Initial Environmental Examination

December 2014

GEO: Sustainable Urban Transport Investment Program – Tranche 1

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APPENDIX 17.

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DESIGN OF THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION

INDEX

LIST OF ACRONYMS

ADB	Asian Development Bank
EA	Executing agency
EARF	Environment Assessment and Review Framework
ECR	Environmental Complaints Register
EIA	Environmental Impact Assessment
EM	Environmental manager
EMP	Environmental management plan
EU	European Union
FI	Financial Intermediary
GDP	Gross Domestic Product
GFC	Grievance Focal Points
GRC	Grievance Redress Committee
GRP	Grievance Redress Process
HSE	Health, Safety and Environment
IEE	Initial environmental examination
MAC	Maximum Allowed Concentrations
MDF	Municipal Development Fund of Georgia
MESD	Ministry of Economic and Sustainable Development
MOE	Ministry of Environment and Natural Resources Protection
MOEP	Ministry of Environment and Natural Resources Protection
MRDI	Ministry of Regional Development and infrastructure of Georgia
NEA	National Environmental Agency
REA	Rapid Environmental Assessment
TOR	Terms of Reference
SC	Supervisor Company
SEMP	Site-Specific Environmental Management Plan
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

1. In Georgia, the development of a sustainable urban transport network is a key component for the development of urban areas and to enhance the role of Tbilisi as an important business center in the South Caucasus region. Tbilisi is the capital of Georgia with a population of 1.1 million inhabitants.

2. Tbilisi Metro opened in 1966 and is now composed of 2 lines totalizing 27 km of double-track and 22 stations.

3. The construction of the Metro Extension from Delisi station to University started in 1985 and was interrupted in 1993. Then the construction was resumed in 1998 and in 2000 Vazha Pshavela Station was opened and operated on single track using one of the twin tunnel tubes between Delisi and Vazha Pshavela. Tunnels between Vazha Pshavela and University stations have been bored up with access shaft and ticket room but the final civil works are not finalized.

Objectives

4. The IEE has been prepared to ensure that the Project is environmentally sustainable as well as in compliance with the safeguard requirements of the ADB (Safeguard Policy Statement, 2009, Appendix 1 ”Safeguard Requirements 1: Environment”) and Government of Georgia (The Law on Environmental Impact Permits, 2008).

5. The IEE covers the general environmental profile of the Project area including physical, ecological, environmental, social, cultural and economic resources. 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 sustainable.

Scope of Report

6. This IEE presents the following:

- Executive summary
- Introduction and background;
- Legal and administrative framework;
- Project Description
- Description of the Environment (Baseline Data)
- Analysis of alternatives
- Anticipated Environmental Impacts and Mitigation Measures
- Information disclosure and participation

- Grievance Redress Mechanism
- Environmental management plan;
- Conclusions and recommendations

Government Policies and Legislation

7. Chapter 2 presents detail description of the environmental legal framework and administrative structure in Georgia including environmental regulations, and indicates the institutions at the local and national levels responsible for issuing permits, licenses, and enforcing compliance with environmental standards.

8. According to the Law of Georgia on Environmental Impact Permits (2008), the metro construction in general is subject to EIA and Environmental Permit (Chapter II, Article 4, Paragraph 1, point "n"), but at the same time particular activities to be financed under the proposed Project (such as building development within urban area, underground pedestrians passages, installation of railway superstructure, installation of metro systems, station interior finishing) are not subject to the state Ecological Examination (EE) and Environmental Permitting process (EP). Georgian legislation does not consider screening procedures to define project category and scoping procedure to determine EIA extent. Simply the project is considered as subject to EIA, EE procedure and Environmental Permit if the activities planned or considered by the project are listed in the Law on Environmental Permits (Chapter II, Article 4, Paragraph 1).

9. However, the Construction Permit procedure, according to the Government Decree decree #57, 24 March, 2009, considers approval of an environmental component that may contain environmental management planning for the construction and operation period, including waste management, pollution prevention, etc. Prior to commencement of activity, the contractor is required to prepare a site plan with detailed information on the location of staging and parking areas; arrangements for water supply, sanitation, vehicle and machinery servicing; storage of construction materials and waste; final disposal of waste; etc. During the whole process of implementing the works the contractor will be responsible for ensuring compliance of the works with environmental management and monitoring plans through application of internal environmental supervision and quality control systems.

10. ADB uses a classification system to reflect the significance of a project's potential environmental impacts and determine the approach to environmental assessment. 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:

(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 (EIA) is required.

(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 for category A projects. An initial environmental examination (IEE) is required.

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

(iv) Category FI. A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Intermediary (FI).

11. Based on categorization procedure undertaken by the ADB, and the Rapid Environmental Assessment (REA) screening checklist, the extension of the Tbilisi metro line 2 and creation of University Station project has been classified as Category B, requiring Initial Environmental Assessment (IEE). This IEE has been prepared in accordance with the ADB Safeguard Policy Statement (ADB, June 2009), Appendix 1 ”Safeguard Requirements 1: Environment”.

12. ADB will require borrowers/clients to submit to ADB the final IEE for disclosure and to engage with communities, groups, or people affected by proposed projects, and with civil society through information disclosure, consultation, and informed participation in a manner commensurate with the risks to and impacts on affected communities.

Project description

13. The project can be divided into two main assignments:

- The 2,6 km long Metro extension from Delisi Station to University Station
- Creation of University Station and a 301 m long tunnel section for cross over and parking tracks.

14. The 2,6 km-long Metro Extension, from Delisi Station to University Station, consists of the following:

- Delisi Station (total length 131 m, P.K. 56+00)
- Scissor crossing and parking tracks after the platform (total length 285 m)
- 760 m-long twin tunnels between Delisi and Vazha Pshavela stations.
- Vazha Pshavela Station (total length 205m, P.K. 68+00).
- 760 m-long twin tunnels between Vazha Pshavela and University stations, including ventilation Shaft n.50, the by-pass galleries from the shaft to the main tunnels and a pump sump.

- University Station (total length 162m, P.K. 78+20), with the sub-station and other technical rooms.
- In the University station, it will be designed a 110 meter platform with an access by a hall located at the intersection of Vazha Fshavela Avenue and Sandro Euli Street.
- This hall is located at elevation 535 and the platforms at 487, so that descend 53 meters.
- 315 m-long section after University Station consisting of a crossover Tg 0,11, parking tracks, a service gallery connecting the station and the crossover, the ventilation Shaft n.51 and a pump sump.

15. Delisi and Vazha Pshavela are shallow stations, built as cut-and-cover structures, while University Station is a deep mined station (about 50 m from the surface). The tunnels between Delisi and Vazha Pshavela were constructed in cut-andcover, while the tunnels between Vazha Pshavela and University are mined.

16. Delisi and Vazha Pshavela stations are finished and in operation. The line between the two stations is operated on one track, since the second tunnel has been constructed but not equipped.

17. Tunnels between Vazha Pshavela and University stations are constructed but the civil works are not finalized (watertight injections and internal finishes). The main cavern of the University Station has been constructed, together with the inclined tunnel for the moving staircase. The atrium at the surface has a single underground level, the excavation is an open-cut and the structures are partially constructed.

18. After University Station the line ends with a crossover – which is partially excavated parking tracks, chambers for pumping stations and equipment.

19. In addition to Civil Works, the following systems must be installed:

- Permanent way,
- Power supply substation,
- Electromechanical equipment (tunnel ventilation, water-pump, escalators),
- Signalling system,
- Low voltages equipment: communication, SCADA, fare collection.

Baseline environment

20. This section describes relevant physical, biological and socioeconomic conditions within the study area. Baseline data collection for the project includes a combination of desk studies and site visits. The following environmental components were focused at this study:

- Air Environment (climate, ambient air quality and noise levels)
- Land Environment (topography, geology, hydrogeology…)
- Ecological Environment (flora, fauna and protected areas)
- Socio-Economic Environment (demographic profile, occupational structure, Educational status, economic development, labor market, etc.)

21. Tbilisi is located in the South Caucasus at 41° 43' North and 44° 47' East Longitude. The city is situated in East Georgia on both banks of the Mt'k'vari River. The elevation of the city ranges from 380-770 meters above sea level and possesses the shape of an amphitheatre surrounded by mountains on three sides. The climate of Tbilisi is transitory from moderate continental to a moderate humid subtropical. The city's climate is influenced both by dry (Central Asian/Siberian) air masses from the east and humid subtropical (Atlantic/Black Sea) air masses from the west. Tbilisi experiences relatively cold winters and hot summers. The proximity to large bodies of water (Black and Caspian Seas) and the fact that the Greater Caucasus Mountain Range blocks the intrusion of cold air masses from North, determines that Tbilisi has a relatively mild micro-climate compared to other cities along the same latitudes.

22. Tbilisi and its surrounding territory represents mountainous region jagged with ravines in the middle of river Mtkvari flow. Basic orographic lines of relief are connected to north-east endings of Trialeti ridge, representing significant ring of Small Caucasus mountain system chain. In this mountainous region Tbilisi is located in deep cavity which is elongated from North to South. River Mtkvari divides Tbilisi in two asymmetrical parts.

23. From a geological point of view the investigation site belongs to Delisi depression of west edge of Tbilisi cavity. The studied site is structured by 6.8-20.7m thick Quaternary clays and lean clays and upper Eocene argillites and sandstones with various weatehring. The studied Delisi depression axis coincides with Saburtalo syncline axis.

24. At the studied site porous circular waters are observed in Quaternary deposits; as seen from Lugeon tests results water permeability of construction site bedrocks is low, filtration properties of bedrocks are low too.

25. There are no surface water resources at the territories adjacent to the Project site. Distance from the Project site to the river Mtkvari is about 4 km, the distance to the small r. Vere (r. Mtkvari right tributary) is about 2 km.

26. Concerning ambient air quality, the following conclusions can be made based on the available information at the observation point closest to the area project (Agmashenebeli Avenue which is located in the central part of Tbilisi, and where the traffic is quite intense):

- Concentrations of CO, SO_2, NO_2 and particulate matter in the air exceeded the national standards for the period 2004-2013. Concentrations of CO decreased in years 2011 and 2012, to values that were lower than the national standard.
- Concentrations of lead have decreased here since 2008, and are now slightly lower than the national standard.
- Measurements of ground level ozone started in 2010 only on Agmashenebeli Avenue and, according to the NEA data, the concentration of this pollutant is within the MAC.

27. Road traffic is the basic source of noise in Georgia. On the basis of measurements, it has been determined that, on the main streets and highways in Tbilisi, as Vazha-Pshavela Ave., noise exceeds the permissible limits during rush hours

28. Tbilisi is situated in the central floristic region of Transcaucasia. The flora of its surroundings includes 1.643 species belonging to 623 geni and 107 families. According to a number of the dominant families and geni, the flora of Tbilisi surroundings is similar to Eastern Mediterranean, Southwest Asian and Transcaucasian flora.

29. Tbilisi environs are featured by phitocenological diversity. The species prevailing among wood vegetation are: *Pinus* sp., *Quercus* sp., and *Fagus* sp., *Carpinus* sp. Also among the wood vegetation there are found *Acer campestre*, *Populus* sp., and others. However, ecological values in the project area are very low due to the urban nature of the environment. Flora in the project area includes some typical urban tree and shrub species: *Pinus* sp., *Larix* sp., *Aesculus* sp., *Platanus orientalis*, *Fraxinus excelsior, Populus* sp….

30. Fauna values in the project area is limited to domestic animals, several species of birds adapted to the urban environment and vermin such as rats and mice, and a wintering colony of up to 500 indivuals of Greater Horseshoe Bat (*Rhinolophus ferrumequinum*). This specie is included in the IUCN Red List (Version 3.1 UICN 2001, Latest Version) under the status "Least Concern" and it is not included in the Red List of Georgia. It can be then concluded that fauna values in the project area are very low, as it corresponds to an urban area.

31. There are no protected areas in or in the vicinity of the project area.

32. Construction industry, transport and telecommunications compose the economic foundation of Tbilisi. Much more than half of the products produced in Tbilisi come on these fields. Only few of industrial or business enterprises are located in the project area: National Center of High Technologies - Institute of Isotopes, MAGTICOM – cellular phone operator, Market of Construction Materials, Zonal Experimental Scientific Design Institute TBILZNIEP

33. There is well developed infrastructure in the Project area that includes water supply, power supply, gas supply, communication cables (telephone, internet, cable TV). Most significant of utilities - "Georgian Water and Power" (GWP) delivers 21 m^3/sec. of drinking water to Tbilisi and its neighborhood. Tbilisi water supply system uses both – groundwater and surface water resources. The intake of underground waters takes place in Aragvi Gorge (about 40 km from Tbilisi), and surface water intake is carried out from Tbilisi Sea. The residential districts adjacent to the construction site are supplied with drinking water with 300 and 600-mm-diameter steel pipes. The system pressure reaches 6 atmospheres. The system is amortized and needs replacement. At present, there are no visible leakages on the study territory.

34. Tbilisi storm water drainage system components with the diameter of 150- 1200 mm are built with brick, arch, concrete, reinforced concrete, ceramic, cast iron, asbestos cement and polyethylene pipes. The drainage system is self-flowing. The total length of the network system is 1600 km. The length of the main trunk wastewater sewer is 72 km. The waste water flows through the sewer to Gardabani Treatment Plant. There are 42 separating chambers on the main sewer. The capacity of Gardabani Treatment Plant is 1, 0 million cubic meters/day.

The water-drainage system is amortized, but is in the working condition, mainly consisting of 800-mm-diameter cast iron pipes.

35. Tbilisi transportation network includes metro, buses and microbuses. The construction site is crossed by the routes of 9 buses and 9 fixed-run microbus-taxis. Most of the buses and microbuses run on diesel fuel and as usual are not in a good technical condition, so the pollution from emissions exceeds the maximum permissible concentration. After the metro station is put into operation, presumably the emissions of harmful substances into the atmosphere by the public transport will be reduced.

36. Tbilisi Metro is a rapid transit system in Tbilisi, it was opened in 1966. Presently the system consists of two lines, 22 stations on 26.4 kilometers of track. 20 stations are below ground and two are at surface level. Of the subterranean stations 16 are deep level and 4 shallow. The Tbilisi transport infrastructure is extremely functional and widely used, despite the fact that it has some deficiencies. The annual number of municipal transport passengers in Tbilisi amounts to 149,9 million/year (Buses + underground). This amounts to, on average, around 410.700 per day. In 2008, the number of passengers transported by metro and buses was almost equal (respectively 51% and 49%). During the last 2 years, the role of buses has increased significantly (from e.g. 36% in 2007 to 43% in 2011).

37. Tbilisi is currently home to 1.175,2 thousand residents (2014), 26% of the total Georgian population of 4.490,15 thousand persons. Tbilisi communities have always been multi-ethnic. The Kurds, Armenians, Jewish, Azeri, Russians, Greek and others have been living side by side with the Georgians. However, in the past two decades, the city has undergone a strong “Georgianization”, due to massive emigration that occurred in the 1990s after the breakup of the Soviet Union

38. The percentage of active population in Tbilisi fluctuates between 52% and 56%. Tbilisi employs 21% of the Georgian labor force; however 45% of unemployed people, registered in the country, reside in Tbilisi.

39. The biggest employers are transport and communications companies (16%), industry (19%), and retail trade (20%). These, along with the educational and heath care section (12%) and the construction sector (10%).

Anticipated environmental impacts

40. The IEE study has identified that the implementation of the project will generate both positive and negative environmental and social impacts.

Expected benefits and positive impacts:

41. The project will result in significant positive impacts. Some of these are non-tangible parameters such as social-economic benefits resulting from safer transport, reductions in travel time, and better accessibility. The main positive impacts that have been identified are:

- Employment opportunities

- Traffic congestion reduction
- Reduced travel times
- Benefits to economic activities
- Quick and safer public transport
- Fuel consumption reduction
- Carbon dioxide reduction and air quality improvement

Expected negatif impacts:

42. The identified potential negative impacts include:

- **Air pollution:** the operation of heavy machinery, vehicles and other construction equipment result in dust generation and fugitive emissions of carbon monoxide, NOx, SO_2, hydrocarbons, and particulate matter.

- **Noise and vibration:** Temporary disturbance of local population is expected during the construction phase: the construction works will likely cause significant noise which can disturb communities around the project area. The activities inside the tunnel, at the depth of 20 to 50 meters, will be unlikely to generate any noise or vibration that can be perceived by people above the ground.

- **Soil and water pollution.** As the Project will involve only very limited tunneling/drilling works, the main potential impact to these elements is that the underlying groundwater and soils may be affected during the construction phase (from both underground and above-ground works) due to poor control of concrete wash waters, leakage of fuel from construction vehicles/equipment, oil spillages during refueling...

- **Impacts on flora:** It will be necessary to cut and uproot 21 trees planted in the different areas around the project area. Although these trees are not considered to have biodiversity value, they have value in terms of landscaping, shade and visual amenity.

- **Impacts on fauna**: Some temporary disturbance to a range of common urban fauna species (mostly birds) will occur, but the impacts are unlikely to be significant. The habitats that might be affected by dust and emissions from construction machinery/vehicles are largely common and widespread including those typical in urban locations, such as street trees and the parkland/green recreation area in the middle of Vaja Pshavela, which is more important for its social value than for nature conservation.

- **Construction waste management.** Construction works are expected to generate wastes: garbage, recyclable waste, food waste, and construction and demolition debris. In addition small quantities of hazardous waste will also be generated mainly

from the vehicle maintenance activities. The most significant solid waste from this project will be construction and demolition debris followed by spoil from excavation.

- **Building stability**: As there is not a significant amount of earthworks required by the Project, because the main tunneling, cut and cover, and mining works were completed in the 80's, vibration from construction activities will not affect existing buildings near the project area.

- **Damage to community facilities:** Transport of materials, operation of construction equipment and various construction activities may damage community utilities.

- Construction activities may cause **traffic congestion** along access roads due to transport of materials and operation of other project-related vehicles.

- Potential damage of **archaeological remains** during the construction works

Mitigation measures

43. The identified potential negative impacts are likely to be able to be minimized and managed effectively with the implementation of the measures detailed below:

Air quality

- Water spraying inside and around the construction sites as well as for transport vehicle wheels will be done regularly.
- Materials transported to site will be covered/ wetted down to reduce dust.
- Use only vehicles and equipment that are registered and have necessary permits. All vehicles will be checked and repaired in case of need to eliminate increased emission due to damaged parts
- Burning of wastes generated at the construction sites shall be strictly prohibited.
- Impose speed limits on construction vehicles to minimize road dust...

Noise and vibration

- Use only vehicles and equipment that are registered and have necessary permits.
- All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people. All vehicles will be checked and repaired in case of need to eliminate increased level of noise due to damaged parts.
- No noisy construction-related activities will be carried out during the night. Such activities shall be restricted to daylight hours.
- Use of silencers, mufflers and acoustic shields on plant and equipment;
- Truck drivers and equipment operators shall minimize the use of horns.
- Limits on the number of machines used at any one time…

Soil and water pollution

- Contractors will ensure the proper handling of lubricants, fuel and solvents.
- Store fuel and hazardous substances in paved areas in tightly sealed containers to avoid contamination of soil and water resources. Regularly check containers for leakage and undertake necessary repair or replacement. If spills or leaks do occur, undertake immediate clean up
- Refueling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, must take place in a designated bounded area. The refueling area should not be situated close to any surface water drain.
- Vehicles will not be left without supervision during refueling process…

Flora: To mitigate the impact on the 21 trees that need to be cut times this number of new trees will be planted. A total of 63 new trees will be planted. 52 trees will be protected by installing tree protection fences.

Fauna: As fauna values in the project area are very low, no specific measures are proposed.

Waste management

44. All associated hazardous waste residuals, such as oil, solvent, material used in oil spill cleanups, together with glue and solvent based paint containers, should be stored within appropriately covered skips prior to removal by a suitable licensed waste management contractor for off-site treatment/recycling/disposal. Any other construction waste should be disposed of on site skips for removal by an approved waste management contractor. Further the contractor should,

- maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal,
- separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure facilities with weatherproof flooring, security fencing and access control and drainage/ wastewater collection systems.
- train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process, and
- ensure that wastes are not haphazardly dumped within the project site and adjacent areas
- provide adequate washing and toilet facilities with septic tanks.

Community facilities

45. The contractor shall implement the following measures to address this impact:

- Permanent monitoring during construction.
- The contractor shall immediately repair any damage caused by the Project to community facilities such as water supply, power supply, communication facilities…

- Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.

Traffic congestion

46. To minimize traffic disturbance, the following mitigation actions are recommended:

- Provide signs advising road users that construction is in progress
- Employ flag persons to control traffic at the station sites for safety reasons when construction equipment is entering or leaving the work area.
- Provide sufficient lighting at night within and in the vicinity of construction sites.
- As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours.
- Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers.
- Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.

Protection of cultural heritage

47. The principal risk of construction archeological and cultural heritage is ground disturbance. According to the outcome of the baseline study, certain archeological sites, particularly tombs of the Late Bronze and Antique Ages, are located in the Project area (tomb No.9 and tomb No.10 of Namgala Mitsa). Potentially some other tombs may be located in the area that will be affected by the construction (tunneling) of University station blind alleys.

48. Considering these remaining tunneling and excavation works, a Chance Finding Procedure is described and should be implemented by the Contractors to ensure that any historical material discovered is properly recognized, recorded and conserved if necessary.

Analysis of alternatives

49. “Analysis of Alternatives” of the IEE describes the existing alternatives for the Project. From the beginning of this Project there was no alternative to the extension scheme and alignment, as any alternatives would have been considered and dismissed long ago in 1980-ies, when the Tbilisi Metro extension scheme has been planned, designed and started.

50. At the feasibility stage in the process of preparation of this IEE, the only one alternative could be considered for the Project. It is the “no project” alternative: to leave the uncompleted metro construction as it is, with the risk of groundwater lowering, impact from exposed soils at the existing construction sites, lost investments and incremental costs of conservation.

51. Two most important criteria for the comparative analysis of “with project” and “without project” alternatives are: a) minimizing environmental impacts and b) optimizing capital and operational costs.

52. The major positive impact of the "with project" alternative will be completion of a major construction project that has been suspended for many years

Information Disclosure, Consultation and Participation

53. Consultations with some of stakeholders, like Tbilisi City Hall and TTC, were held during monthly project meetings.

54. Public Consultations for the Initial Environmental Examination prepared for the Project for Metro to Line 2 and Creation of University Station Project took place on May 9, 2014 in the Vake District Gamgeoba building

55. The meeting was attended by residents of the neighboring, chairmans of condominiums; representatives of the Municipal Development Fund of Georgia, technical Director of the Metro and a representative of "Euroestudios".

Grievance Redress mechanism

56. 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).

