Georgia will be linked to Azerbaijan and its capital Baku through the modern road meeting the international standards. This road will be used to comfortably transport the cargo and passengers to Tbilisi and Black Sea ports. The design road is also very much important for the social-economic development of the population of Kvemo Kartli region, particularly for the population and industries in the city of Rustavi and Gardabani region. Many of 120000 residents of Rustavi work or study in Tbilisi.

688. In short term perspective, the project will also have some benefit for local population, providing job opportunities (about 100 new jobs could be available for local residents). The negative impact related to the construction nuisance (dust, emissions, noise) is temporary, insignificant and manageable by application good construction practices.

689. At this stage, it can be summarized, that this project will affect as minimum 164 households: 131 AHs are affected directly and 33 are the employees losing their jobs. Project impact is related to permanent take of 132 private land plots with total area of 98580 sqm. Out of this amount 30 are legalizable and 102 with full registration. No crops are cultivated on the affected commercial land plots. Acquisition of only 5 land plots is associated with losses of 54 productive trees. The main impact is related to the loss of structures and businesses. In total 4 major structures and some ancillary facilities will be destroyed, including 1 car washing station, 3 petrol filling stations. 6 legal entities will suffer in terms of business impacts: permanent loss of business facilities According to the ADB SPS 2009 this sub-project is thus classified as of category A and needs the preparation of a Land Acquisition and Resettlement Plan (LARP).

690. The Land Acquisition and Resettlement Plan (LARP) will provide detailed census of affected households, inventory of loses, description of social status and identification of vulnerable groups. Compensation and rehabilitation plan will be elaborated upon completion of valuation of the lost assets. All the affected households will be provided with the adequate compensation according to the Georgian legislation and ADB SPS 2009 requirements. Vulnerable and severely affected households will be provided with the additional allowances.

691. The major environmental issues to be considered during the project implementation are listed below:

- Disposal of asbestos containing roofing plates (special project and EIA should be prepared by MDF or by Contractor (depending on contract details).
- Prevention of spillage related pollution during dismantling, transportation and storage of gas filling station equipment (4 gas filling stations)
- Tree planting and landscaping plan should be developed and implemented
- Noise barriers of 1.5km length and 6.5m height should be installed

692. No sensitive ecological habitats are represented in the project area. However, around 4000 trees will be felled. Additional ecological studies are required prior to start-up of the construction operations,

immediately after the demarcation of the construction corridor. The cadastral description of trees to be felled should be conducted within the demarcated corridor, all efforts should be made to avoid any individual tree of red data specie, the trees to be cut down should be marked. As minimum 10000 trees should be planted under the landscaping and greenery plantation program.

693. The waste and hazardous material handling, dust and emission control, traffic management, health and safety procedures and other common construction related activities should be managed according to good international construction practices.

694. All the work sites (except permanently occupied by the road and supporting facilities) should be reinstated to its initial conditions (relief, topsoil, vegetation cover).

695. The contractor will prepare a spoil and waste disposal plan in consultation with MoE and local municipalities and submit to MDF for approval. Filling materials will be provided from licensed Quarries and borrow pits.

696. Compliance to the environmental management plan during various phases will minimize the negative impacts of the Project to acceptable levels. To ensure that these plans and mitigation measures are implemented and negative impacts avoided, the EMP will be included in the contract documents of the Project with a separate line item on environmental management in the bills-of-quantities.

697. Environmental Consultants of Construction Supervision Consultants are responsible for monitoring of implementation of EMP and ensure compliance. Environmental Division of MDF is also responsible for supervision of construction works and compliance to EMP in coordination with supervision consultants and hiring of external/independent monitoring consultants.

698. The Project will have overall beneficial impact as well as some minor negative impacts that will be carefully monitored and adequately mitigated. Therefore, the completion of this IEE fully meets the MoE and ADB requirements and submitted to MoE to obtain EIP.