57. MDF will facilitate the establishment of a Grievance Redress Committee (GRC) and Grievance Focal Points (GFPs) prior to the Construction Contractor's mobilization to the construction site. The functions of the GRC and GFPs are to address concerns and grievances of he local communities and affected parties as necessary.

58. 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).

59. EA will assist residents of affected territories (Tbilisi municipality) and affected community to identify local representatives to act as Grievance Focal Points (GFP). GFPs are designated personnel from within the community.

60. 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;

(iv) Identification of members of the Grievance Redress Committee (GRC)

61. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below:

(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 Environment and Natural Resources 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) If the complaint is not 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.

Environmental management plan

62. This chapter of the IEE describes the Environmental Management Plan (EMP) for the Project, based on the environmental impacts and respective mitigation measures proposed in Chapter 5.

63. The Environmental Management Plan (EMP) documents the impacts identified in the IEE 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.

64. 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.

65. The impacts identified and the specific mitigation measures proposed to address them have been consolidated into the Environmental Management Plan presented in a form of matrix, which includes time frames, responsibilities and where applicable, estimated costs for each measure.

66. The EMP specifies the need for the civil works Contractor to provide its own detailed Site Specific Environmental Management Plan (SEMP) based on EMP included in the IEE, but supplemented with the description 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.

67. An Environmental Monitoring Plan is presented, also in a form of a matrix, which outlines the activities and responsibilities associated with monitoring the effectiveness of the proposed EMP and ensuring compliance with the recommendations of the IEE.

Conclusions and recommendations

68. The general conclusion prevails that the benefits and gains justify the project implementation. This project will result in a number of expected benefits and beneficial impacts which will far outweigh the few anticipated negative environmental impacts.

69. This chapter states that the major positive impact of the Project will be completion of a major construction project that has been suspended for many years, what optimizes (actually rescues) the initial capital investments. This will produce a number of benefits, including: less disturbance to the Saburtalo landscape and district community; less air pollution and dust; less road congestion due to reduction in usage of vehicles; improved accessibility to affordable and comfortable transport; and improved traffic safety at Vaja Pshavela Avenue. The Project will deliver good quality transport integration and generate social and economic benefits, such as potential growth in the economy of the district, substantial income and employment opportunities, improved living conditions.

1 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

70. The Government of Georgia has received a loan from the Asian Development Bank (ADB) to finance the Sustainable Urban Transport Investment Program – Project 1. Part of the loan proceeds will finance the Tbilisi Metro line 2 extension including the creation of the University Station.

71. For that purpose, the Municipal Development Fund of Georgia (MDF), which will implement the project, now needs to provide the project with the services of "engineering, procurement, construction management and supervision of the Extension of the Tbilisi Metro Line 2 and creation of University Station.

72. The project can be divided into two main assignments:

- The 2,6 km long Metro extension from Delisi Station to University Station
- Creation of University Station and a 301 m long tunnel section for cross over and parking tracks.

1.2 OBJECTIVES

73. The IEE has been prepared to ensure that the Project is environmentally sustainable as well as in compliance with the safeguard requirements of the ADB (Safeguard Policy Statement, 2009, Appendix 1 "Safeguard Requirements 1: Environment") and Government of Georgia (The Law on Environmental Impact Permits, 2008).

74. The IEE covers the general environmental profile of the Project area including physical, ecological, environmental, social, cultural and economic resources.

75. 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 ORGANIZATION OF THIS REPORT

76. The IEE report of Tbilisi Metro line 2 and creation of University station project is organized in the following way:

Chapter 1 gives general information about background, the purpose and need of the project and the scope of IEE.

Chapter 2 describes the legal and institutional framework in which the project is being proposed.

Chapter 3 describes the proposed project.

Chapter 4 describes the existing baseline environmental and socioeconomic conditions in the project area of influence.

Chapter 5 describes the potential positive and negative impacts that may result from the construction and operation activities of the project. This Chapter also gives information about environmental and social protection measures required to avoid, minimize, mitigate and/or compensate adverse impacts of the proposed project.

Chapter 6 describes the existing alternatives for the Project.

Chapter 7 contains information disclosure, consultation and participation procedure.

Chapter 8 describes grievance redress mechanism.

Chapter 9 contains the Environmental Management Plan for addressing potentially significant impacts and the monitoring program for verifying conclusions made in the IEE process and evaluating the efficacy of mitigation efforts.

Chapter 10 describes the conclusions and recommendations.

2 LEGAL AND ADMINISTRATIVE FRAMEWORK

77. This Chapter describes the legal and administrative framework of the Tbilisi Metro line 2 and creation of University Station project. It lists the national laws pertinent to the Project and describes the procedure for obtaining an environmental permit to allow Project implementation. In chapter 2.3 screening requirements according to the ADB Safeguard Policy Statement (ADB, June 2009), are described.

2.1 ENVIRONMENTAL POLICY AND LEGISLATION OF GEORGIA

78. According to Georgian legislation, during the planning and implementation process of a project the investor/proponent is obliged to take adequate measures for reduction or elimination of the expected negative impacts on the environment and human health. Below is a brief overview of Georgia's environmental legislation as it pertains to the proposed project.

79. The Law of Georgia on Environmental Protection (1996) is a framework law that regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities in the scope of environmental protection and in the use of nature. It applies to all of Georgia including its territorial waters, airspace, continental shelf and special economic zone. The Law discusses the aspects of environmental education and environmental management; describes the economic sanctions, licensing, standards and results of Environmental Impact Assessment (EIA); it also discusses the various aspects of protection of natural ecosystems, habitats to be protected, the issues of global and regional management, protection of the ozone layer, protection of biodiversity, protection of the Black Sea, and aspects of regional cooperation.

80. On December 14, 2004 a number of changes were introduced into this Law. According to Article 35, the term "environmental permit" has been changed to "environmental impact permit" and therefore the new version of Article 37 of the Law says: Environmental Impact Assessment shall be carried out prior to issuing an environmental impact permit for the proposed activity to prevent or minimize the harmful impact on the environment.

81. The Law of Georgia on Environmental Impact Permits (2008) was prepared on the basis of changes introduced into the Law of Georgia on Environmental Protection. The Law establishes the procedure of obtaining environmental impact permits. In particular, Article 4 deals with the activities subject to ecological expertise (EE, see below) and bodies authorized for granting rights on implementation of the activities. The Article describes the procedure for obtaining environmental impact permits, including: public discussion of the EIA report; rules for documenting the results of public discussion of the EIA report; the list of documents required for obtaining permits; the rule of issuing permits; the EIA procedure and the requirements for the content of the EIA report; exemption of certain activities from EIA; duties and responsibilities of the project proponent; duties and responsibilities of the permit issuing authority; etc.

82. The Law of Georgia on Ecological Expertise (2008) replaced the Law on State Ecological Expertise. It defines the basic principles of ecological expertise; identifies the authority responsible; establishes the rules for conducting ecological expertise; determines the role of independent experts; determines the conclusion of ecological expertise; establishes the duties and responsibilities of those involved in the process; etc. Ecological expertise is a review of the EIA or other documents, submitted in support of an environmental permit application and is undertaken by a commission composed of independent experts for different impacts/disciplines related to the project profile. After submission of an EIA report by the project proponent, the experts review/examine the data presented, impacts identified and mitigation proposed. A positive Ecological Expertise Conclusion is a prerequisite for issuing the Environmental Permit, and the recommendations made by the experts are usually attached to the environmental permit as Conditions.

83. The Law of Georgia on Protection of Atmospheric Air (1999) regulates protection of ambient air from harmful anthropogenic impact. The purpose of this Law is to preserve and improve air quality and prevent and decrease chemical, physical, biological and other impacts on air that cause harm to human health, the national economy and the flora and fauna of the country. The role of the State in the sphere of air protection is:

(a) to develop ambient air quality standards and regulations for an emission inventory;

(b) to establish state control and enforcement mechanisms. The measures for improvement of ambient air quality are stipulated by the state plans of economic and social development.

84. The norms of maximum allowable limits of concentration of pollutants and the norms of harmful impact rates are established for the assessment of the ambient air quality.

85. The Law of Georgia on Water (1997) regulates the use of water resources; determines the rights and responsibilities of water users; establishes the types and rules of licensing on water use, describes the conditions and rules for issuing licenses; determines the conditions for their suspension, cancellation, withdrawal and change; and regulates water discharges.

2.2 ENVIRONMENTAL PERMITTING

86. Paragraph 1 of Article 4 of Chapter II (Procedure of Issuance of Environmental Permit) of the Law of Georgia on Environmental Impact Permits determines activities subject to ecological expertise, which require obtaining environmental impact permit, issued by the Ministry of Environment and Natural Resources Protection (MoE).

87. According to the legislation, a project proponent is required to prepare and submit an EIA report to obtain the environmental impact permit. EIA is defined in the law as the study and investigation of the planned activity aimed at the protection of certain elements of the environment, people, landscape and cultural heritage. EIA identifies and describes the direct and indirect impacts on human health and safety, flora and fauna, soil, air, water, climate, landscape, ecosystems and historical monuments or combination of the above-listed factors,

including the impact of these factors on cultural values (heritage) and social and economical factors (for infrastructure projects). Development of mitigation measures for the above-listed impacts, as well as preparation of environmental management and monitoring plans is an essential element of the EIA process. Thus, if the proposed activity requires an environmental impact permit, the EIA report shall be presented to enable MoE to make a decision on permitting.

88. Environmental Impact Permits are issued by the MoE (competent authority) under a procedure that includes (i) An Environmental Impact Assessment (EIA) Report, (ii) Ecological Expertise (EE) and (iii) Public Participation. The steps included in securing the Environmental Impact Permit are:

(i) The proponent will conduct an environmental assessment study and prepare an EIA report;

(ii) The proponent will arrange a public hearing on the EIA. The procedure involved in public consultation is:

(iii) one week before submitting draft EIA reports to MoE and the Ministry of Economic and Sustainable Development (MESD), the proponent issues an advertisement in regional and national newspapers about the project, and the date, time and place of public consultations; and sends written invitations to the local government, MoE and MESD; and

(iv) The proponent must then arrange consultations within 50 to 60 days after publishing the advertisement in the newspaper;

(v) The proponent will submit an application for an Environmental Impact Permit (EIP) with the EIA report, minutes of meetings of public hearing and other required documents to MoE and MESD; and (vi) MoE will carry out Ecological Expertise on the EIA report and issue an EE Conclusion (EEC). If the conclusion is positive, MoE will issue the Environmental Impact Permit.

89. For projects requiring a Construction Permit (almost all new construction projects plus those rehabilitation projects that require major reconstruction or major change in technology), no special permit is issued by MoE (according to the “one window principle”, only one permit shall be issued for each activity). The Construction Permit is issued by MESD, subject to the consent of MoE and other institutions relevant to the project profile. Consent of the MoE in such cases is issued according to the same procedures (EIA; public consultations; EE etc.) as for issuing an Environmental Permit. As an administrative body issuing a permit, MESD ensures the involvement of MoE as a different administrative body in the proceedings initiated for the purpose of permit issuance, in accordance with Georgia’s Law on Licenses and Permits (2005).

90. According to the law of Georgia on Environmental Impact Assessment permit (2008) the metro construction in general is subject to EIA and Environmental impact Permit (Chapter II, Article 4, Paragraph 1, point “n”), but at the same time particular activities to be financed

under the Project (such as building development within urban area, underground pedestrians passages, installation of railway superstructure, installation of metro systems, station interior finishing) are not subject to the Ecological Examination (EE) and Environmental Permitting process (EP).

91. Georgian legislation does not specify screening procedures to define project category or a scoping procedure to determine EIA extent. Simply the project is considered as subject to EIA, EE procedure and Environmental Impact Permit if the activities planned or considered by the project are listed in the Law on Environmental Impact Permits (Chapter II, Article 4, Paragraph 1).

92. In the proposed projet a letter from the Ministry of Environment and Natural Resources Protection of Georgia has been received verifying that planned activities aren't subject to the EE and Environmental Permitting.

93. However, the Construction Permit procedure, according to the Government Decree decree #57, 24 March 2009, considers approval of an environmental component that may contain environmental management planning for the construction and operation period, including waste management, pollution prevention, reinstatement, etc. Prior to commencement of construction, the contractor is required to prepare a site plan with detailed information on: the location of staging and parking areas; arrangements for water supply, sanitation, vehicle and machinery servicing; and storage of construction materials and waste; final disposal of waste; etc. During the whole process of implementing the works the contractor will be responsible for ensuring compliance of works with environmental management and monitoring plans through application of internal environmental supervision and quality control systems.

2.3 ADB ENVIRONMENTAL REQUIREMENTS

94. The ADB requirements for Environmental Impact Assessments are set out in the ADB Safeguard Policy Statement (ADB, June 2009), Appendix 1 "Safeguard Requirements 1: Environment". As stated in Paragraph 9 of this appendix:

95. Depending on the significance of project impacts and risks, the assessment may comprise a full-scale environmental impact assessment (EIA) for category A projects, an initial environmental examination (IEE) or equivalent process for category B projects, or a desk review. An EIA report includes the following major elements:

(i) executive summary,
(ii) description of the project,
(iii) description of the environment (with comprehensive baseline data),
(iv) anticipated environmental impacts and mitigation measures,
(v) analysis of alternatives,
(vi) environmental management plan(s),
(vii) consultation and information disclosure, and
(viii) conclusions and recommendations.

96. An IEE, with its narrower scope, may be conducted for projects with limited impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

97. The Project Screening and Categorization requirements are presented in ADB Operation Manual OM Section F1 OP (2006) "Environmental Considerations in ADB Operations". ADB carries 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.

98. The process of determining a project's environment category involves a Rapid Environmental Assessment (REA), and completion of an environmental categorization form prior to project initiation. REA uses a sector-specific screening checklist, taking into account: the type, size, and location of the proposed project; sensitivity and vulnerability of environmental resources in the project area; and the potential for the project to cause significant adverse environmental impacts.

99. 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:

(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 (EIA) is required.

(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 for category A projects. An initial environmental examination (IEE) is required.

(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.

(iv) **Category FI**. A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Intermediary (FI).

100. Based on the screening procedure, the metro extension project has been classified as **Category B** Project.

101. In line with ADB's Public Communications Policy (January 2010), ADB is committed to working with the borrower/client to ensure that stakeholders, including the general public, can provide meaningful inputs into project design and implementation. To provide information to aid this process ADB will post the following safeguard documents on its website:

- For environment category A projects, draft EIA reports at least 120 days before consideration by the ADB Board of Directors;
- Draft environmental assessment and review framework, draft resettlement frameworks and/or plans, and draft Indigenous Peoples planning frameworks and/or plans before project appraisal;
- Final or updated EIA or IEE, resettlement plans, and Indigenous Peoples plans upon receipt;
- Environmental, involuntary resettlement and Indigenous Peoples monitoring reports submitted by borrowers/clients during project implementation upon receipt.

102. This IEE has been prepared in accordance with the ADB Safeguard Policy Statement (ADB, June 2009), Appendix 1 "Safeguard Requirements 1: Environment" and the Law of Georgia on Environmental Impact Permits (2008).

2.4 PUBLIC CONSULTATIONS

103. The Law of Georgia on Environmental Impact Permit determines the timeframes and participation procedures for public consultations on the EIA only for the activities/projects that are subject to Ecological Examination and Environmental Permit (listed in Chapter II, Article 4, Paragraph 1 – see Appendix A). In particular, for the present project a letter from the Ministry of Environment and Natural Resources Protection of Georgia has been received, verifying that planned activities aren't subject to the EE and Environmental Permitting.

104. The IEE would be disclosed and publicly discussed according to ADB's requirements. The document will carry out information about ADB's requirements on public awareness.

3 PROJECT DESCRIPTION

3.1 BACKGROUND

105. In Georgia, the development of a sustainable urban transport network is a key component for the development of urban areas and to enhance the role of Tbilisi as an important business centre in the South Caucasus region.

106. Tbilisi Metro opened in 1966 and is now composed of 2 lines totalizing 27 km of double-track and 22 stations. The completion of the metro line 2 extension and the University station opening will improve and increase mobility, offer quick and efficient alternative and relieve pressure on the road network.

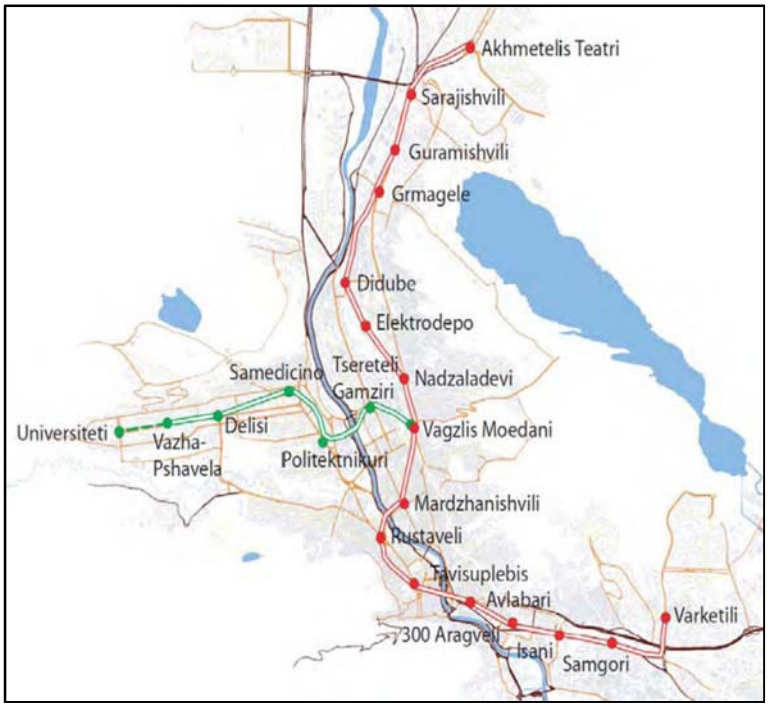


Figure 1.- Tbilisi Metro network

107. The construction of the Metro Extension from Delisi station to University started in 1985 and was interrupted in 1993. Then the construction was resumed in 1998 and in 2000 Vazha Pshavela Station was opened and operated on single track using one of the twin tunnel tubes between Delisi and Vazha Pshavela. Tunnels between Vazha Pshavela and University stations have been bored up with access shaft and ticket room but the final civil works are not finalized.

108. Georgia has received a loan from the Asian Development Bank (ADB) toward the cost of Sustainable Urban Transport Investment Program – Project 1 that consists in the extension and renovation of Tbilisi Metro line 2 and creation of University station. For that purpose, the Municipal Development Fund of Georgia (MDF), which will implement the project, now needs

to provide the project with procurement of Works for the Extension of the Tbilisi Metro Line 2 and creation of University Station.

109. The project can be divided into two main assignments:

- The 2.6 km long Metro extension from Delisi Station to University Station
- Creation of University Station and a 301 m long tunnel section for cross over and parking tracks.

3.2 GENERAL CHARACTERISTICS OF THE PROJET

110. The 2,6 km-long Metro Extension, from Delisi Station to University Station, consists of the following:

- Delisi Station (total length 131 m, P.K. 56+00)
- Scissor crossing and parking tracks after the platform (total length 285 m)
- 760m-long twin tunnels between Delisi and Vazha Pshavela stations.
- Vazha Pshavela Station (total length 205m, P.K. 68+00).
- 760m-long twin tunnels between Vazha Pshavela and University stations, including ventilation Shaft n.50, the by-pass galleries from the shaft to the main tunnels and a pump sump.
- University Station (total length 162m, P.K. 78+20), with the sub-station and other technical rooms.
- In the University station, it will be designed a 110 meter platform with an access by a hall located at the intersection of Vazha Fshavela Avenue and Sandro Euli Street.
- This hall is located at elevation 535 and the platforms at 487, so that descend 53 meters.
- 315m-long section after University Station consisting of a crossover Tg 0,11, parking tracks, a service gallery connecting the station and the crossover, the ventilation Shaft n.51 and a pump sump.

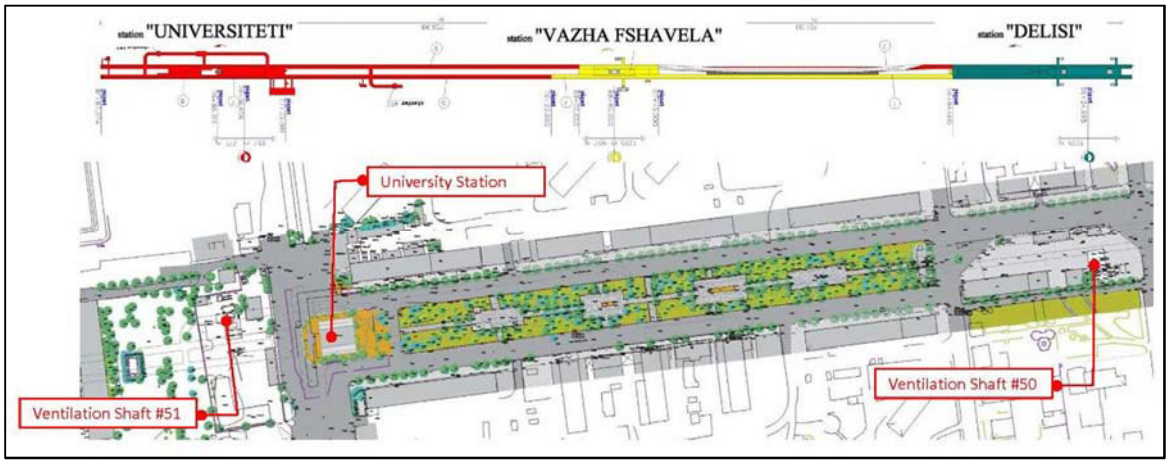


Figure 2.- General plan of the project

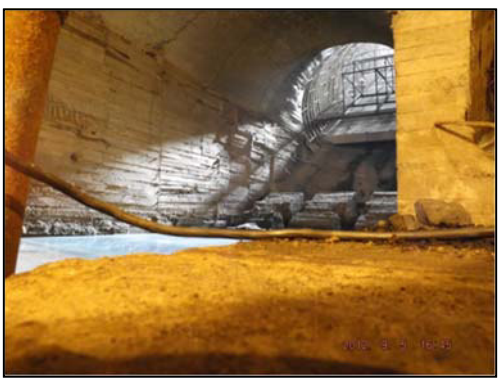
Figure 3.- Metro line in Saturbalo District

111. Delisi and Vazha Pshavela are shallow stations, built as cut-and-cover structures, while University Station is a deep mined station (about 50m from the surface). The tunnels between Delisi and Vazha Pshavela were constructed in cut-andcover, while the tunnels between Vazha Pshavela and University are mined.

112. Delisi and Vazha Pshavela stations are finished and in operation. The line between the two stations is operated on one track, since the second tunnel has been constructed but not equipped.

113. Tunnels between Vazha Pshavela and University stations are constructed but the civil works are not finalized (watertight injections and internal finishes). The main cavern of the University Station has been constructed, together with the inclined tunnel for the moving staircase. The atrium at the surface has a single underground level, the excavation is an open-cut and the structures are partially constructed.

114. After University Station the line ends with a crossover – which is partially excavated parking tracks, chambers for pumping stations and equipment.



115. In addition to Civil Works, the following systems must be installed:

- Permanent way,
- Power supply substation,
- Electromechanical equipment (tunnel ventilation, water-pump, escalators),
- Signalling system,
- Low voltages equipment: communication, SCADA, fare collection.

116. The development of the Multistory building is not included in the project scope. Anyway, the following issues have been taken into consideration:

- The maximum admissible load would be the same as the earth load (assimilated to 2 floors and roof level). It is preferable not to rely on the existing structure.
- After reorganizing the urban situation and alignments, it was clarified that the multistory building occupation over the upper-station was not necessary, so it was preferable to move it next to the boulevard.
- There is no connection projected between the public level of the upper-station and the multistory building.

3.3 UNDERGROUND CIVIL WORKS

117. The completed and the un-completed civil works have been analyzed in order to communicate future design recommendations in the required areas and to carry on the uncompleted civil works.

118. Grouting works are necessary to make possible the start-up of all the existing underground infrastructures located between Vazha Pshavela Metro Station and the end of the tunnels. Grout injections will be carried out in the main tunnels, University Station and its crossover as well as the auxiliary galleries along a total length of around 2 Km.

119. Since the tunnels were constructed some decades ago and have never been in operating and maintenance condition, the objective of the grouting works is to preserve and restore the structural adequacy of the tunnels, protect them from external factors and make them suitable for use and correct operation.

3.3.1 LINE BETWEEN DELISI AND VAZHA PSHAVELA

120. The line between Delisi and Vazha Pshavela stations is finished and operated on one track only since the second tunnel has been constructed but not equipped. The conditions of performance are appropriate so there is no need of rehabilitation. Minor seepage needs to be treated.

3.3.2 EXCAVATION, SUPPORT AND LINING

121. Throughout the underground structures, the excavation, the support and lining are fully completed except in the following zones:

- Section 79+08 to 79+19 (left tunnel), crosscut located in 81+70 (connection between main tunnels) and crosscut located in 81+70 (connection between right tunnel and main drain pump). As they were excavated but not supported, the material is unstable and the excavation has collapsed partially.

  In this part of the tunnel the following actions need to be taken:
  - It is necessary to reinforce previously with steel ribs and Bernold metallic sheet 10m before 79+08 and 10m after 79+19.
  - Shotcreting the ceiling without removing the debris
  - Performance of a lid that will be supported by the ribs and fill de gap with concrete. The essential volume of debris will be removed
  - Concreting the collapsing area
  - Demolishing the rib.
  - Continue excavating and supporting

- Crossover: Part of the crossover bench is not fully excavated. But most of the drift wall has been executed already and the invert is not constructed.
  - It will be necessary to excavate the remaining bench and remove the material. Afterwards, a support will need to be performance (the support will be the same as the rest of the crossover: steel reinforcement and cast in place concrete).
  - Finally, the invert needs to be performance with cast in place concrete with steel reinforcement.

- 80+10 till the end(right/left tunnel)
  The lower part of the both drift walls of the lining needs to be performed with cast in place concrete with steel reinforcement.

- 74+69-74+80 (right and left tunnels)
  The final lining has to be completed with cast in place concrete because the steel bars are already installed.

3.4 ARCHITECTURAL AND STRUCTURAL DESIGN OF THE STATION

3.4.1 CURRENT SITUATION

122. The current design is thirty years old. The design of the Metro Extension to University Station was developed following the Russian standards (SNIP).The other systems have been designed according to the standards in force at the end of the 80's ; in most of the cases, these are outdated.

- ✓ The underground section of the station consists of a big cavern which has been completely excavated.

- ✓ The lining has been completely cast in place and tubes have been left in the crown of the cavern to allow secondary injections (filling and re-compacting injections, respectively with mortar and grout), which still have to be executed.
- ✓ A flood event have damaged the platform concrete and the major part of the platform concrete in the station cavern will have to be demolished and reconstructed
- ✓ The surface section of the University Station, with atrium, shops, ticketing room and technical rooms is partially constructed but it is not covered.
- ✓ The technical spaces for escalators' engines and equipments have been designed according to the Russian equipment in use at the time.

Upper station

Escalators chamber

Substation chamber

3.4.2 AREAS AFFECTED BY THE WORKS

123. Most of the infrastructure is underground and has been built 30 years ago. The improvement designed to accommodate the new systems does not involve enlargement of the existing infrastructure and hence do not affect existing buildings in the area. The surface works are mainly the access to the site works and shall not affect the buildings near it. Surface Exits in the University Station are:

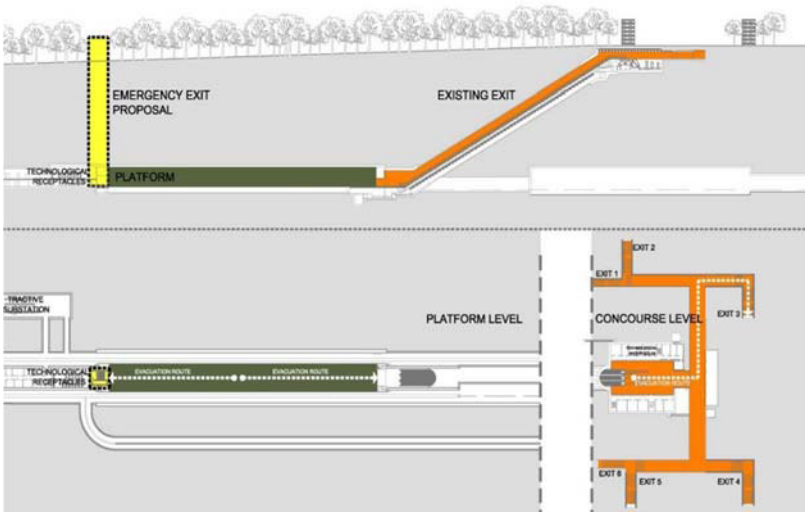
- Exists 1 and 3: these are adjacent to the private empty lots and do not affect any building.
- Exit 2: this is an exit already built. So it just has to improve and adapt to the new technologies.
- Exit 4: This is the unique exit near a residential building, but the exit neither affects it.

124. The ventilation shaft nº 50 is already excavated. The ventilation shaft nº 51 is already executed and is located in a private lot. The emergency shaft will be excavated in the heart of the Boulevard.

125. The emergency exit is projected in order to deliver the highest quality of safety. As far as fire safety is concerned, the designs of the University Station system are mostly based on the international proven standard [NFPA_130], with inclusion of some specific provisions adapted to the Metro Tbilisi context. The [NFPA 130] is a generic fire safety standard that covers all possible fixed guideway and passenger rail systems. It has been applied worldwide.

126. Emergency exits shall be designed at every station level in order to provide an alternative egress path in addition to the regular egress route formed by regular stairs and escalators.

127. The emergency exits shall provide a safe egress route from each station level to the street level via enclosed emergency staircases and passageways, and in addition shall serve as an access for fire- and rescue services to each level of the station.



128. The Emergency Exit is an structure with depth of 42,3 m, width of 9,8 m and height of 3,38 m (landscaping finishing to be coordinated with the municipality, as indicated in plan 09.02.26).

3.4.3 NEW CIVIL WORKS

129. To complete the works, it is necessary to undertake new civil works as described in the following scheme:

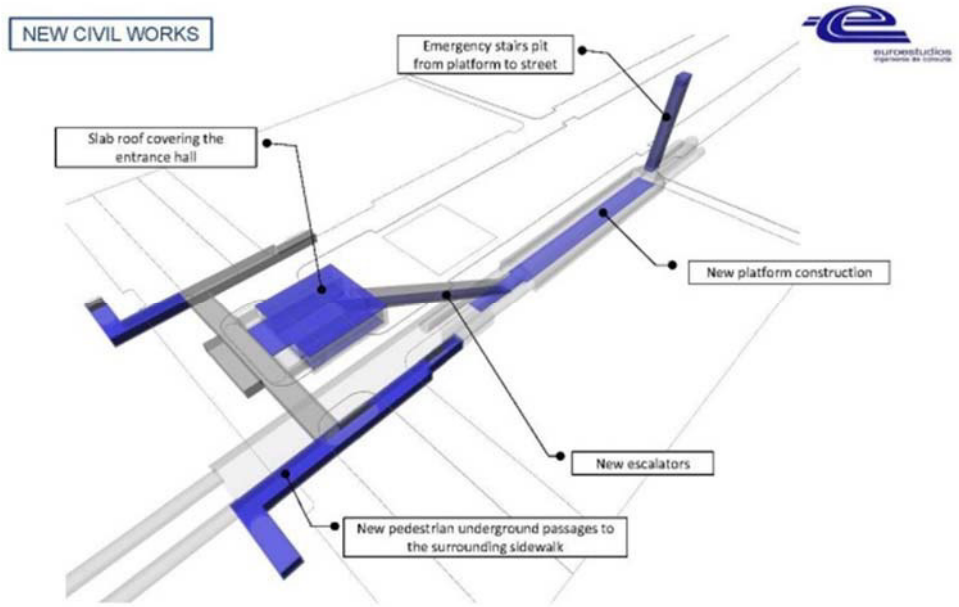


Figure 4.- New civil works to undertake at University station

3.4.4 DETAILED DESCRIPTION OF THE STATION

130. The station can be divided into front and back-of-house areas that either serve the passengers, staff, station or the railway network, e.g. concourse, staff areas and plant areas. The individual areas have been grouped together, according to their functional nature, into categories and termed functional modules, as follows:

a) Intermodal Facilities;
b) Landscaping;
c) Entrances & Exits;
d) Horizontal & Vertical Circulation;
e) Barrier-Free Access;
f) Concourse;
g) Back of House Areas;
h) Platform;
i) Facilities Areas.

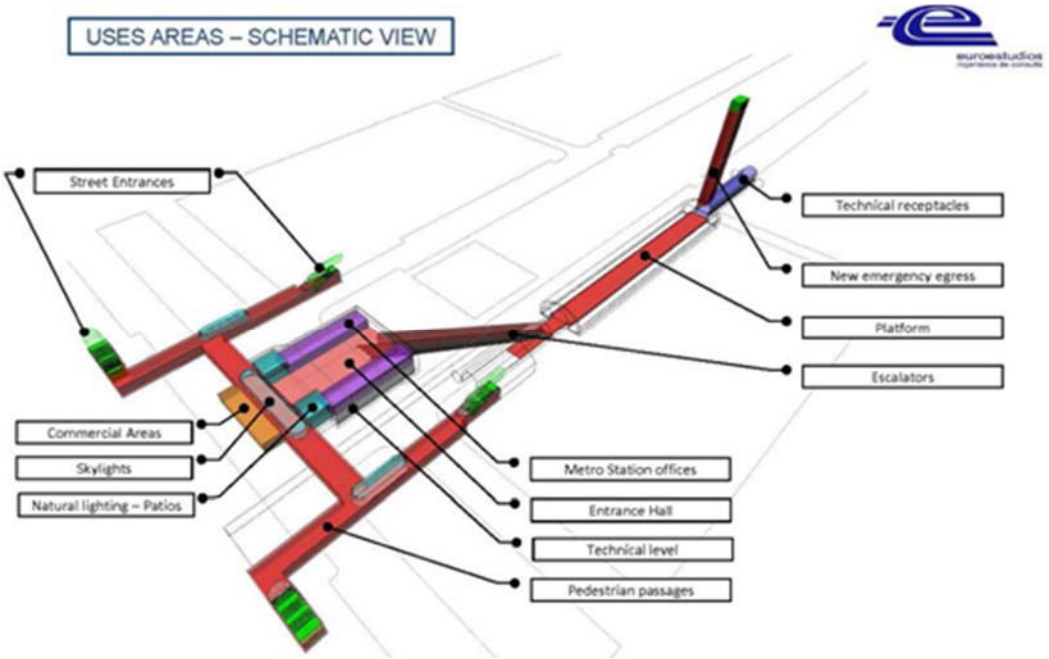


Figure 5.- Uses of the Station. Schematic view

3.5 STRUCTURAL DESIGN OF THE STATION

131. The analysis of the structure has been divided into two parts:

- Study and analysis of the existing structural elements.
- Analysis, decisions and definition of the new elements projected

132. The following elements have been studied separately:

- Substation chamber
- Platform
- Escalator's tunnel
- Concourse Level and Technical Level
- Pedestrian passage
- Technical receptacles

Substation chamber:

133. Current situation: Parallel to the main tunnel, in the substation chamber, all the equipment and facilities for train traction and substation will be located. In this chamber there are two areas with different kind of tunnel structure. The first part is not finished completely, and only the upper part of the vault is done. The bottom part has not been constructed. In the second part of the chamber both parts, top and bottom, are completed.

134. Analysis and decisions: Due to the bad state of the existing brackets and due to the architectural and equipment to be installed, as well as for the protection against water entrance and humidity, these brackets have been thought to be demolished and will not be used as a support of the new slab of the upper level to be constructed. This slab will be supported on two lines of reinforced concrete columns and also in perimeter walls of the chamber, without brackets but directly joined to the wall with steel pins, if the concrete tests results confirm the viability of this type of support.

Platform:

135. Current situation: The supporting structure of the existing platform consists in a reinforced concrete slab supported by three concrete walls, two located at the slab border, and one at the slab mid span. Between those walls, in one side an earth filling has been done to support the platform slab, while in the other, a free space has been left to serve as a facilities passage. This structure is partially demolished and partially unfinished.

136. Analysis and decisions: Due to the bad state of the platform, this structure will be completely demolished and substituted by a new structure made by concrete walls supporting a concrete slab with the same dimensions of the existing one, but complying with the new requirements of height and free space for facilities.

Escalator's tunnel:

137. Current situation: The escalators tunnel that goes from the bottom platform to concourse level is completely executed. The structure that supports, both mechanical escalators and standard concrete ones consists in precast reinforced concrete slabs.

138. Analysis and decisions: The resistance of the existing stockpiled precast reinforced concrete slabs will have to be verified with the final loads given for the escalators to be installed, by the final supplier of escalators. For this analysis, concrete core tests will have to be done to know the resistance of the existing concrete. In case that existing precast slabs do not comply the resisting requirements, new precast slabs will have to be constructed.

Concourse level and Technical Level

139. Current situation: Almost all perimeter walls are constructed and foundation seems to be finished completely, although no information of reinforcement or thickness has been collected.

140. In the concourse level, the lateral areas are partially constructed with precast reinforced concrete slabs supported on brackets made on walls that seem in good conditions.

141. In foundation level some starts of reinforcement bars and shafts can be seen. They are thought to be for facilities' benches.

142. Although no roof slab has been constructed over concourse level, reinforced steel bars have been left in all wall's ends, so an 'in situ' concrete slab was thought to be done. These bars end are not always vertical, as if a chapiter was projected.

143. Analysis and decisions: The next items will have to be checked by the Contractor:

- Foundation slab for the new loads (depending on core tests results and ferroscaning)
- Validation of concrete Wall for actual state and for the future loads to be carried from the roof slabs in the final state.
- Existing precast reinforced concrete slabs in lateral of concourse level.
- Brackets for intermediate level slab support.

Pedestrian passages

144. Current situation: The access to concourse level of the station are partially built, consisting in 'in situ' reinforced concrete walls over a R.C. slab, that support precast reinforced concrete slabs. Passage from main entrance to concourse level to Entrance nº1, with commercial area is already built. Entrance nº1 is finished but closed. The rest of corridors and access entrances are not constructed.

145. Analysis and decisions: These structures will not have changes of dimensions nor loads, so they don't need to be checked. New structures for the new passages have been defined.

Technical receptacles (beside platform)

146. Current situation: In this area, a reinforced concrete slab supported over two brackets on each side of the chamber, as well as over intermediate concrete walls, is built. As some shear cracks were found near to the supports on the brackets, this slab will be demolished.

147. Analysis and decisions: No further analysisis neededsince the shear cracks found in the intermediate level slab recommend the demolition of this element.

3.6 INVESTIMENTS FUNDED BY THE PROJECT

148. A list of the investiments funded by the project is given below:

A. BILL Nº1 GENERAL ITEMS

- Mobilization of Contractor
- Equipping of office for Project Manager
- Mobile communication for Project Manager
- Documents Edition (printing, copies, etc)
- As-built documents
- Works Fulfillment Warranty
- Insurance of the Works and Equipment
- Third-Party Insurance
- Insurance of Personnel
- Purchase od off-road vehicles (4x4) for the Works Supervision

B. MAIN WORKS

- Previous works
- Earthworks
- Concrete structure
- Steel structure
- Landscape and urban furniture
- Underground civil works
- Superstructure
- Waterproofing and drainage
- Architecture, structure and landscaping of the station
- Electromechanical installations
- Monitoting and control
- Utilities
- Eelectric substation
- Communication and signalling
- Electrification
- Environmental impact measures
- Emergency exit

4 ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 ENVIRONMENTAL BASELINE

149. This section describes relevant physical, biological and socioeconomic conditions within the study area. Baseline data collection for the project includes a combination of desk studies and site visits. Desk studies use existing sources of information, including data available on the internet; reports and the scientific literature; IEE of the Tbilisi University Metro Extension (Project Number: 42414, May 2010) and recent IEEs/EIAs for projects in areas near the project. Site visits were made in October 2012 to supplement and verify information provided by desk studies.

150. The baseline environmental study defines the existing status of the ecosystem(s) potentially threatened by the developmental activities.

4.1.1 CLIMATE

151. The climate of Tbilisi and its surroundings is moderately continental, with prevailing north-west and east winds determined by local mesorelief. It can be classified as moderately humid subtropical (Köppen climate classification Cfa). The city's climate is influenced both by dry (Central Asian/Siberian) air masses from the east and humid subtropical (Atlantic/Black Sea) air masses from the west. Tbilisi experiences relatively cold winters and hot summers. Because the city is bounded on most sides by mountain ranges, the close proximity to large bodies of water (Black and Caspian Seas) and the fact that the Greater Caucasus Mountain Range (further to the north) blocks the intrusion of cold air masses from Russia, Tbilisi has a relatively mild micro-climate compared to other cities that possess a similar continental climate along the same latitudes.

152. The Tbilisi weather station is located at 41 41N 044 57E. The elevation of this weather station is 1607 feet/ 490 metre. The average annual temperature in Tbilisi is 12.9 °C (55.2 °F). January is the coldest month with an average temperature of 1.5 °C (34.7 °F). July is the hottest month with an average temperature of 24.5 °C (76.1 °F). The absolute minimum recorded temperature is −23 °C (−9 °F) and the absolute maximum is 40 °C (104 °F).

	Temperatures ºC (ºF)												
	Jan.	Fev.	Mar	Apr	May	Jun	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Year
High	5.9 (42.6)	7.1 (44.8)	12.2 (54.0)	19.3 (66.7)	23.1 (73.6)	27.5 (81.5)	31.0 (87.8)	30.2 (86.4)	26.1 (79.0)	19.4 (66.9)	12.7 (54.9)	7.8 (46.0)	18.6 (65.5)
Mean	1.5 (34.7)	2.4 (36.3)	6.8 (44.2)	13.0 (55.4)	17.0 (62.6)	21.1 (70.0)	24.5 (76.1)	23.7 (74.7)	19.8 (67.6)	13.6 (56.5)	7.8 (46.0)	3.4 (38.1)	12.9 (55.2)
Low	-1.5 (29.3)	-0.8 (30.6)	3.0 (37.4)	8.1 (46.6)	12.1 (53.8)	16.0 (60.8)	19.4 (66.9)	18.6 (65.5)	15.0 (59.0)	9.4 (48.9)	4.5 (40.1)	0.5 (32.9)	8.7 (47.7)

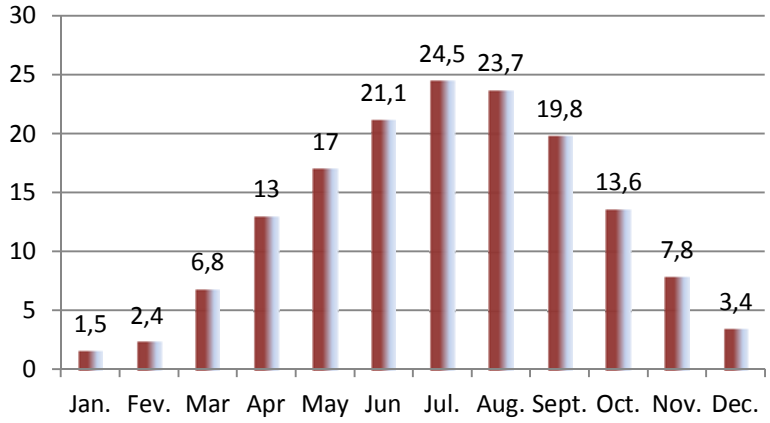


Figure 6.- Average annual temperature(ºC) in Tbilisi

153. Average annual precipitation is 517 mm (20.4 inches). May and June are the wettest months (84 mm) while January is the riest (20 mm).

	Precipitation mm (inches)												
	Jan.	Fev.	Mar	Apr	May	Jun	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Prec.	20 (0.8)	29 (1.1)	31 (1,2)	51 (2.0)	84 (3,3)	84 (3,3)	41 (1,6)	43 (1,7)	35 (1.4)	41 (1.6)	35 (1.4)	23 (0.9)	517 (20.4)
Days*	4.0	4.6	5.9	7.6	9.7	8.7	5.7	5.7	5.0	5.6	4.4	4.0	70.9

* Average precipitation days (≥ 1 mm)

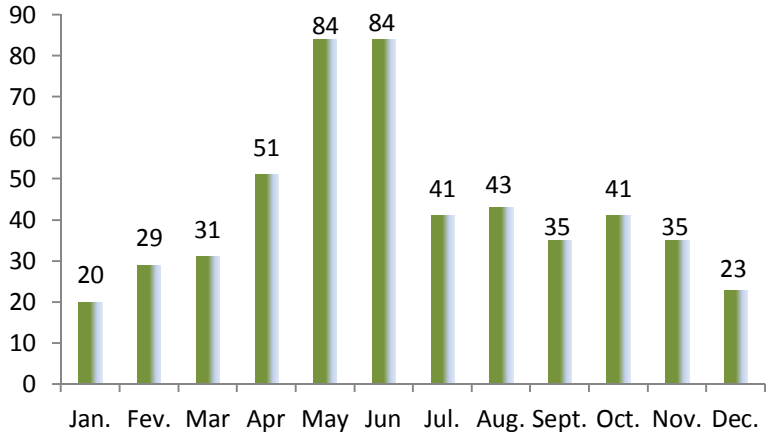


Figure 7.- Average annual precipitation (mm) in Tbilisi

154. Snow falls on average 15–25 days per year. The surrounding mountains often trap the clouds within and around the city, mainly during the Spring and Autumn months, resulting in prolonged rainy and/or cloudy weather. Northwesterly winds dominate in most parts of Tbilisi throughout the year. Southeasterly winds are common as well.

4.1.2 AIR QUALITY

155. The National Environmental Agency (NEA) which is a subordinate organization of the MEP is responsible for monitoring the state of ambient air quality in Tbilisi.

156. At present NEA monitors air quality in Tbilisi at 3 observation points located on Agmashenebeli, Tsereteli and Moscow avenues. The closest point to the area project is the one situated at Agmashenebeli avenue, where the concentrations of the following parameters are being measured in ambient air: total particulate matter, carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), lead (Pb) and ground level ozone

157. Air samples at the observation points are taken 3 times a day and only on working days (sampling is not automated). Concentration of the pollutants is compared to the national standards of air quality to determine the degree of air pollution. The national standards called Maximum Allowed Concentrations (MAC) of harmful substances in ambient air were established by the Ministry of Labour, Health and Social Protection of Georgia in 2003[1]. Maximum Allowed Concentration of a substance in ambient air represents the concentration (averaged for a specific time period) below which the substance does not affect humans' health or the environment over regular periodic or lifetime exposure. There are two types of MACs established:

a) Maximum one-time concentration (measured within 20-30 min, mg/m^3),
b) Mean daily (24 hours) concentrations (mg/m^3). Average annual concentrations are also measured based on the mean daily concentrations.

158. It must be noted that MACs for air pollutants formally established in Georgia are based on former Soviet standards of air quality, and they in some cases differ from standards recommended by the World Health Organization (WHO) as well as standards adopted by the EU.

159. The Table below provides types and values of the MACs for selected air pollutants and respective standards of the WHO and the EU.

[1] Order #297/N of the 16 or August 2001, of the Ministry of Labor, Health and Social Affairs of Georgia "on the approval of environmental quality norms".

Polluting substance	Maximum allowed concentrations (mg/m^3)			Concentration averaging period
	According to Georgian legislation	Recommendation of the WHO	According to EU legislation	
PM 2.5	-	0.01	0.025	1 year
	-	0.025	-	24 hours
PM 10	-	0.02	0.04	1 year
	-	0.05	0.05	24 hours
Total suspended particulates (PM)	0.5	-	-	30 min
	0.15	0.12	-	24 hours
Nitrogen dioxide (NO_2)	-	0.2	0.2	1 hour
	-	0.04	0.4	1 year
	0.04	-	-	24 hours
	0.2	-	-	30 min
Sulphur dioxide (SO_2)	-	0.5	-	10 min
	-	-	0.35	1 hour
	-	0.05	-	1 year
	0.05	0.02	0.125	24 hours
	0.5	-	-	30 min
Carbon monoxide (CO)	-	100	-	10 min
	-	10	10	8 hours
	-	30	-	1 hour
	5	60	-	30 min
	3	-	-	24 hours
Lead compounds	-	0.0005	0.0005	1 year
	0.0003	-	-	24 hours
	0.001	-	-	30 min
Ground level ozone	-	0.12	012	8 hours
	0.03	-	-	24 hours
	0.16	-	-	30 min

Figure 8.- Maximum permissible concentrations of harmful substances in ambient air

160. The figures below illustrate air pollution levels on Aghmashenebeli Avenue in Tbilisi:

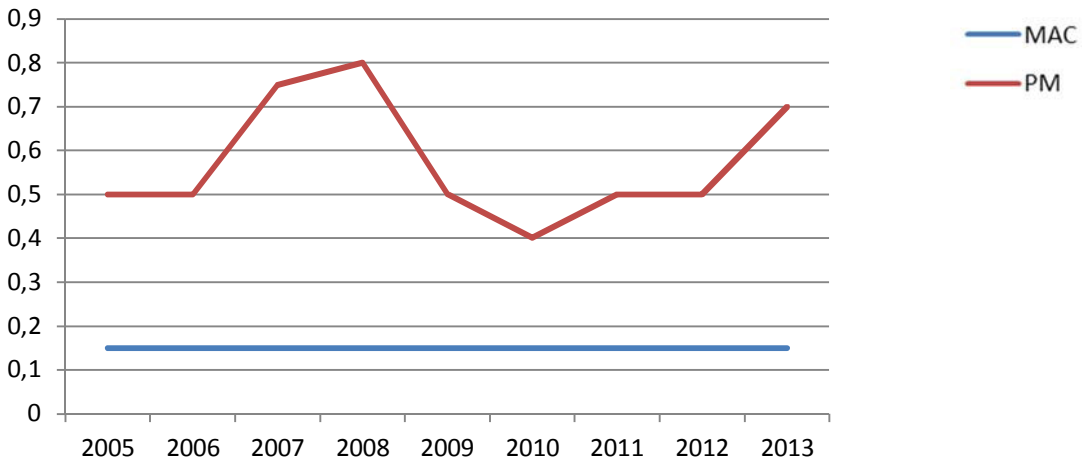


Figure 9.- Average annual concentrations of total particulate matter (PM)

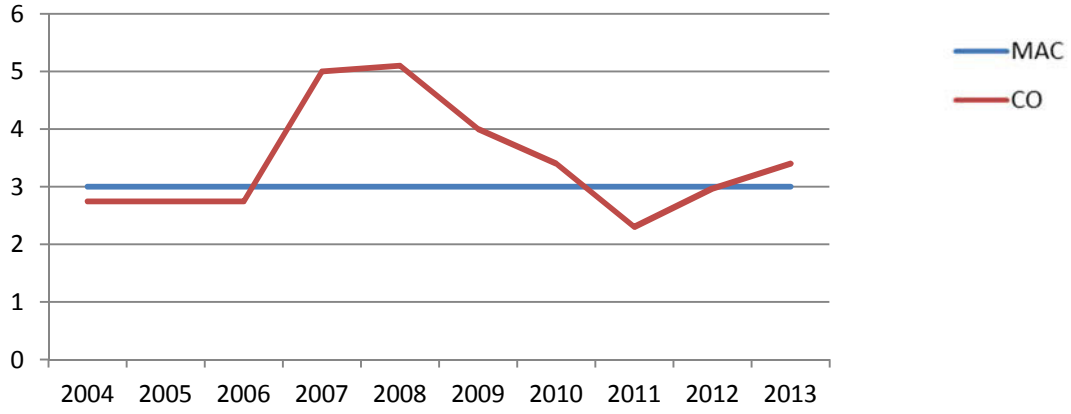


Figure 10.- Average annual concentrations of carbon monoxide (CO)

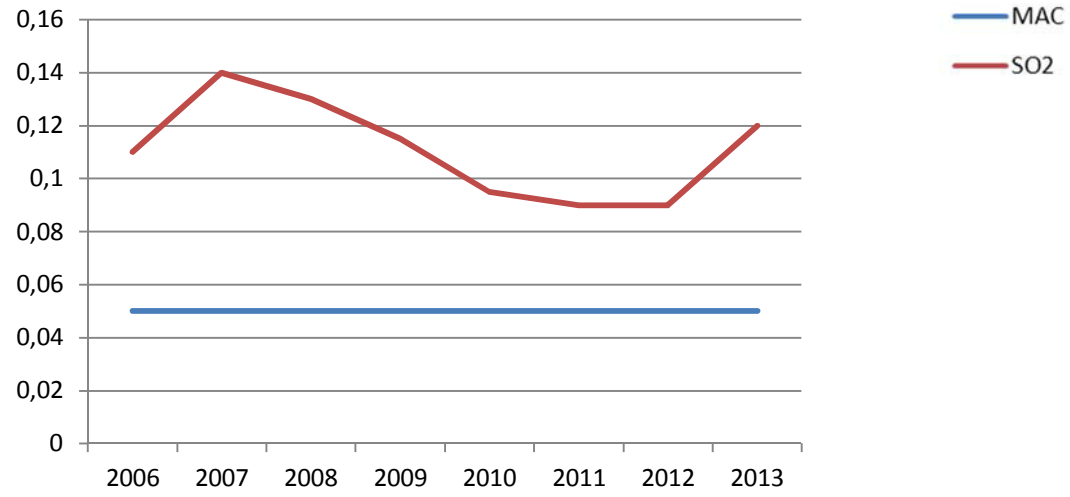


Figure 11.- Average annual concentrations of sulphur dioxide (SO_2)

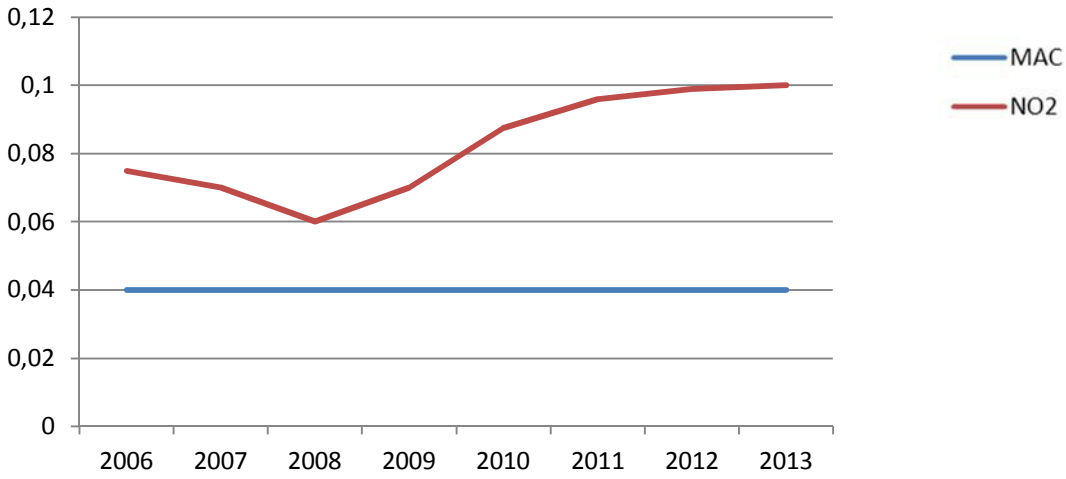


Figure 12.- Average annual concentrations of nitrogen dioxide (NO_2)

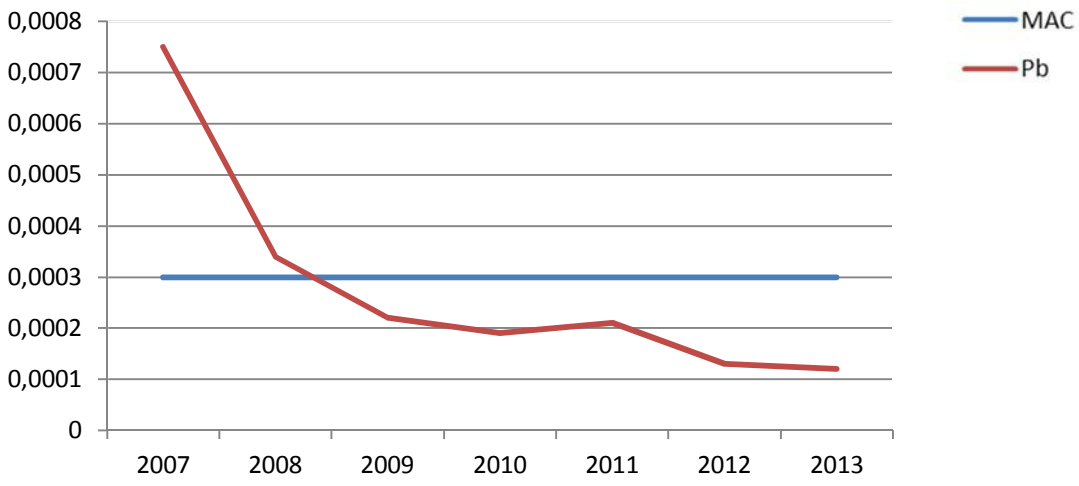


Figure 13.- Average annual concentrations of lead (Pb)

161. The following conclusions can be made based on the available information (given by the NEA) concerning ambient air quality at the observation point closest to the area project (Agmashenebeli Avenue which is located in the central part of Tbilisi, and where the traffic is quite intense):

- Concentrations of CO, SO_2, NO_2 and particulate matter in the air exceeded the national standards for the period 2004-2013. Concentrations of CO decreased in years 2011 and 2012, to values that were lower than the national standard.
- Concentrations of lead have decreased here since 2008, and are now slightly lower than the national standard.
- Measurements of ground level ozone started in 2010 only on Agmashenebeli Avenue and, according to the NEA data, the concentration of this pollutant is within the MAC.

162. Air emissions from industrial facilities have been significantly reduced. Despite the revival of the industrial sector in recent years, air emissions from this sector continued to decrease. This is attributed to the continued reduction of air polluting industrial activities e.g. machinery, and growth of less polluting industries in the city. In contrast, air emissions from traffic have increased substantially due to the increasing number of vehicles. At present, according to data provided by the MEP[2], almost all air pollution emissions in Tbilisi are related to the transport sector (see figure 14)[3]. The increase of air emissions from traffic is largely due to relatively cheap importing of used motor vehicles from the USA, Japan and European countries. 82% of motor vehicles in Tbilisi are more than 10 years old.

[2] Source: GEO-Cities Tbilisi: an integrated environmental assessment of state and trends for Georgia's capital city (2011)

[3] These data include emissions from industrial facilities and motor vehicles. Emissions from other sectors, e.g. construction, landfills, are not included.

	Carbon monoxide (CO)	Nitrogen dioxide (NO_2)	Sulphur dioxide (SO_2)	Hidrocarbons (∑CH)	Particulate matter (PM)
Motor vehicles	103.165	10.155	3.460	23.724	2.423
Stationary sources	30	14	3	7	105

Figure 14.- Emissions of selected polluants from stationary sources and motor vehicles in Tbilisi (Tons, 2009)

4.1.3 NOISE

163. Noise is one of the important physical factors influencing the natural environment and human health. In Georgia, the norms for impact of noise on human health were established by Decrees of the Minister of Labor, Health and Social Security of Georgia (Decrees Nos. 297/N of 16.08.2001, including the changes made to it by further decrees of the Ministry Nos. 38/N of 02.24.2003, 251/N of 09.15.1006, 351/N of 12.17.2007). In particular, this document establishes the permissible limits of noise at working places, the premises of public buildings and residential sites.

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

165. Inside the residential buildings:

- For Leq (7a.m. - 11p.m.) the indicative (equivalent) sound = 40dB(A), maximum level = 55d B(A)
- For Leq (11p.m. - 7a.m.) the indicative (equivalent) sound = 30dB(A), maximum level = 45dB (A)

166. Outside the residential buildings (measured at the wall):

- For Leq (7a.m. - 11p.m.) the indicative (equivalent) sound = 55dB(A), maximum level = 70 dB(A)
- For Leq (11p.m. - 7a.m.) the indicative (equivalent) sound = 45dB(A), maximum level = 60 dB(A)

167. Road traffic is the basic source of noise in Georgia. On the basis of measurements, it has been determined that, on the main streets and highways in Tbilisi, noise exceeds the permissible limits during rush hours (see Figure 15):

	Level of noise (dB)			
	2002	2003	2004	2005
Vazha-Pshavela Ave.	-	75	76	76
I. Abashize St.	-	73	73	73
Kostaba St.	-	76	75	75
Melikishvill St	76	77	76	76
Al. Kazbegi Ave.	-	75	76	76

	Level of noise (dB)			
	2002	2003	2004	2005
Rustaveli Ave.	76	76	77	77
Pushkini St.	-	77	-	-
Varaziskhevi	80	78	80	80
Tsereteli Ave.	-	-	76	76

Figure 15.- Traffic noise characteristics in some streets and highways in Tbilisi

168. At certain sections of main highways and streets, noise reaches 78 dB, whereas on central highways 75 dB is the permissible threshold level between 7 and 11 p.m., and between 11 p.m. and 7 a.m., the permissible threshold level is 65 dB. The highest index number 78-80 dB is recorded in Varaziskhevi.

169. The given data confirm an assumption that at residential and public buildings located along main streets and highways in Tbilisi, the level of noise is above established standards.

170. Also, during the first redaction of the project, in 2010, instant measurements of noise were carried out at the Project site. These measurements were taken on February 18, 2010 at 10.00 am., 14.00 pm. and 18.00 pm. using the standard certified Russian device - "Shum 1M30".

171. The map for the sampling sites and average results of measurement are provided on fig 19. and table below. Comparison of the measurement data with the values determined under the statutory shows that the background noise on the site is higher than the maximum permissible level. The main source of noise is traffic.

	Noise (dB) at different times (2010)		
Point	10:00	14:00	18:00
1	76,0	75,0	79,1
2	72,0	72,6	73,1
3	70,9	72,3	72,3

Figure 16.- Points 1, 2 y 3 – noise and radiation measurement locations

172. Preliminary studies of the background radiation were carried out near University Station (point 1), construction site 1 (point 2) and construction site 2 (point 3). The need for such assessment is determined by following reasons:

a) The Georgian EIA regulations require providing information about baseline radiation values.

b) the project site is in the vicinity of the Institute of Isotopes (250m).

c) Baseline radiation in some residential houses varies in a range of 8 – 16 milliroentgen/hour. The reason for that may be radiation of certain construction materials.

173. The measurements were carried out on February 18, 2010 using the standard certified Russian device – "SRP 6801". The sampling points were the same as for noise assessment. The results are provided on table below. The background radiation is acceptable for urban areas.

Point No.	Radiation mr/h	Maximum permissible level mr/h
1	10	15
2	10	15
3	10	15

Figure 17.- Radiation level at the Proyect Area (Mid Vaja Pshavela Ave)

4.1.4 TOPOGRAPHY AND SOILS

174. Tbilisi is located in the South Caucasus at 41° 43' North and 44° 47' East Longitude. The city is situated in East Georgia on both banks of the Mt'k'vari River. The elevation of the city ranges from 380-770 meters above sea level and possesses the shape of an amphitheatre surrounded by mountains on three sides. To the north, Tbilisi is bounded by the Saguramo Range, to the east and south-east by the Iori Plain, to the south and west by various slopes (sub-ranges) of the Trialeti Range.

175. The diversity of Tbilisi relief is the result of its geo-morphological structure. Tbilisi is located between two folded mountain systems, in particular, the foot of an intensely dislocated southern slope of the Central Caucasus in the north and the folded system of Ajara-Trialeti in the south. Its tectonomorphic structure means that the topography mirrors the underlying structure, when anticlines[4] form ridges, while synclines[5]5 produce depressions. Paleogene-Neogene alluvio-volcanic and terrigenous deposits are covered in many places by thick Quaternary formations.

[4] anticlines – fold of geological formation with swelling or arch (saddle) form directed upward, where the oldest geological deposits are located in the central (nuclear) part

[5] synclines - synclinal basin, fold of geological formation with depression form (saddle) directed downward

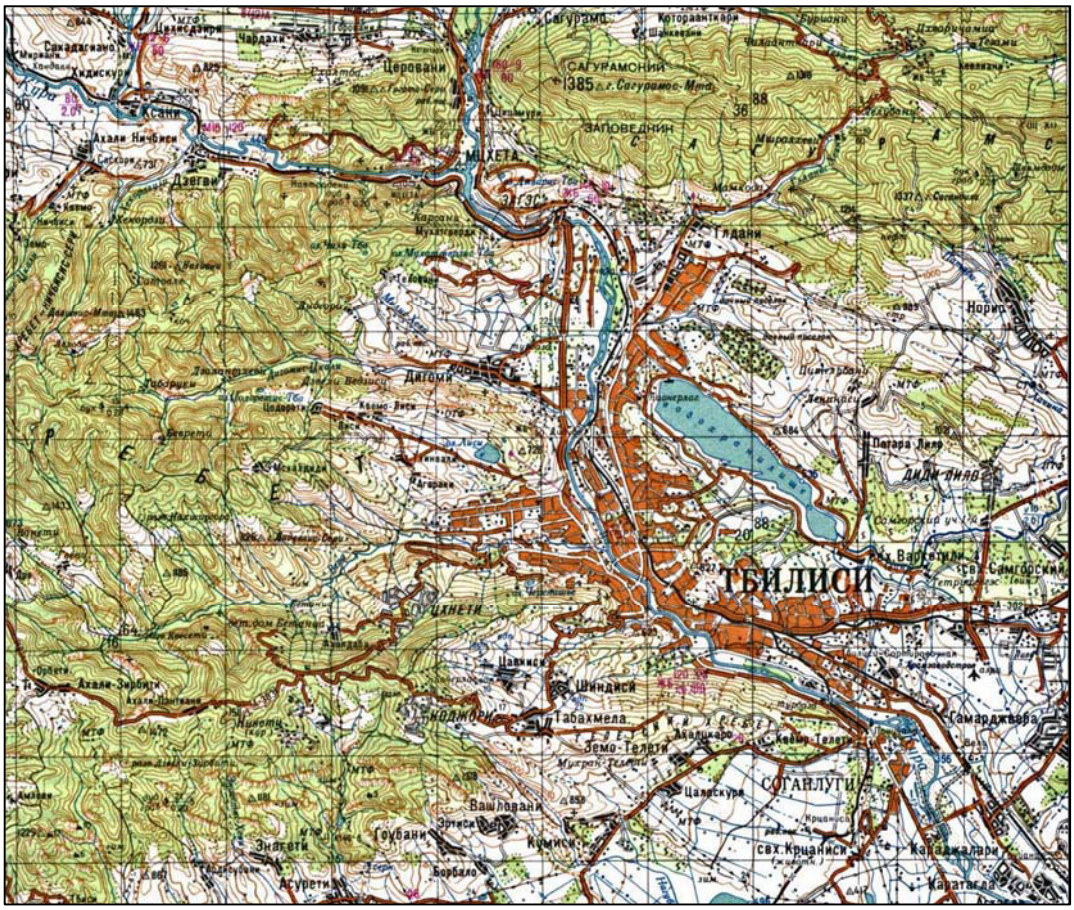


Figure 18.- Tbilisi Topgraphic plan

176. . The relief has been strongly transformed under the anthropogenic impact over the centuries. Among natural-tectonic events and processes are landslides, mudflow, erosion and floods. The principal factors hampering the development of Tbilisi and damaging city infrastructure are landslide-gravitational events and mudflows, historically taking place on the basin slopes.

177. The project area is located in a slight depression among the two hilly areas spread from West to East. The relief is slightly inclined to the East. The hills provide a local drainage boundary (catchment), so that from the construction sites, surface and groundwater are drained to the East, towards the river Mtkvari. Distance from the project area to the river Mtkvari is about 4 km.

178. Filling is of non-uniform loam mass with (0 – 4,5m). Dark brownish loamy soil with dense sand bends and 10-15% of boulder-like inclusions, with gruss, broken stone and clusters of rocks.

4.1.5 GEOMORPHOLOGY AND GEOLOGICAL CONDITIONS

179. Tbilisi and its surrounding territory represents mountainous region jagged with ravines in the middle of river Mtkvari flow. Basic orographic lines of relief are connected to north-east

endings of Trialeti ridge, representing significant ring of Small Caucasus mountain system chain. In this mountainous region Tbilisi is located in deep cavity which is elongated from North to South. River Mtkvari divides Tbilisi in two asymmetrical parts.

180. The width of cavity is 3-4km at some places, but at Metekhi fortress it gets narrow up to 35-40 m. Absolute height of plain surface of the studied territory is 504-540 m, but surrounding ridges' height is within 534-768m absolute elevation areas.

181. Delisi depression base is structured by middle and upper Oligocene and lower Miocene deposits. Mentioned deposits are covered with Quaternary proluvial-deluvial genesis deposits. Thickness of Quaternary deposits is significant during their disposition close to the tunnel surface; it is connected to deepening old Paleo ravines in bedrocks.

182. Middle and upper Oligocene and lower Miocene deposits are lithologically represented by thick bedded sandstones and thin bedded argillite beds, also by dark grey thin bedded clays, with thin interbeds of sandstones and argillites.

183. From a geological point of view the investigation site belongs to Delisi depression of west edge of Tbilisi cavity. The studied site is structured by 6.8-20.7m thick Quaternary clays and lean clays and upper Eocene argillites and sandstones with various weatehring.

184. The studied Delisi depression axis coincides with Saburtalo syncline axis.

185. At the studied site porous circular waters are observed in Quaternary deposits; as seen from Lugeon tests results water permeability of construction site bedrocks is low, filtration properties of bedrocks are low too.

4.1.6 HYDROLOGY AND HYDROGEOLOGY

186. The city lies in Eastern Georgia on both banks of the Mtkvari River (internationally called Kura River).

187. The river divides the city into two parts, with the left side of the city exceeding the right in both territory and population. The part of the city which lies on the left bank of the Mtkvari River extends from the Avchala District to River Lochini. The part of the city which lies on the right side of the Mtkvari River on the other hand is built along the foothills of the Trialeti Range, the slopes of which in many cases descend all the way to the edges of the river Mtkvari.

188. There are no surface water resources at the territories adjacent to the Project site. Distance from the Project site to the river Mtkvari is about 4 km, the distance to the small r. Vere (r. Mtkvari right tributary) is about 2 km. Topographically the riv. Vere gorge is separated from the project area by watershed hills, so surface water, as well as shallow groundwater from the project area is not drained to the riv. Vere. The Lisi lake and Kus-tba lake (Tortoise lake) are located respectively 100m and 170m above the level of project area, at a distance of 2,2km and 3,5km.

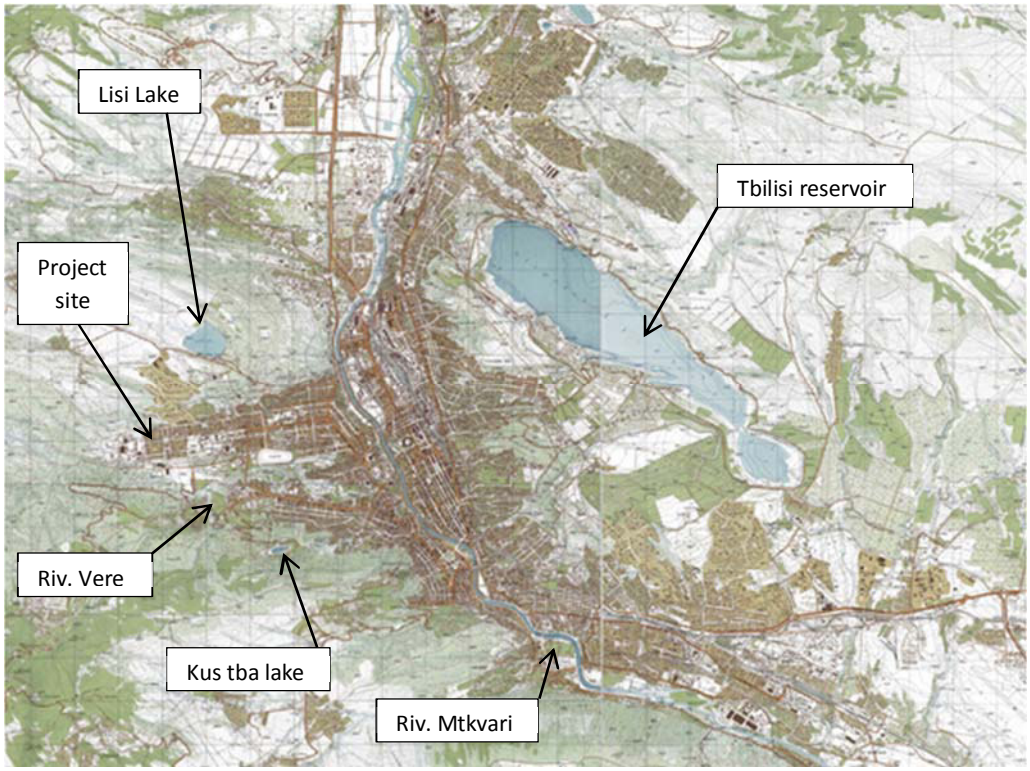


Figure 19.- Project site and surface water resources

189. According to the hydrogeological zoning of Georgia (Buachidze I., 1970), the Project site and its adjacent territory are located within the area with the fissure and fissure-karst[6] waters of Tbilisi artesian basin[7]. The feeding area of the underground waters of Tbilisi is mostly located beyond the city borders. The relief of the city, in particular, the lithological content of the constituent rocks and their bedding elements, negative humidity balance and other conditions, do not support the feeding of the underground waters.

190. On the right bank of the Mtkvari, which is characterized by strongly inclined slopes and little vegetation cover, during abundant rainfall, the water infiltration into the grounds is complicated and therefore, the constituent rocks of the Project area are less water-infused than other areas of the city. Rainfall is drained down into the r. Mtkvari mainly as surface water.The fault zones contain chemically aggressive sulphate-rich thermal water circulating under pressure. In particular, these waters have adversely affected the Tbilisi Metro (G.Buachidze, G.Chokhonelidze,) by damaging tunnel lining, ceilings, stone and paint finishing, etc.

[6] fissure-karst waters - type of groundwater that circulates in the karst structures (cavities, channels, fissures) formed due to washing out of soluble materials of the rock formations

[7] artesian basin – basin of pressurized (confined) groundwater

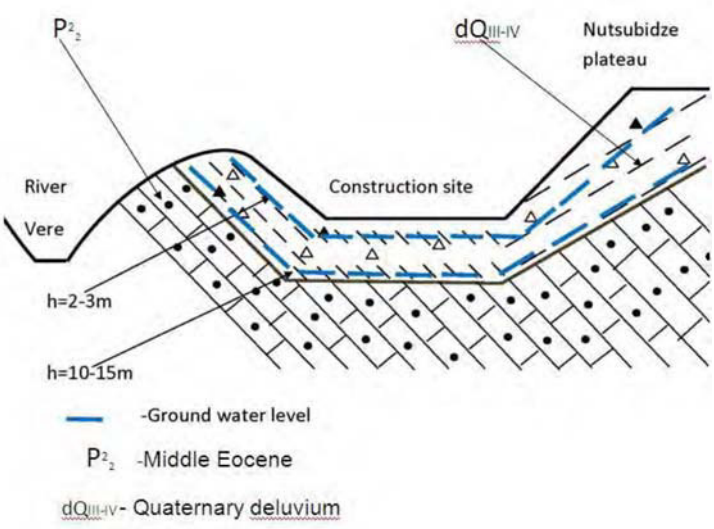


Figure 20.- Schematic drawing of lithological cross-section of aquifers in the project area

191. The underground waters of a deep circulation of the Middle Eocene are characterized by a high content of hydrocarbon of up to 12 g/l. These waters also contain up to 19.28-22% of methane and nitrogen. The underground waters are characterized by high flow rate. Their circulation is associated with the fissures of the constituent rocks (sandstones). As for the mudstones, they present an almost water-proof stratum. Within the project area there are significant flows of ground waters formed in the Quaternary deposits of the eluvial-deluvial genesis (sandy clay with gravel inclusions.

4.1.7 FLORA AND VEGETATION

192. Tbilisi is situated in the central floristic region of Transcaucasia. The flora of its surroundings includes 1.643 species belonging to 623 geni and 107 families. According to a number of the dominant families and geni, the flora of Tbilisi surroundings is similar to Eastern Mediterranean, Southwest Asian and Transcaucasian flora.

193. Tbilisi environs are featured by phitocenological diversity. The species prevailing among wood vegetation are: *Pinus* sp., *Quercus* sp., and *Fagus* sp., *Carpinus* sp. Also among the wood vegetation there are found *Acer campestre*, *Populus* sp., and others.

194. However, ecological values in the project area are very low due to the urban nature of the environment. Flora in the project area includes some typical urban tree and shrub species: *Pinus* sp., *Larix* sp., *Aesculus* sp., *Platanus orientalis*, *Fraxinus excelsior, Populus* sp….

195. These are found mostly within the park along the median of Vazha-Pshavela Avenue, and along the sides of this Avenue.

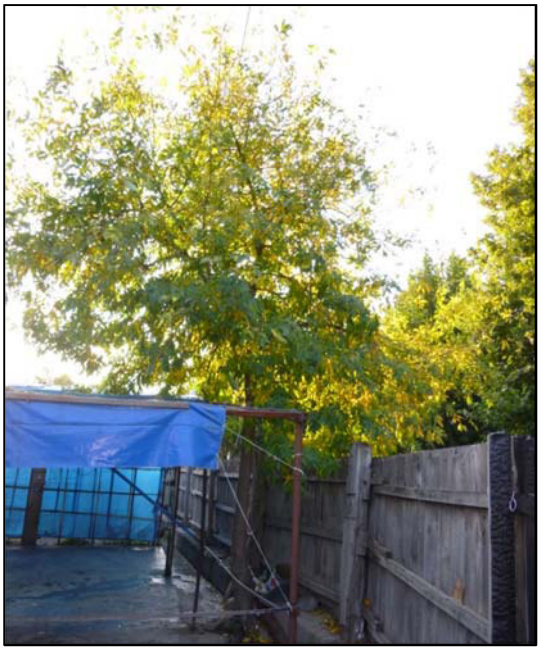
196. Flora in the project area has no biodiversity value but in general trees are large and mature specimens that have value in terms of landscaping, shade and visual amenity.

197. In this chapter a detailed inventory of the trees planted in the project areas is presented.

Area A-1

198. A plane tree and a walnut grow in this area situated inside the perimeter of the Area 1 (see plane 16.2). A picture of both trees is shown below:

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	0-30	31-60	61-90	91-120	121-150	>150	Total
Poplar *(Populus sp.)*		1					1
Walnut (*Juglans regia*)		1					1



Area A-2

199. As it can be seen in the picture, no trees have been planted in this area.

200. Many spontaneous bushes have grown in without human intervention.

Area A-3

201. Many plane trees are planted in alignment in this area situated along the side of Vazha-Pshavela Avenue; these trees are not affected by the project, but they should be protected.

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	61-90	91-120	121-150	151-180	181-210	>210	Total
Plane tree (*Platanus sp.*)			4	4	4	2	14

Area A-4

202. A list and some pictures of the trees that have been identified in this area is given below:

Type of tree	Diameter at Breast Height (DBH)					
	0-30	31-60	61-90	91-120	>120	Total
Elm (Ulmus sp.)				1		1
Goldenrain (*Koelreuteria paniculata*)	1					1
Pear trees (*Pyrus sp.*)		2				2
Walnut (*Juglans regia*)		1	2	1		1

Area A-5

203. It is composed of two areas: one, where an emergency exit is projected and the other one near university station. A list and some pictures of the trees that have been identified in the first one, where an emergency exit is projected, is given below:

Type of tree	Diameter at Breast Height (DBH)					
	0-30	31-60	61-90	91-120	>120	Total
Larch (Larix decidua)				1	7	8
Pine (Pinus sp.)				1	3	4

204. A list of the species planted in this second part of area 5 (located close to University Station), is given below.

Type of tree	Diameter at Breast Height (DBH)					
	30-60	61-90	91-120	121-150	>150	Total
Larch (*Larix decidua*)		1				1
Horse-chestnut (*Aesculus* sp)		3				3
Pine (*Pinus* sp.)			2	1		3

Area A-6

205. Area located in the intersection of Sandro Euli Street and Vazha-Pshavela Avenue. List and characteristics of the plant species that have been identified in the designed project area A-6 are the following

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	61-91	91-120	121-150	151-180	151-180	>180	Total
Plane tree (*Platanus sp.*)		1		1			2
Ash tree (*Fraxinus* sp.)			2				2
Pine (*Pinus* sp.)		1		1			2

Area A-7

206. Area located in the intersection of Sandro Euli Street and Vazha-Pshavela Avenue; list and characteristics of the plant species that have been identified in the designed project area A-7 are the following:

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	0-30	31-60	61-91	91-120	121-150	151-180	Total
Cypress (*Cupressus* sp.)	6	3					9
Plane tree (*Platanus sp.*)			1	1			2
Poplar (*Populus* sp.)			1				1
Pine (*Pinus* sp.)			1	1		2	4

Area A-8

207. Area located in the intersection of Sandro Euli Street and Vazha-Pshavela Avenue (see plane 16.2); list and characteristics of the plant species that have been identified in the designed project area A-8 are the following:

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	30-60	61-90	91-120	121-150	151-180	>180	Total
Ash tree (*Fraxinus* sp.)		1	3				4
Pine (Pinus sp.)					1		1

Area A-9

208. Area located in the intersection of Sandro Euli Street and Vazha-Pshavela Avenue; a list and characteristics of the plant species that have been identified in the designed project area A-9 are the following:

Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground						
	61-91	91-120	121-150	151-180	181-210	>210	Total
Poplar (*Populus* sp.)		1	3			4	4

209. In this area there are also some mature limes (*Tilia* sp), ash trees (*Fraxinus excelsior*) and walnuts (*Juglans regia*) that shall removed. A total of 5 trees will be protected in Area 9.

4.1.8 FAUNA

210. Tbilisi's environs were covered with forest in the past, but now there are mainly open slopes and plains. In some places there are still some shrubs and forest. Only a small part of the original abundance of different birds and animals is still found here. 213 species of birds have been identified in Tbilisi and its surroundings, 10 species of frogs (amphibians), 25 species of reptiles, over 20 species of fish, and 20 species of mammals. Currently there are not more than 50 species of birds.

211. The following species of mammals are found in Tbilisi's environs: European badger (*Meles meles*), stone marten (*Martes foina*), least weasel (*Mustela nivalis*), golden jackal (*Canis aureus*), Fox (*Vulpes vulpes*), wild cat (*Felis silvestris*), Rabbit (*Lepus europaeus*), squirrel (*Sciurus vulgaris*), transcaucasian squirrel (*Sciurus anomalus*). From rodents widely spread in Tbilisi and its environs there should be noted: wood mouse (*Apodemus silvaticus*), black rat (*Rattus rattus*), and domestic mouse (*Mus musculus*).

212. From 10 genera of three families of chiroptera, 13 species of seven genera are found in Tbilisi and its environs, from which three species are included into the Red Book of Georgia. These are *Barbastella barbastellus*, *Rhinolophus euriale* and *Rhinolophus mehelyi*.

213. Reptiles are increasing in number these days. The most significant are: *Lacerta strigla, Lacerta sacsicolor, Ophisaurus apodus, Natrix tescelata, Vipera lebetina*, *Emys orbicularis* and *Testudo graeca* are noted. As for amphibians, in Tbilisi environs there could be found *Bufo bufo* and *Rana ridibunda*. In the Mtkvari River and its tributaries, as well as in the number of reservoirs of Tbilisi environs the various kinds of fish are found: *Leuciscus cephalus fauriscus, Varicorhynus capoeta*, *Barbus cyri*, *Nemachilus brundti*, *Silurus glanis, Cobius platirostris cyricus*.

214. The ornithological fauna of Tbilisi environs is much more diverse. In particular, 213 species of 19 genera are accounted. Only several widespread species will be given; dwelling birds: *Passer domesticus, Turdus merula, Chloris chloris, Turdus viscivorus, Fringilla coelebs*; hibernating birds: *Anas platyrhynchos, Turdus pilaris, Serinus pusillus*; nestling birds: *Coturnix coturnix, Cuculus canoris, Apus apus, Hirundo rustica, Delichon urbica*; from birds of passage *Scolopax rusticola* can be found.

215. An additional survey was conducted in 2010 (during the redaction of IEE for Tblisi University metro extension) to determine the following: a) the real extention of the colonies of bats; b) which bat species exactly dwell in the tunnel.

Figure 21.- Bat colony wintering in the metro tunnel

216. As a result of this investigation, that was conduced by using a photo-counting approach, a Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) wintering colony consisting of up to 500 individuals was found. This colony is probably biggest wintering colony of this species in the city. The investigation revealed that the only especie of bat that was present in the tunnel was the Greater Horseshoe Bat. During the field visits made the Consultant Environmental Specialist on October 2012, the presence of bats was confirmed.

217. According to the "Bats Conservation Action Plan for the Caucasus" (Tbilisi 2008), the Greater Horseshoe Bat is classified as Vulnerable in the Regional Legislation. However Status under the IUCN Red List (Version 3.1 UICN 2001, Latest Version) is "Least Concern"[8] and it is not included in the Red List of Georgia (http://chm.moe.gov.ge/index.php?page=downloads&lng=en_).

218. Regarding this information, it can be concluded that fauna values in the project area are very low due to the urban nature of the environment and the high level of disturbance; it is limited to domestic animals, non protected bats in the tunnel, several species of birds adapted to the urban environment and vermin such as rats and mice. No non-captive, endangered species are expected to be found in the project area.

4.1.9 PROTECTED AREAS

219. There are no protected areas in or in the vicinity of the project area.

4.2 BASELINE SOCIOECONOMIC CONDITIONS

[8] The IUCN's Red List system contains nine categories, with the main purpose of classifying species from lowest (Least Concern) to highest (Critically Endangered) risk of extinction. Specific, quantitative criteria relating to species' population size and trends are used to determine whether a species is at risk of extinction or not. Species that are at high risk of extinction are placed in one of three categories: Vulnerable (VU), Endangered (EN) or Critically Endangered (CR). If a species is classified into one of these three categories, it is a threatened species. A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

4.2.1 LAND USE

220. The Project site is located in a part of Tbilisi urban area, that was developed in the 1960`s. In the North, East and South the site is surrounded by residential blocks of various densities with 5- to 12-storey houses. The area located west of the site is industrial and building complexes of scientific-research institutes, offices, laboratories, mechanical workshops, technical headquarters of cellular communication providers, etc. Therefore the urban landuse has about half century history and the area is completely urbanized.

221. There are two suspended constructions of residential buildings started during "construction boom" of 2007-2008 (before 2008 crisis) in the vicinity of the Project, that might be resumed within the Project period. Tbilisi Municipality estimates (according to Tbilisi Master-Plan) that the completion of the metro extension with the University station, in addition to improving access to Tbilisi University facilities, Jikia street business, and the relatively remote Nutsubidze Plateau 1st District, will also extend residential and commercial development in the area, with creation of additional jobs.

Figure 22.- Buildings in the vicinity of University Station

Figure 23.- Shaft nº 50. Construction site


Figure 24.- Shaft nº 51. Construction site

4.2.2 DEMOGRAPHIC SITUATION

222. Tbilisi, the capital and the largest city of Georgia, is one out of 450 cities in the world with more than one million inhabitants. It is multifunctional settlement situated on the same latitude as Rome and Barcelona; this ensures climatic conditions and an environment favorable for human habitation, economic activities and recreation. The city covers an area of 504 sq km and has a population of 1.162 million people. This information is given in the Basic Data table below:

Surface	504 sq km
Population	1.162 mln residents (2011)
Density	2,310 persons per sq. km
Administrative	Gldani-Nadzaladevi, Didube-Chugureti, Vake-Saburtalo, Old Tbilisi, Isani-Samgori, Didgori

223. The city has 6 districts: Old Tbilisi, Vake-Saburtalo, Didube-Chughureti, Gldani-Nadzaladevi, Isani-Samgori and Didgori (added to the administrative area of the city in 2007). Five out of six administrative districts are divided in smaller managerial units – Ubani (neighborhoods), 30 in total.

4.2.2.1 Demographics

224. Tbilisi is currently home to 1,175,2 thousand residents (2014), 26% of the total Georgian population of 4,490,15 thousand persons. Unlike many cities in emerging economies, Tbilisi has not experienced high rates of population growth.

Size of population and sex structure

225. The population of Tbilisi continued to grow steadily throughout the past century and, according to official statistical data, reached its maximum level - 1.267 mln people by 1992

(see Figure 25)[9]. In the following years which were characterized by political unrest, armed conflicts in Abkhazia and South Ossetia, and a dramatic economic downturn in the country, Tbilisi's population started to decrease. In the period between 1992-2004, Tbilisi's population decreased by about 15%. This reduction is attributed to two major factors:

- Massive emigration of Tbilisi population to other countries due to the grave socio-economic conditions, massive unemployment, political instability and ethnic tensions. Statistics indicate that, during 1991-2009, a 'negative migration balance' of 169,300 people is estimated for Tbilisi.

- Low birth rates in relation to the mortality rates, what involves a very little natural growth, as the low birth rate (15.6% in 2003, down to 11.4% in 2004) almost equals the mortality rate (11.7% in 2003, down to 10.2% in 2005); this has reduced the natural growth of Tbilisi's population (4.3% in 2002 vs. -0.1% in 2004).

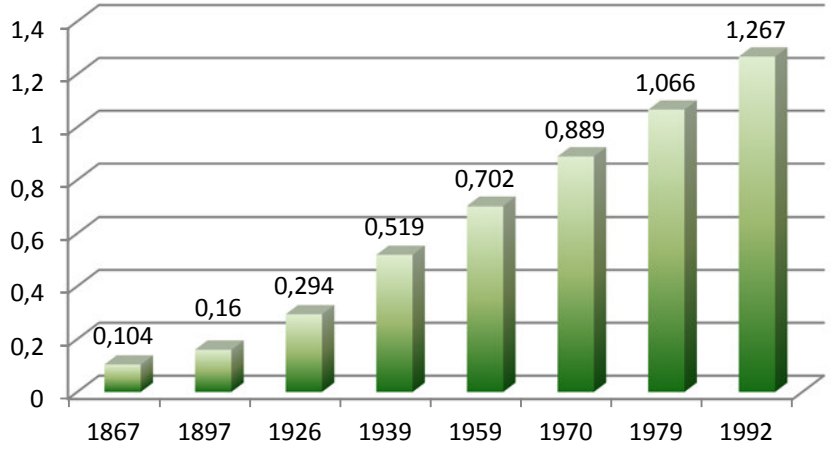


Figure 25.- Population growth in Tbilisi in the period 1897-1992

226. Tbilisi's population stabilized in the period 2002-2005 at around 1.08 million persons, and then started to grow asit can be seen in figure 26.

[9] Data on the population during 1897-1992 have been taken from the Tbilisi City Hall Document - Tbilisi Municipality Economic Development Plan (2006), www.tbilisi.ge; data for the period 2000 to 2014 have been provided by the National Statistics office of Georgia, www.geostat.ge.

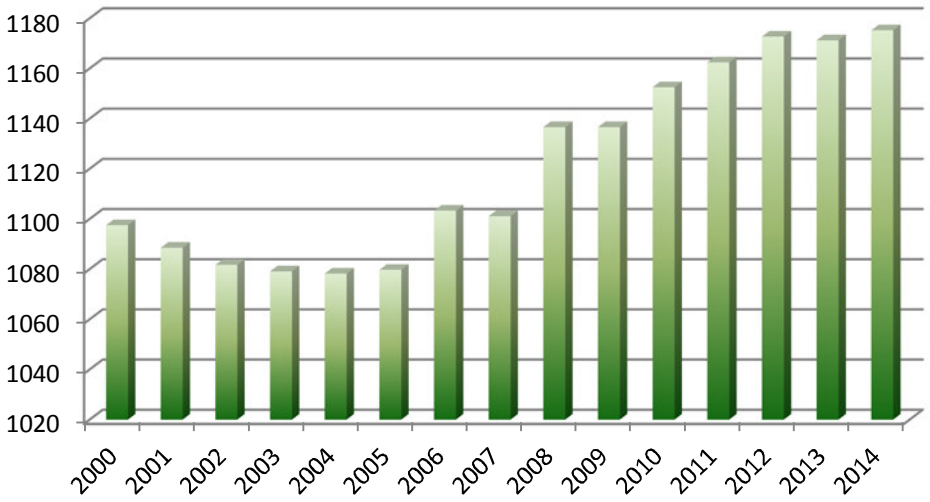


Figure 26.- Population growth in Tbilisi in the period 2000-2014

	2000	2001	2002	2003	2004	2005	2006
Population (Thousands)	1.097,5	1.088,5	1.081.7	1.079,1	1.078,9	1.079,7	1.103,3
Number of live births	15.380	15.648	16.057	16.058	16.059	16.060	16.061
Number of deaths	11.690	11.408	11.465	12.597	12.424	11.164	12.454
Natural growth	3.690	4.240	4.592	3.461	3.635	4.896	3.607
Population growth rate	-0,9	-0,8	-0,6	-0,2	-0,1	0,1	2,2

	2007	2008	2009	2010	2011	2012	2013
Population (Thousands)	1.101,1	1.136,6	1,136,6	1.152,5	1.162,4	1.172,7	1.171,2
Number of live births	16.062	16.063	16.064	16.212	16.715	16.573	17.010
Number of deaths	12.040	12.123	12.397	11,645	12.291	12.459	12.356
Natural growth	4.022	3.940	3.667	4.567	4.424	4.414	4.654
Population growth rate	-0,2	3,2	0,0	1,4	0,86	0,89	-0.13

Age and sex structure

227. The distribution of the population by gender has changed during the past century from a predominantly male population (59.7% in 1897), to, after 1970, a stable and higher percentage of women. There are currently more women than men living in Tbilisi, accounting for almost 55% of the population. This can be explained by the longer life expectancy of women (an average of 81 years in comparison to 73.99 years estimated for Georgia overall), as well as by higher share of men emigrating from Tbilisi[10].

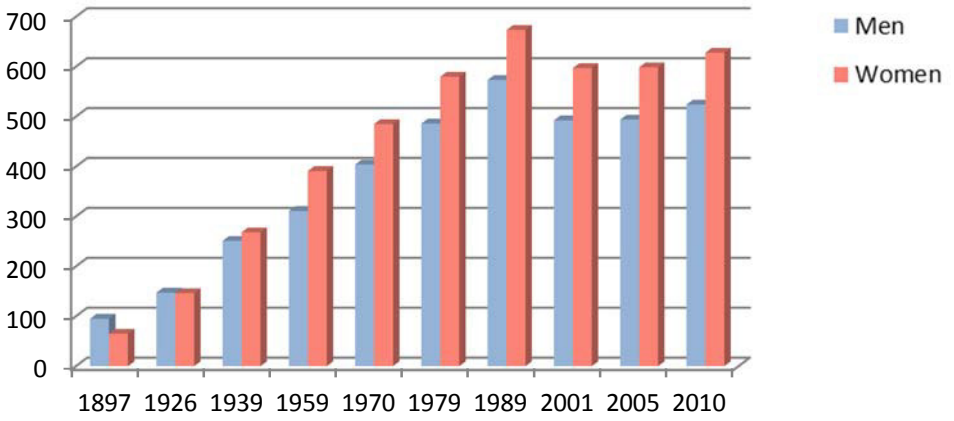


Figure 27.- Dynamics of Tbilisi population number and the gender balance

228. The share of younger population groups (under 40) has decreased dramatically in a relatively short time. In line with the reasons noted above, this trend can be attributed to sharp decrease in the birth rate (see figure 28); also combined with the relatively high level of child mortality in the mid 1990s.

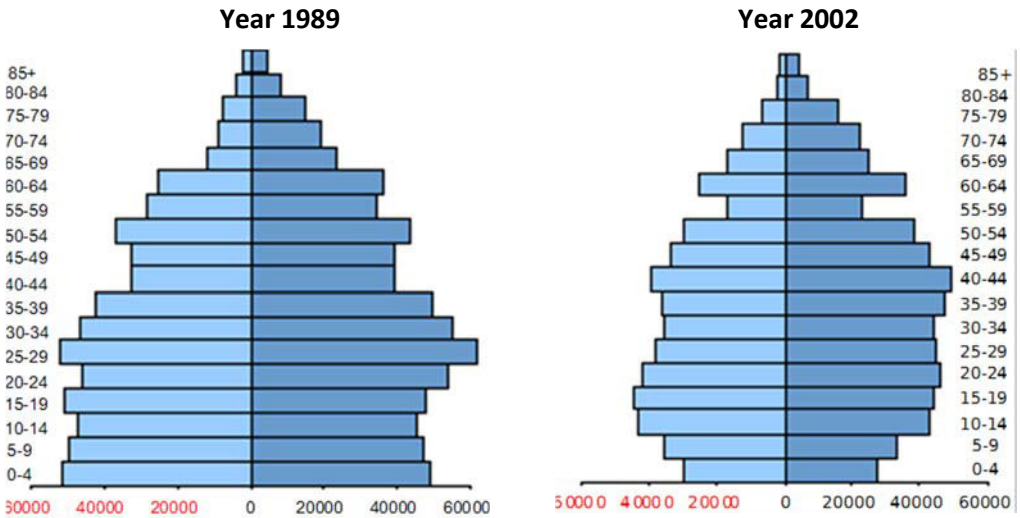


Figure 28.- Dynamics of Tbilisi population number and the gender balance

[10] Meladze, 2003 and https://www.cia.gov/library/publications/the-world-factbook/geos/gg.html

229. The negative impacts of the civil war, ethnic conflicts, etc. and the subsequent emigration of portions of the male population are also reflected in the shifting age-sex structure of Tbilisi's population. The reduction in the number of population of the soon-to-be productive age will have an impact on the labor market in upcoming years.

Trend in family size

230. There is a trend in family size; families are becoming smaller. The number of families with one child is on the increase, with 2 children has remained relatively stable, while those with 3 children are on the decrease. In 2002, only 10.5% of families in Tbilisi had 3 or more children, down from 18.8% of the families in 1970. The average family size was 3.4 persons in 2007 (Deloitte, 2007).

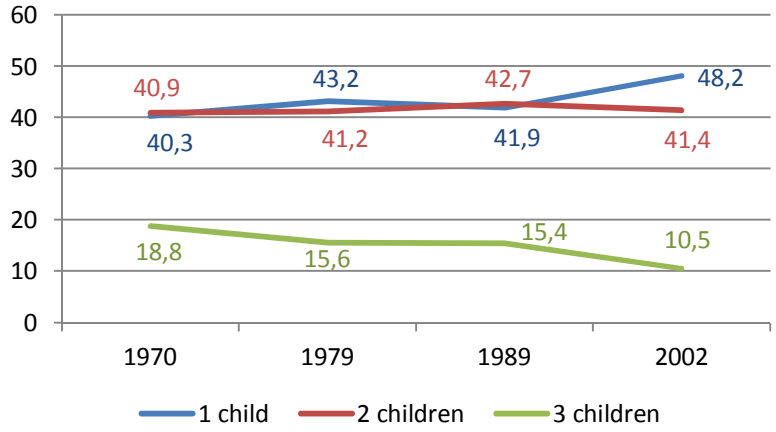


Figure 29.- Dynamics on distribution of number of children in the families

Ethnical structure

231. The population of Tbilisi has always been multi-ethnic. Different ethnic groups including Armenians, Assyrians, Azeris, Greeks, Jews, Kurds, Ossetians, Russians, Ukrainians and other ethnic groups have been living side by side with ethnic Georgians. In fact, Georgians were minority in the city in 19th century.

232. However, as the figures below demonstrate, in the past two decades, the city has undergone a strong "Georgianization" (see figure 30), due to massive emigration that occurred in the 1990s after the breakup of the Soviet Union

	1876	1897	1922	1926	1959	1979	1989	2002
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

	1876	1897	1922	1926	1959	1979	1989	2002
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	11.6	17.8	14.3	14.1	10.1	9.7	14.7	23.8
Total*	104.0	159.6	233.9	294.0	694.7	1056.1	1246.9	1081.7

*Total population (Thousands)

233. According to the 1926 Population Census only 6% (112 thousands) of all ethnic Georgians lived in Tbilisi, while in 2002 this number reached 84% (824 thousands).

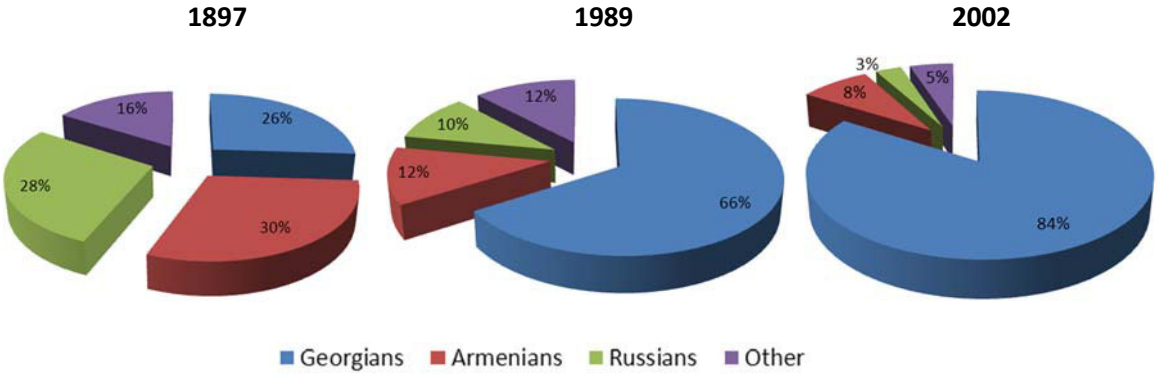


Figure 30.- Changes in ethnic composition of Tbilisi population

Education

234. Georgia's education system is structured as follows: noncompulsory preschool education (2 years), compulsory education (9 years: 6 years for primary education and 3 years for lower-secondary education), upper secondary (3 years), and tertiary education (4 years for Bachelors degree and 2 years for Masters- level education).

	2005/06	2006/07	2007/08	2008/09	2009/10
Number of public and private schools	319	321	313	323	330
Number of students			167374	179460	173942
Number of secondary professional schools	44	53	44	11	
Public	23	19	15	8	
Private	21	34	29	3	
Number of pupils of sec. professional schools	11908	12671	6928	1175	
Public	9172	7892	3844	919	
Private	2736	4779	3084	256	
Number of higher education institutions			109	89	84
Public	14	10	9	9	9
Private			100	80	75

235. Demand for general education services is projected to decrease rapidly in the near future. Due partly to migration and partly to declining fertility rates, the population of Georgia has been decreasing in recent years (a drop that has been noticeable for the education system), and the trend is expected to continue in the near future. Estimates indicate that

during 2005–2050, Georgia's school-age population will contract by 45 percent (at a rate of 1.7 percent per year). This trend will inevitably have an impact on the future demand for education services. While currently Georgia's education system serves approximately 604,000 children aged 5 to 14, it will serve only 270,000 children of similar age in 2050.

236. There is a visible increase in the levels of education in Tbilisi. In particular, the number of people that have completed secondary and university education has consistently increased since the early 1970s; this has resulted in a high share of residents with secondary and university degrees, and in a highly educated supply on the labor market.

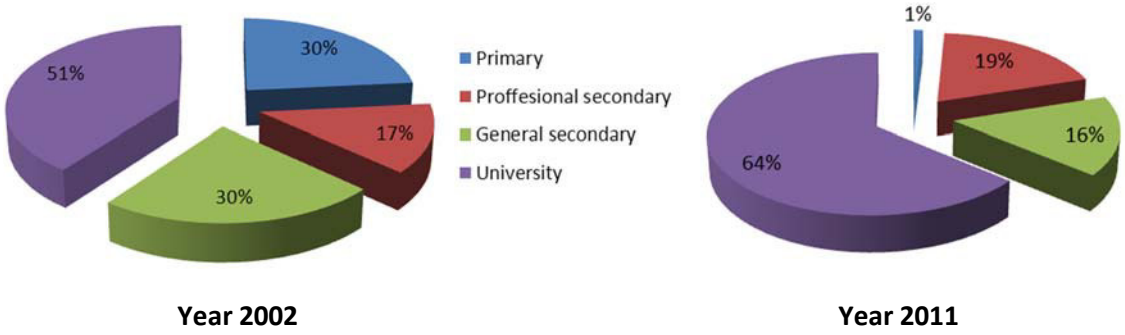


Figure 31.- Educational status of the population in the productive age

4.2.3 ECONOMIC CONDITIONS

Economic development

237. Development of Tbilisi as an industrial center intensified in the 1950s when the Soviet government launched the construction of a number of medium- and large-size industrial facilities in the city. The most developed industrial sectors were heavy machinery (including military), electronics and microelectronics, light industry, food processing, textiles, pharmaceuticals and perfumes. Industrial outputs were sold throughout the Soviet Union.

238. Political turmoil in the country and its capital city that followed the breakup of the USSR in the beginning of the 1990s brought Tbilisi's infrastructure and social-economic system to the brink of collapse. Economic activities drastically decreased, many industrial facilities stopped production due to losing traditional channels for supplying inputs and selling products in the markets of the former USSR. The energy supply to industry and households decreased to critical levels. In the period 1990-1994, the Gross Domestic Product (GDP) of Georgia plummeted by nearly 65%.

	1990	1991	1992	1993	1994	1995	1996
Changes in GDP	-15	-20.1%	-39.7%	-29.3%	-12.1%	3.3%	11.0%

239. Economic recovery in the country and its capital began in 1995 as a result of renewed political stability in the country, initiated privatization processes, and institutional and

structural reforms. GDP started to increase with growth rate amounting 6-12% between 2004-2007. Armed conflict with Russia in August 2008 and global economic crisis severely affected Georgia's economic development. Real GDP growth rate reduced to 2.3% in 2008 and it was negative in 2009. Nevertheless, GDP grew 6.4% in 2010, 7.2% in 2011, 6.2% in 2012 and 3.2% in 2013.

	Georgia's GDP in 2008-2013					
	2008	2009	2010	2011	2012	2013
GDP at current prices, mln GEL	19074.9	17986.0	20743.4	24344.0	26167.3	26824.9
GDP at constant 2003 prices, mln GEL	12491.4	12019.7	12771.3	13687.5	14533.6	14996.7
GDP real growth, %	2.3	-3.8	6.3	7.2	6.2	3.2
GDP per capita (at current prices) GEL	4352.9	4101.3	4675.7	5447.1	5818.1	5982.6
GDP per capita (at current prices) USD	2921.1	2455.2	2623.0	3230.7	3523.4	3596.6
USD/GEL (period average)	1.49	1.67	1.78	1.69	1.65	1.66

Labor market

240. The graphic below indicates that the percentage of active population in Tbilisi fluctuates between 52% and 56%. Tbilisi employs 21% of the Georgian labor force; however 45% of unemployed people, registered in the country, reside in Tbilisi.

241. Tbilisi attracts its workforce from all over the country. The number of formally economic active population in 2008 was 430,100, which accounts for 22.4% of the formally active population of the country. Slightly more than 300 thousand (i.e. ~70%) were employed.

	Labour market in Tbilisi in 2005-2011						
	2005	2006	2007	2008	2009	2010	2011
Unemployment rate (%)	29.0	30.2	28.0	29.8	29.6	30.1	29.3
Active rate (%)	54.4	52.9	55.3	52.4	53.2	55.5	54.7
Employment rate (%)	38.6	37.0	39.8	36.8	37.5	38.8	38.7

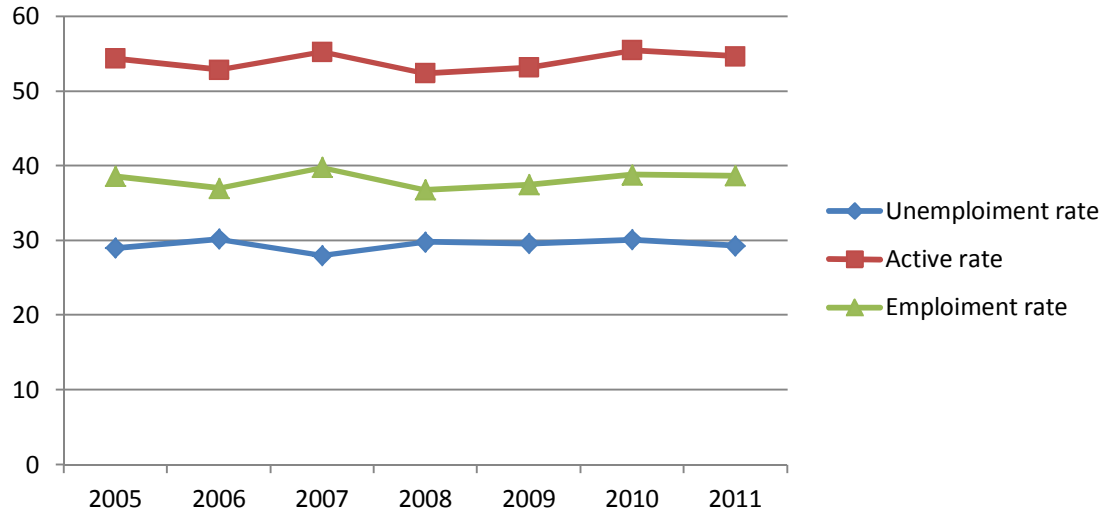


Figure 32.- Labor market in Tbilisi (2005-2011)

242. The unemployment rate has been high since 1991. The reports available on growth rates indicate an increase in the period 2000-2004 from 19.3 to 26%, and to over 30% in the second half of 2000s. According to official statistics, in 2008, the unemployment rate in Tbilisi was 29.8% of the formal, economically active population.

	Labor market in Tbilisi (by thousands units)						
	2005	2006	2007	2008	2009	2010	2011
Active population	429,8	434,7	480,7	430,1	438,4	455,3	437,4
Employed	305	303,6	346,1	302,1	308,7	318,3	309,4
Hired	248,9	248,8	291	240,6	241,1	251,0	251,2
Sef -employed	55,6	53,8	55,2	61,4	66,7	67,1	57,3
Un-employed	124,8	131,1	134,6	128	129,7	137,0	128,0

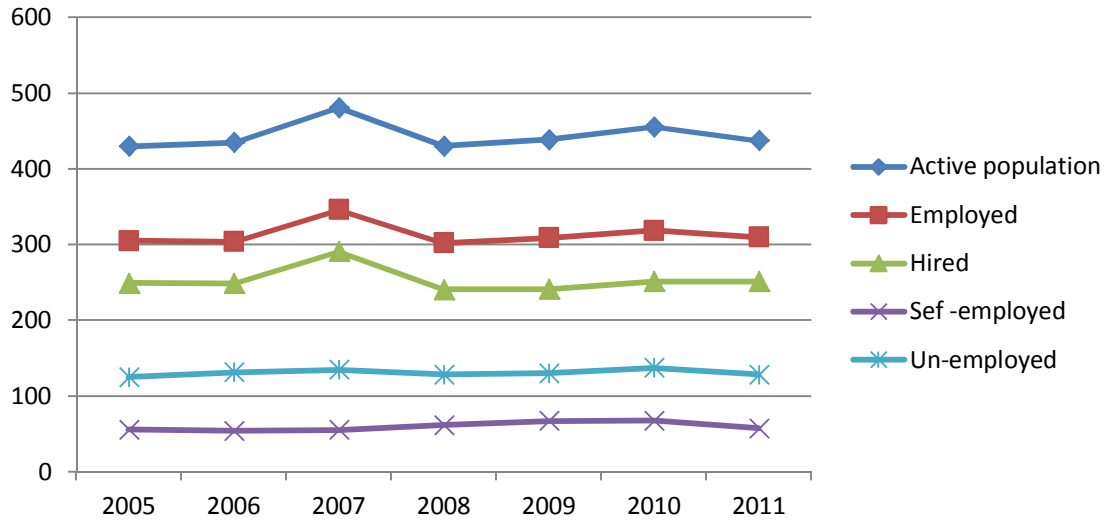


Figure 33.- Labor market in Tbilisi (2005-2011)

243. Statistics shows that the groups below 30 years of age have a higher unemployment rate, while age groups above 60 years of age have lower unemployment rates. This was after structural reforms in public sector (e.g. administrative, police, educational, healthcare reforms, etc.), as well as technological innovations in commercial sectors.

Employment structure

244. The biggest employers are transport and communications companies, industry, and retail trade. These, along with the educational and heath care section (12%) and the construction sector (10%).

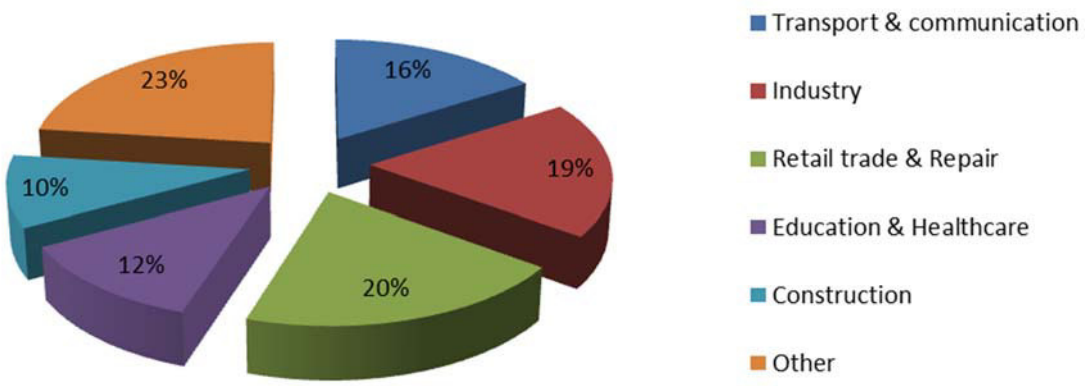


Figure 34.- Formal employment structure in Tbilisi (2011)

Average income

245. Tbilisi's economic importance for Georgia is indisputable: 64% of total goods and services are produced in the capital city and average household income is 45% higher in Tbilisi compared to the rest of Georgia.

246. According to the National Statistical Office, average cash income per capita in Tbilisi was 168 GEL (about 100 USD) per month and the monthly subsistence minimum for average consumer was about 115 GEL (about 66 USD) in 2009.

247. There is no statistical data for income inequality for Tbilisi specifically, but generally speaking, income inequality is high in Tbilisi, and among the poor and socially vulnerable, the unemployment level is even higher.

248. There is no concentration of poor households in particular districts of the city. Both wealthy and socially vulnerable families can be found in all districts of the city. The table below provides information on the average household (four members) income and sources of the income in Tbilisi.

	2006	2007	2008	2009
Cash income and transfers	**368.5**	**439.2**	**570.7**	**614.4**
Wages	**213.6**	**266.0**	**339.5**	**357.0**
From self-employment	55.0	49.6	81.1	90.7
From selling agricultural production	0.5	0.1	2.8	0.5
Property income (leasing, interest on deposits…)	2.7	8.1	6.1	8.8
Pensions, scholarships, assistances	30.3	37.6	59.4	65.6
Remittances from abroad	18.6	26.9	23.3	27.7
Money received from relatives and friends	47.7	50.8	5	64.2
Non-cash income	13.3	**13.4**	**15.8**	**13.1**
Income total	**381.8**	**452.6**	**586.4**	**627.5**

4.2.4 INFRASTRUCTURE AND INDUSTRIE

Industrie

249. The events of the 1990s in Georgia and its capital as well as the economic developments brought Tbilisi infrastructure and social-economic system to the brink of collapse. The main economic parameters started to improve as of 2001. As a result of comprehensive social and economic reforms of the new Government the Gross Domestic Product (GDP) started to increase in 2003. A significant share of the economic growth comes from the economic activities in Tbilisi.

250. Construction industry, transport and telecommunications compose the economic foundation of Tbilisi. Much more than half of the products produced in Tbilisi come on these fields. Only few of industrial or business enterprises are located in the project area:

- ✓ National Center of High Technologies - Institute of Isotopes (21 Kavtaradze str.)
- ✓ MAGTICOM – cellular phone operator (5 Politkovskaia str.)
- ✓ Market of Construction Materials (Kavtaradze str.)
- ✓ Zonal Experimental Scientific Design Institute TBILZNIEP (5A Sandro Euli str.)

251. Development of the new branch of metro will have certain positive impact providing more possibilities and choices for the employees of the mentioned entities.

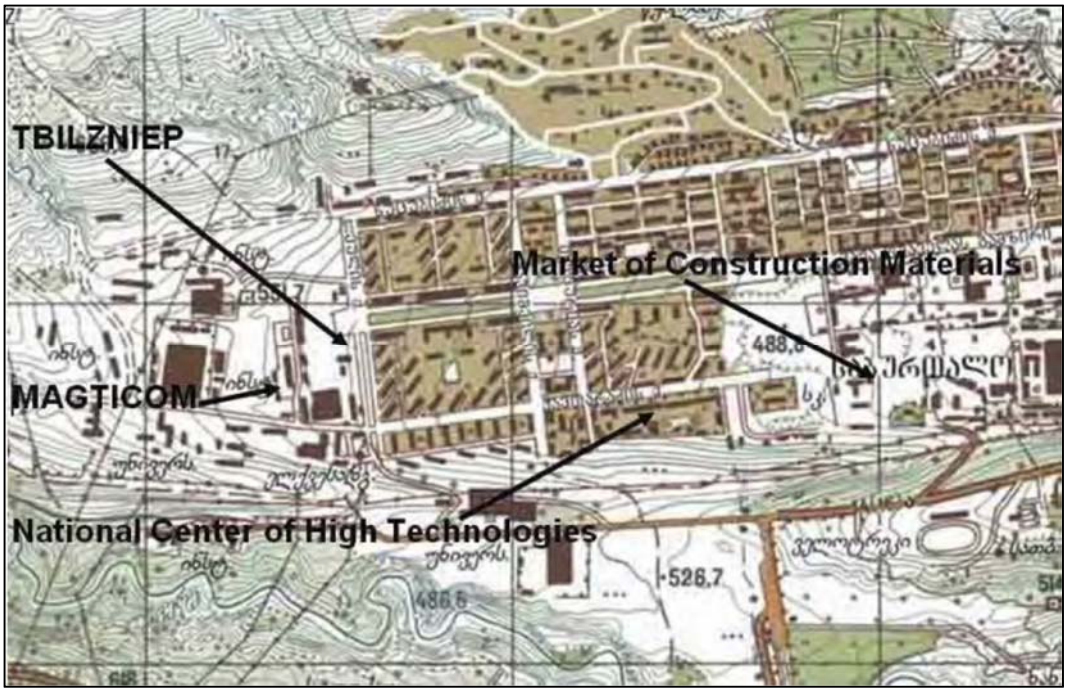


Figure 35.- Industrial and business enterprises at the project area

252. There is well developed infrastructure in the Project area that includes water supply, power supply, gas supply, communication cables (telephone, internet, cable TV). Most

significant of utilities - "Georgian Water and Power" (GWP) delivers 21 m^3/sec. of drinking water to Tbilisi and its neighborhood. Tbilisi water supply system uses both – groundwater and surface water resources. The intake of underground waters takes place in Aragvi Gorge (about 40 km from Tbilisi), and surface water intake is carried out from Tbilisi Sea through Grmagele and Samgori treatment facilities. The residential districts adjacent to the construction site are supplied with drinking water with 300 and 600-mm-diameter steel pipes. The system pressure reaches 6 atmosphere. The system is amortized and needs replacement. At present, there are no visible leakages on the study territory.

253. Construction of the storm water drainage system of Tbilisi started in 1835. Brick sewers in which utility and sanitary waters as well as rainfalls flowed and empted in the river Mtkvari. At present Tbilisi drainage systems with the diameter of 150- 1200 mm are built with brick, arch, concrete, reinforced concrete, ceramic, cast iron, asbestos cement and polyethylene pipes. The drainage system is self-flowing. The total length of the network system is 1600 km. The length of the main trunk wastewater sewer is 72 km. The waste water flows through the sewer to Gardabani Treatment Plant. There are 42 separating chambers on the main sewer. The capacity of Gardabani Treatment Plant is 1, 0 million cubic meters/day. The water-drainage system is amortized, but is in the working condition, mainly consisting of 800-mm-diameter cast iron pipes.

Power sources and transmission

254. Currently 24 hour uninterrupted power supply of the residential houses, public buildings, industry, transport sector and commercial entities in Tbilisi is ensured by the power generation and distribution system. Tbilisi Metro is considered as one of the major consumers of electrical energy, it uses 62.000 MWt/h of electricity.

255. Power supply for the residential districts adjacent to the Project site comes through 600-KV sub-station "Saburtalo-2" located within 280m from the site, at the beginning of Jikia Street. Electricity is supplied to 7330 subscribers, which use about 1,7 MW/hour of electricity in winter period and 1,3 MW/hour of electricity in the summer period.

Transportation

256. Transport infrastructure is one of the most important indicators of the quality of urban life. The Tbilisi transport infrastructure is extremely functional and widely used, despite the fact that it has some deficiencies. The annual number of municipal transport passengers in Tbilisi amounts to 149,9 million/year (Buses + underground). This amounts to, on average, around 410.700 per day. In 2008, the number of passengers transported by metro and buses was almost equal (respectively 51% and 49%). During the last 2 years, the role of buses has increased significantly (from e.g. 36% in 2007 to 43% in 2011):

		Passengers				
		2007	2008	2009	2010	2011
Underground	Every year (mln)	91.8	87.5	78.3	78.9	85.1
	Every day (thousand)	251.0	240.0	214.5	216.1	233.2
Buses	Every year (mln)	51.9	84.2	56.9	62.4	64.8
	Every day (thousand)	142.0	231.0	155.8	171.0	177.5

Source: Transport Municipal Department of Tbilisi City Hall (2011)

257. The urban transport network is structured as follows:

258. Public transport system consisting of:

	Underground	Buses
Length of network in km	57	2178
Number of lines	2	91
Number of station	22	1788

Source: Transport Municipal Department of Tbilisi City Hall (2011)

- There is a red and green Metro line; presently the system consists of two lines, 22 stations on 26.4 kilometers of track. 20 stations are below ground and two are at surface level. Of the subterranean stations 16 are deep level and 4 shallow. Due to Tbilisi's uneven landscape, the metro, particularly the Gldani-Varketili line, in two cases goes above ground.

Figure 36.- Line map of Tbilisi metro

- A number of well-equipped bus lines with high frequencies on corridors where the Metro is not available (for example Vake to Center or Saburtalo to Gldani);
- Bus lines along the Metro corridor,

259. Private transport systems involve:

- Minibuses lines that are operated privately and hence are not considered part of public transport system. They compete with the bus lines off the main corridors (except in the old city), offering quicker service and on-demand stops.
- Taxis are operated by private companies and are bringing passengers to every place in the city. The taxis are not registered

260. The construction site is crossed by the routes of 9 buses (13, 21, 25, 44, 55, 71, 92, 115, 125) and 9 fixed-run microbus-taxis (19, 75, 88, 137, 147, 149, 184, 200, 201). Most of the buses and microbuses run on diesel fuel and as usual are not in a good technical condition, so the pollution from emissions exceeds the maximum permissible concentration. After the metro station is put into operation, presumably the emissions of harmful substances into the atmosphere by the public transport will be reduced.

4.2.5 PUBLIC HEALTH AND SAFETY

261. According to the 2002 census, the latest census in Georgia, 45.1% of the population in Tbilisi was male with the remaining 54.8% being female. The average age of the population was 35.8 years, with the average age of the male population being 33.6 and for females, 37.6 years. There are no statistical data on life expectancy for Tbilisi specifically. However, at the country level, according to the World Health Organization (WHO), life expectancy at birth for males was 66 years in 2006, while for females this indicator was 74.

262. Polyclinics, dispensaries, health centres, female consultation clinics, doctor ambulatories and hospitals (in-patient healthcare) make up the core of the primary health care system in Tbilisi. Current data on health indicators in Tbilisi (2009) are as follows:

- Number of hospitals 78 Number of hospital beds 4,078
- Independent women consultations, clinics and dispensaries 117
- Number of physicians (excluding dentists) 10,098
- Number of paramedical personnel 7,079

263. The metro system is used mainly by patients of the primary healthcare facilities and specific medical and diagnostic centers. Three of primary facilities are located in the project area. Some of the specific hospitals, medical and diagnostic centers are located close to the metro line and could be used by patients.

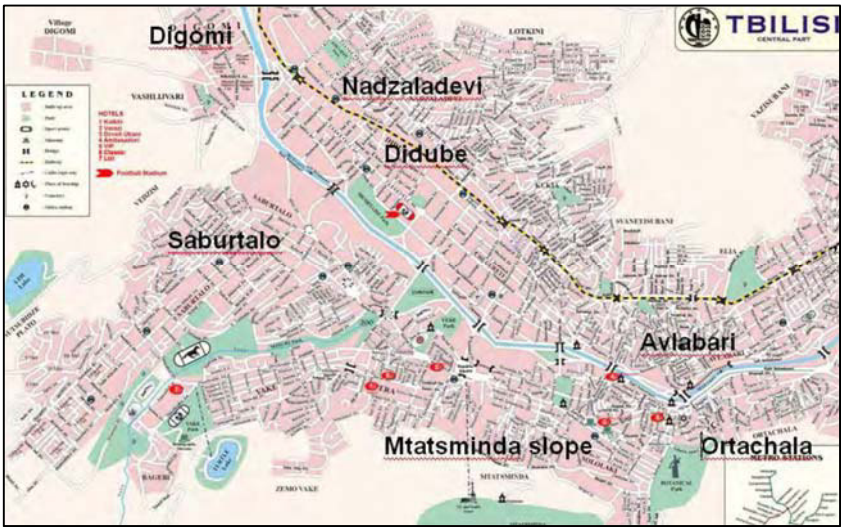
264. Particularly, along the Vaja-Pshavela line – the Republic Infectious Disease Clinic, Republic Central Clinical Hospital, Septic Center, AIDS center, children policlinics and policlinics No 26, Diagnostic center “Limbach Group” and Children Diagnostic Center are located in the vicinity of metro station “Medical University”. The research Institute of Hematology and

Transfusion, National Center for Disease Control, Research Institute of Psychology, Research Institute of Narcology are located near the metro station Delisi. Republic Clinic No 2 – Medical center integrating several clinics (16 Kavtaradze str. 300 m from the project site), Cardio-diagnostic center and Family Medicine Center No 1 (15m from project site) are located in the vicinity of metro station Vaja Pshavela.

4.2.6 CULTURAL RESOURCES AND ARCHAEOLOGICAL SITES

265. Archeological studies have demonstrated that territories of Tbilisi have been populated since the ancient age (5th-6th cc. B.C.) through the Late Feudal Age. There are over 150 archeological monuments of different periods found at present, including: Delisi site of ancient settlement in Vazha-Pshavela avenue (V-IV cc. B.C.), sites of ancient settlement and tombs of the Early and Middle Bronze Ages (IV-II cc. B.C.) in Digomi, Saburtalo, Vashlijvari, etc.

266. The territory of Tbilisi was particularly densely populated in the Late Bronze and Early Iron Ages (XIV-VII cc. B.C.). The sites of ancient settlements and burials of this period have been found in Avlabari, Ortachala, Saburtalo, Didube, Digomi, Mtatsminda slope, Nadzaladevi, Avchala and in other places. The monuments of the Antique Age (VI c. BC – II-IV c. AD) were found in Avlabari, Mtatsminda slope, Tavisupleba Square, Agmashenebeli Avenue, Digomi, Saburtalo, Gldani, Vake, Didube, Nadzaladevi, Ortachala, Grmagele, etc.



267. During the metro earthworks at Vaja Pshavela avenue in 2001 there were several chance findings identified as artifacts of the Antique Age. The ordinary citizen of Tbilisi brought the artifacts they found at Vaja Pshavela open cuts to Tbilisi archeological museum. A bronze lion and gladiator statuette dated by the I-III cc. and a silver bowl with the Phalaurian inscription were found.

268. The archeological excavations carried out later have shown that the metro earthworks in 2001 had damaged several tombs of the Late Bronze and Antique Ages. There are several archeological sites (Tombs No.1, 2, 9, 10, 11) already identified/known in the Project area as burial place Namgala Mitsa.

5 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

269. This section presents key environmental issues and mitigation measures associated with the proposed Project. The long-term impact of the Project is mainly beneficial. Short-term impacts during the construction phase can be mitigated with proper planning, good engineering and construction practices, and implementation of specific mitigation measures.

5.1 EXPECTED BENEFITS AND POSITIVE IMPACTS

270. The project will result in significant positive impacts. Some of these are non-tangible parameters such as social-economic benefits resulting from safer transport, reductions in travel time, and better accessibility. The main positive impacts that have been identified are:

- Employment opportunities
- Traffic congestion reduction
- Reduced travel times
- Benefits to economic activities
- Quick and safer public transport
- Fuel consumption reduction
- Carbon dioxide reduction and air quality improvement

5.1.1 EMPLOYMENT OPPORTUNITIES

271. The construction of the Extension from Delisi station to University is estimated to be accomplished in a period of 21 months. During this period, a lot of laborers will be required for many construction, operation and maintenance activities.

5.1.2 TRAFFIC CONGESTION REDUCTION

272. It is quite clear that the project (2.6 km long Metro extension from Delisi Station to University Station) will improve the traffic congestion situation, one of the biggest issues facing Tbilisi today. The Metro will streamline and facilitate movements of public from the West to the center of the city. It is estimated that Metro Line No.2 will carry over 150,000 passengers per day – trips that would otherwise have been undertaken using road transport.

273. Improved public transport and reduced congestion will significantly enhance the city's attractiveness. Tourism activities, an increasingly important contributor to the City's economy, will directly benefit from these improvements.

5.1.3 BENEFITS TO THE ECONOMY

274. Tbilisi is the capital of Georgia with a population of 1.14 million inhabitants. Based on local development strategy and existing masterplans, the Government has prioritized the improvement of transport services in all towns and cities through the country, starting in areas of most urgent or strategic needs.

275. The development of a sustainable urban transport network is a key component for the development of urban areas and to enhance the role of Tbilisi as an important business centre in the South Caucasus region

5.1.4 FUEL CONSUMPTION REDUCTION

276. There is a significant increase in the number of private cars in Georgia (see table below). Almost 200,000 cars belong to the inhabitants of Tbilisi (235,059 in 2009).

Registered vehicles in Georgia 2000-2006

2000	2001	2002	2003	2004	2005	2006
201,992	225,992	250,358	276,225	306,211	342,047	387,866

277. The daily number of passengers that uses Metro Line No.2 is 150,000. These are trips that would otherwise have been taken using road transport. On the basis of expected modal splits, it can be assumed that these trips would be 40% by bus, 40% by car and 20% by taxi. Using occupancy rates of 3 per taxi, 2.0 per car, and 60 per bus this gives approximately the following vehicle trips:

- Cars : 30,000
- Buses : 1,000
- Taxi : 10,000

278. Considering that the daily average movement that will be covered with the project is 1,7 km (from Vazha Pshavela Station to University Station and vice versa: 1087 left track and 1237 right track), and the gasoline consumption of a car inside the city is around 12 litre gasoline/100 km, the total gasoline consumption for the trips by private transport is estimated as:

[30,000 (cars/day) + 10,000 (taxi/day)] x 1,7 (km/day) x12/100 (litre/km) =
8,160 litres gasoline/day

279. The benefit to fuel consumption reduction is very clear. Once the two new stations of Metro Line No.2 will be operational, the total gasoline consumption reduction from private vehicles will be around 2,9 million litres of gasoline per year. (This does not include the bus journeys).

5.1.5 AIR EMISSIONS REDUCTION

280. Air emissions from industrial facilities have been significantly reduced, while emissions from traffic have increased substantially due to the increased number of motor vehicles in the city.

281. Auto transport exhaust is a major source of air pollution in Tbilisi today. The level of air pollution caused by auto transport depends on type, average age, technical fitness of transport, type and quality of fuel, management of transportation flow, conditions of natural ventilation (general micro-relief of town, characteristics of its development, meteorological parameters, seasonality), working regime of engines and other factors.

	Number of automobiles registered in Tbilisi (2009)				
	0-5 years	6-10 years	11-15 years	16-20 years	Above 20 years
Total	22192 (8%)	25950 (9.4)	69055 (25.2%)	66916 (24.4%)	90329 (33%)
Light automobiles	17766	23764	62147	57175	74205
Truck	1095	966	3186	3317	7259
Bus and microbus	1085	481	2664	4855	6550

282. According to 2010 data, there is an average of 325.000 operational automobiles in Tbilisi (all types); this constitutes 41% of the vehicle fleet existing in the country. The total length of roads and motorways of Tbilisi is 1200 km. The flow capacity of main and secondary roads of Tbilisi is 1500 cars per hour. It should be noted that the majority of automobiles in Tbilisi are old and correspondingly poorly maintained, which increases transport-induced emissions.

283. There are no data on emissions from auto transport in Tbilisi. However, taking into account that the number of cars in Tbilisi constitutes 41% of all vehicles in Georgia, it is possible to calculate emissions for Tbilisi based on emissions from transport in Georgia, which is presented in the table below.

	Quantity of emitted hazardous substances (tone per annum)					
	Carbon Oxide CO	Nitrogen Dioxide NO_2	Sulphur Dioxide SO_2	Carbon Hydrogen ∑CH	Benzopiren $C_{20}H_{12}$	Carbon Dioxide CO_2
Auto-transport consuming gasolina	204700	11631	930	37218	0.1070	1492451
Auto-transport consuming diesel fuel	46922	13138	7507	20645	0.1164	1204193
Auto-transport in Georgia	251622	24769	8438	57864	0.2234	2696644
Auto-transport in Tbilisi	103165	10155	3460	23724	0.09	1105624

284. The air emission loads caused by a car is described as follows[11]:

- CO_2 : 189 gr/km
- NO_x: 0.3 gr/km
- SO_2 : 0.18 gr/km
- CO: 3.8 gr/km
- CH: 0.4 gr/km

285. With the reduction of 40,000 car and taxi trips and car trips per day due to the Metro operation, a large amount of CO_2 and air pollutants will be removed from the city air environment as described below (Again, this does not include the reductions from bus trips).

- CO_2 : 189 gr/km x 1,7 km x 365 days/year = 117,274.5 gr/ year (1 vehicle)
- NO_x: 0.3 gr/km x 1,7 km x 365 days/year = 186.2 gr/year (1 vehicle)
- SO_2 : 0.18 gr/km x 1,7 km x 365 days/year = 111.7 gr/year (1 vehicle)
- CO: 3.8 gr/km x 1,7 km x 365 days/year = 2,357.9 gr/year (1 vehicle)
- CH: 0.4 gr/km x 1,7 km x 365 days/year = 248.2 gr/year (1 vehicle)

5.2 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES DURING CONSTRUCTION PHASE

286. Completion of the infrastructure is expected to take 21 months and will not involve major construction as the tunnel and most of the basic structure of the underground station has already been built.

287. The majority of the remaining works will mostly be done underground, and the main interactions with the surface environment will be at the existing construction sites at Vaja Pshavela station and University station. Most of materials will be loaded into special railway wagons at the existing open-air sections

288. Impacts of the construction works are expected to be mainly temporary and relatively minor because both locations are a good distance from surrounding houses, and there are no other especially sensitive features nearby. Disturbance can be reduced by commonly used mitigation measures (traffic planning, noise screening, spraying to reduce dust, etc) and there is no requirement for land acquisition or relocation of people and there should be no economic displacement.

289. The potential negative impacts are many as listed below:

- Air pollution
- Noise and vibration
- Community and traffic disturbance
- Soil and water pollution (ground and surface water)
- Solid waste and spoil disposal
- Ecological damage (flora and fauna)

[11] Emission factors correspond to average speed of 25-30 km/h, Source: DOSTE, 2000

- Public and safety risks (occupational safety, diseases, land subsidence and flooding risk).
- Impacts on cultural relics and archaeology

5.2.1 AIR POLLUTION

5.2.1.1 Impacts

290. Constructing the line involves the use of heavy machinery, bulldozers, excavators, vehicles and equipment to transport construction materials. Construction activities have the potential to generate dust, as wellas other emissions from construction machinery/vehicles (carbon monoxide, NOx, SO_2, hydrocarbons, and particulate matter), so air quality is likely to be degraded to an extent during the construction period.

291. Dust is likely to be the main issue, produced in and around the surface construction sites by construction activities and heavy vehicles, and along transportation routes. Exhaust emissions will also contribute to a general lowering of air quality in these areas, but this will not be a major issue because houses and flats are located some distance from the sites and wind dispersion is generally good in Saburtalo area.

292. It is not possible to eliminate the emission of dust from a construction sites entirely; nevertheless, mitigation measures should be implemented to reduce the impact on about 5-7 thousands residents in the residential blocks along both front lines of Vaja Pshavela Avenue, neighboring the shafts construction sites and the station construction site.

5.2.1.2 Mitigation measures

293. To reduce gaseous and dust emission during construction, the contractor shall implement the following measures:

- Water spraying inside and around the construction sites as well as for transport vehicle wheels will be done regularly.
- Materials transported to site will be covered/ wetted down to reduce dust.
- Construction materials should be stored as far as possible from the residential areas and must be properly covered;
- Use only vehicles and equipment that are registered and have necessary permits. All vehicles will be checked and repaired in case of need to eliminate increased emission due to damaged parts
- Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited.
- Concrete production plants shall be located more than 300m away from the residential buildings to avoid direct impact of emissions (government Decree # 234n by Ministry of Health and Social Welfare of Georgia, 2003).
- Impose speed limits on construction vehicles to minimize road dust.

- Existing trees on site should also be retained as much and as long as possible as they will also help to intercept dust.

294. Conclusion: Impact of the project on air quality is minor, temporary (mostly limited to construction period and maintenance activities) and is easily manageable through application of good construction and vehicle/equipment maintenance practices.

5.2.2 NOISE AND VIBRATION

5.2.2.1 Impacts

Noise

295. The operation of construction equipment and transport vehicles and the construction methods employed during construction phase will likely cause significant noise settlement which can disturb communities around the project area at noise sensitive receivers (mostly residential blocks along Vaja Pshavela Avenue, specially those located close to University Station where construction works will be done at an open site).

296. To adequate University Station, it will be necessary to do some demolition works that will cause noise, because of the use of mechanical equipment (hammer drills, concrete vibrators, etc).

297. There could also be noise impacts along routes used by heavy vehicles bringing equipment and materials to site. Access routes to construction sites should therefore be planned with the objective of avoiding any buildings or locations that may be specially vulnerable to noise disturbance (schools, hospitals, etc).

298. The activities inside the tunnel at the depth of 20 to 50 meters will be unlikely to generate any noise that can be perceived by people above the ground.

299. The baseline environmental data shows that the existing noise levels monitored along Vazha-Pshavela Ave. already exceed the permitted maximum noise standard during day time (7 am to 11 pm: 55 dBA). Thus, the noise impact will be intensified during the line construction, especially at open sites construction/demolition works. Table below illustrates some examples of typical noise levels from construction equipment.

300. 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 (15.24 m) 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:

Source of noise	Equivalent noise level, dBA
Backhoes	84 – 85
Bulldozers	84 – 85

Source of noise	Equivalent noise level, dBA
Graders	91 – 92
Compressors	80 – 88
Jackhammers	85 – 98
pile drivers	96 - 107
Compacters (rollers)	72 – 75
Front loaders	72 – 83
Tractors	78 – 95
Scrapers, graders	80 -95
Pavers	85 – 88
Trucks	83 - 93
Compressors	75 - 88
crane, movable	75 – 85
Hammer drills	82 - 98
Vibrator	82 - 98
Saw	72 - 82

301. These noise levels at the distance of 7 meters from the noise source obviously exceed the allowed standards.

302. 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:

$$\text{Sound level 1} - \text{Sound level 2} = 20 \log r_2/r_1.$$

303. This means that for every doubling of distance, the sound level decreases by 6 dBA ("inverse square law").

Distance from the Edge of the Construction Ground	Predicted Noise Level Average Value - dBa	Predicted Noise Level Maximum Value - dBa
5 m	80	90
10 m	74	84
20 m	68	78
40 m	62	72
80 m	56	66
160 m	50	60

304. As a result of rough estimation of construction related noise, we can assume that 60dB noise (average value) is generated at a distance of 50-60m from the work-site. As the closest residential houses are situated at a distance of 15 to 40 meters from construction sites, the impact due to noise will affect most of the residential blocks along Vaja Pshavela Avenue.

305. It is not possible to eliminate the emission of noise from a construction sites entirely; nevertheless, mitigation measures should be implemented to reduce the impact on residents in the residential blocks along both front lines of Vaja Pshavela Avenue, neighboring the shafts construction sites and the station construction site.

306. One especially sensitive receptor is the hospital located at Kavtaradze street, and as this is over 800 m away from University Station, noise should not affect patients in this facility.

Vibration

307. Vibration and ground-borne noise are aspects of the same phenomenon, perceived differently or conveyed in different media. Vibration is movement of a surface or structure perceived by humans by the tactile sense; ground-borne noise is vibration of a surface or structure perceived by humans as sound.

308. According to the project design scope, the use of a large TBM (Tunnel Boring Machine) is not considered because the underground structures, the excavation, the support and lining are almost fully completed, and only some minor works need to be completed.

309. However, there will be certain potential vibration sources in the construction phase, due to the demolition works that need to be done to adequate University Station. Vibration due to demolition works will principally affect workers and should not have an impact on nearby structures, as they affect areas contiguous to the machine activity within a radious of 5 m. The closest buildings are more than 20 m away from the demolition areas.

310. The activities inside the tunnel at the depth of 20-50 meters will be unlikely to generate any vibration that can be perceived by people above the ground.

5.2.2.2 Mitigation measures

311. Mitigation measures to be implemented by contractors to reduce noise and vibration levels from construction works are listed below:

- Use only vehicles and equipment that are registered and have necessary permits.
- All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people. All vehicles will be checked and repaired in case of need to eliminate increased level of noise due to damaged parts.
- No noisy construction-related activities will be carried out during the night. Such activities shall be restricted to daylight hours.
- Use of silencers, mufflers and acoustic shields on plant and equipment;
- Truck drivers and equipment operators shall minimize the use of horns.
- Limits on the number of machines used at any one time;

312. Conclusion: All noise impacts generated from the proposed works are expected to be adverse, but temporary and of moderate magnitude (as there will be no explosions, the majority of the tunneling works have been completed…).

313. Vibration sources will not affect buildings in the area, as the buildings are located more than 20 m away from the demolition areas.

5.2.3 GEOLOGY, SOIL AND WATER POLLUTION

5.2.3.1 Impacts

314. The principal source of construction impacts on geology and soils for this particular Project is related to the groundwater. Throughout the long existence of the tunnel, groundwater has drained into the tunnel void through the unsealed walls, and this has been removed continuously by pumping to the surface and discharging through roadside drains into the River Mtkvari.

Figure 37.- Water in the tunnel and University Station

315. The project includes the design of the waterproofing system and the drainage system to be used in the tunnel, stations and the remaining operational elements in the section. It will only be necessary to carry out the cleaning of the existing drainage system (side drainage channels and centreline channel) and the restoration of the PVC half-pipe channel, which is anchored to the upper part of the slurry walls and collects the small inflows detected in localised zones in the tunnel.

316. The completion of the works related to the desing of the waterproofing system and the drainage system, may therefore represent, in itself, the major mitigation measure to prevent lowering of water table and avoid negative impact on geo-technical characteristics, as this will greatly reduce the volume of water entering the tunnel, allowing the water table to return to its “natural” level.

317. As the Project will involve only very limited tunneling/drilling works, the main potential impact to this element is that the underlying groundwater quality may be affected during the construction phase (from both underground and above-ground works) due to poor control/treatment of concrete wash waters, leakage of fuel from construction vehicles/equipment, oil spillages during refueling or equipment maintenance operations, leakage from chemical storage areas and inappropriate disposal of chemicals (paints, oils, glues etc.). Surface contaminants can then migrate towards underlying groundwater sources.

318. All of the potential risks to ground - and surface- water in the construction phase are considered likely to be of low significance. This is mainly because contractors will be required by their contracts to operate good housekeeping practices to prevent leaks and spills (as described below), which should protect the surrounding groundwater and soil.

5.2.3.2 Mitigation measures

319. Specific mitigation measures should be implemented at the construction site for prevention of water and soil pollution:

- Contractors will ensure the proper handling of lubricants, fuel and solvents. Store fuel and hazardous substances in paved areas in tightly sealed containers to avoid contamination of soil and water resources. Regularly check containers for leakage and undertake necessary repair or replacement. If spills or leaks do occur, undertake immediate clean up.

- Refueling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, must take place in a designated bunded area of the construction compound. The refueling area should not be situated close to any surface water drain. If it is not possible to bring a machine to the refueling point, fuel will be delivered in a double skinned mobile fuel bowser.

- 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.

320. Contractors will be required to prepare and implement an emergency response plan, that will specify containment measures for pollution incidents, a list of appropriate clean-up materials and equipment, details of staff responsibilities and trained personnel, and contact details for pollution clean-up teams, relevant local authorities and emergency services.

5.2.4 IMPACTS ON FLORA

5.2.4.1 Impacts

321. The Project does not involve temporary or permanent loss of habitat along the new extension or at the metro station entrances during construction or operation phases.

322. It will be necessary to cut and uproot some trees planted in the different areas designed by the project. An inventory of all trees subject for clearance has been prepared:

Area	Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground					Total
		61-90	91-120	121-150	151-180	> 210	
A-5	Larch (*Larix decidua*)					4	4
	Pine (*Pinus* sp.)					2	2
	Larch (*Larix decidua*)				1		1
	Horse chesnus (*Aesculus* sp)		2				2
	Pine (P*inus* sp.)		2				2

Area	Type of tree	Diameter at Breast Height (DBH) measured 1,30 cm above the ground					Total
		61-90	91-120	121-150	151-180	> 210	
A-7	Plane tree (*Platanus sp.*)	1	1				2
A-8	Ash tree (*Fraxinus* sp.)		1				4
A-9	Walnuts (Juglans regia)						2
	Mature lime (*Tilia* sp.)						1
	Ash tree (*Fraxinus* sp.)						1
							21

323. A total of 21 trees will be affected. The species are not valuable or rare. Although these trees are not considered to have biodiversity value, they have value in terms of landscaping, shade and visual amenity.

5.2.4.2 Mitigation measures

324. After completion of construction works re-vegetation will be carried out in order to compensate for tree losses. 21 trees will be removed from the project site:

- 5 Larch (*Larix decidua*)
- 2 Horse chesnut(*Aesculus* sp.)
- 2 Plane trees (*Platanus* sp.)
- 4 Pines (*Pinus* sp.)
- 5 Ash trees (*Fraxinus* sp.)
- 2 Walnuts (*Juglans regia*)
- 1 Mature lime (*Tilia* sp.)

325. Therefor to mitigate this impact more than three times this number of new trees will be planted. A total of 63 new trees will be planted and 52 trees will be protected by installing tree protection fences as shown in the picture.

326. This 52 trees to be protected are the ones located in areas described in chapter 4.1.7, that it is not necessary to cut.

327. Conclusion: Impact on vegetation during construction works will be direct (damage, loss) and indirect (emissions). As the trees that will be cut down are only 21 (low magnitude) but have value in terms of landscaping, shade and visual amenity (medium significance), the impact on vegetation can be evaluate as minor. Cutting of trees and mitigation/compensation

measures should be agreed with the local municipality as well as list tree species which will be planted.

5.2.5 IMPACTS ON FAUNA

5.2.5.1 Impacts

328. Some temporary disturbance to a range of common urban fauna species (mostly birds) will occur, but the impacts are unlikely to be significant. The habitats that might be affected by dust and emissions from construction machinery/vehicles are largely common and widespread including those typical in urban locations, such as street trees and the parkland/green recreation area in the middle of Vaja Pshavela, which is more important for its social value than for nature conservation

329. As explained in Chapter 4.1.8 above, a wintering colony of the Greater Horseshoe Bat (*Rhinolophus ferrumequinum*) consisting of up to 500 individuals was found in the tunnel, from the University station side. This specie is under protection of the Convention on Migratory Species (CMS) and its Agreement on the Conservation of Populations of European Bats (EUROBATS, 1994) to which Georgia is a contracting Party.

5.2.5.2 Mitigation measures

330. Status of Greater Horseshoe Bat under the IUCN Red List (Version 3.1 UICN 2001, Latest Version) is “Least Concern” and it is not included in the Red List of Georgia. Widespread and abundant taxa are included in this category, so no specific measures are required to protect this specie. Noise and human presence will probably cause bats to abandon the tunnel and search for another habitat.

5.2.6 SOLID WASTE AND SPOILS GENERATED FROM EXCAVATION

5.2.6.1 Impacts

331. Construction works are expected to generate wastes from including garbage, recyclable waste, food waste, and construction and demolition debris. In addition small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze, etc.).

332. The most significant solid waste from this project will be construction and demolition debris, followed by spoil from excavation (underground University Station, crossover complex…). It is estimated that:

- 4,250.00 m^3 of different types of materials will be generated as a result of the demolition activities
- 3.460,04 m^3 of spoil will be excavated and transported to dump.
- 1.787,95 m^3 due to different types of excavations for construction of the emergency exit that are also transported to dump.

333. Without careful management, the transport and disposal of solid waste and spoils are likely to cause significant detrimental impacts on the environment, in terms of both air and water bodies.

5.2.6.2 Mitigation measures

Spoils from excavationsolid waste

334. Contractor will submit a spoil disposal plan to the MDF and MoEP for approval. The spoil plan should show the location of proposed sites (landfill or borrow pits) to be used and the measures to be taken to rehabilitate these pits upon finalization of the Project.

Hazarous waste

335. Constructing Contractor shall collect all hazardous waste residuals, such as oil, solvent, material used in oil spill cleanups… and store them within appropriate covered skips, and pass it to a licensed operator (e.g. Sanitari Ltd), having environmental permit on operation of the hazardous wastes.

Construction waste and domestic waste

336. Any other construction waste should be disposed of to on-site skips for removal by an approved waste management contractor.

337. Further the contractor should,

- provide refuse containers at each worksite and ensure that all storage containers are in good condition with proper labeling,
- maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal,
- train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process, and
- provision of adequate washing and toilet facilities with septic tanks will be made obligatory.

338. All this measures must be included in the Site Specific Environmental Management Plan that shall be prepared by the contractor and submitted to the project supervision consultant and MDF for approval.

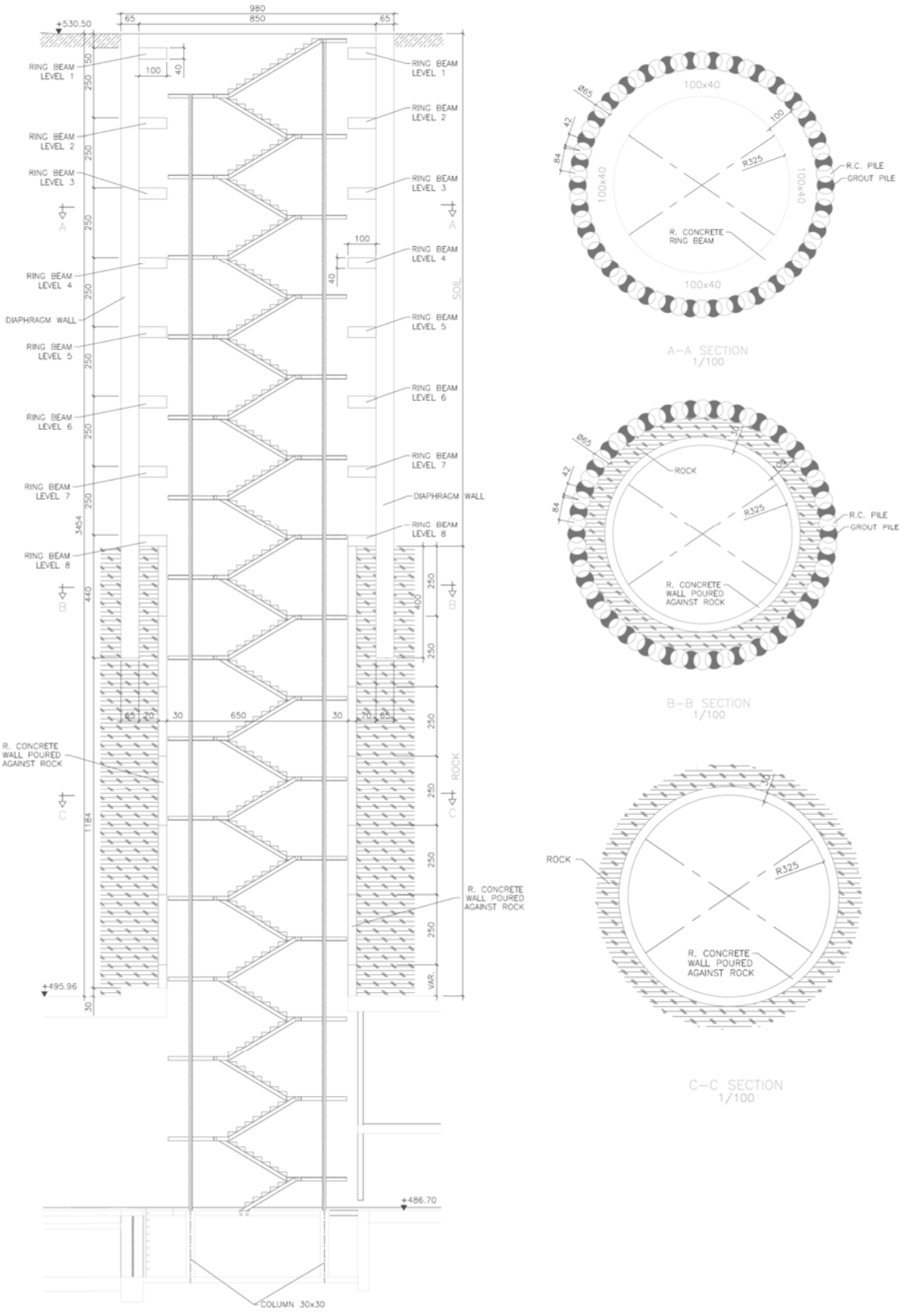
5.2.7 BUILDING STABILITY

339. As there is not a significant amount of earthworks required by the Project, because the main tunneling, cut and cover, and mining works were completed in the 80's, vibration from construction activities will not affect existing buildings near the project area.

340. Inhabitated buildings near the emergency exit will not be affected by excavation works, as they are far enough from the excavation area, and specially because of the proposed construction method for the shaft: Cast in place concrete piles.

341. Cast in place concrete piles eliminate the need for pile driving machinery which can cause dangerous vibration and precipitate landslides. A hole is bored in the ground to the required depth and lined, as necessary, with a steel casing made up in convenient lengths. The precast sections are then threaded over a central steel tube to form the pile core. Lowering into the borehole continues as each section is added.

342. All the equipment and components needed for the piles are kept light and easy to handle. The vibration associated with pile driving is eliminated, a big advantage in built-up areas, and headroom and space p roblems are largely avoided.


980
65
850
65
+530.50
RING BEAM LEVEL 1
RING BEAM LEVEL 2
RING BEAM LEVEL 3
RING BEAM LEVEL 4
DIAPHRAGM WALL
RING BEAM LEVEL 5
RING BEAM LEVEL 6
RING BEAM LEVEL 7
RING BEAM LEVEL 8
SOIL
ROCK
R. CONCRETE WALL POURED AGAINST ROCK
+495.96
+486.70
COLUMN 30x30
100x40
R325
R.C. PILE
GROUT PILE
R. CONCRETE RING BEAM
A–A SECTION
1/100
ROCK
B–B SECTION
1/100
C–C SECTION
1/100

343. However, for excavation works, the following measures shall be implemented by the contractor:

- Prior to Commencing any structural excavation work which is 1.5 m or greater in depth, the Contractor shall design an excavation support system.

- Details of the excavation support system shall be submitted to the Engineer for review and approval at least one week before any excavation work commences. Details of the excavation support system shall be complete with, but not limited to, the following:

    - drawings of the structural support members showing materials, sizes and spacing,
    - calculations showing the maximum theoretical deflection of the support member.

- The system is to be designed so that no members extend through surfaces exposed in the finished construction, and no shoring or bracing is placed under permanent structures.

- The Contractor shall submit to the engineer calculations of lateral earth pressure for the full excavation depths, surcharge loads of any description, equipment loads, forces at various stages of support during excavation, the maximum design loads to be carried by various members of the support system and strut pre-load forces.

- If the structure support system proposed includes tieback anchors, the Contractor's submitted details shall include drawings that show the profile of the soil in which each anchor is to be installed.

344. No mitigation measures to control building stability are required with respect to the operational phase of the Project

5.2.8 DAMAGE TO COMMUNITY FACILITIES

5.2.8.1 Impacts

345. There is not a significant amount of earthworks required by the Project, because the main tunneling, cut and cover, and mining works were completed some years ago, and this included relocation of utility infrastructure (water supply, wastewater/sewer, storm water systems, power and communication cables, natural gas). There is however still some tunneling works remaining for the blind alleys, passages, etc. and, although no significant impact on utility infrastructure is expected, all utilities along the remaining excavation and tunneling alignments should be assessed during the preconstruction survey undertaken by the Contractor. Consultation should take place with all relevant utility companies and authorities to ensure that all services that are needed to provide continuity of supply are known, and that appropriate action is taken to re-route these facilities if necessary.

5.2.8.2 Mitigation measures

346. If transport of materials, operation of construction equipment and various or construction activities damage community utilities, the contractor shall implement the following measures to address this impact:

- The contractor shall immediately repair any damage caused by the Project to community facilities such as water supply, power supply, communication facilities…
- Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.

5.2.9 TRAFFIC CONCERNS

5.2.9.1 Impacts

347. It is generally accepted that there will be some negative traffic impact during the construction phase, mostly along Vaja Pshavela Avenue. The main impact is likely to arise when/if there is a requirement to temporarily occupy road space for construction works, resulting in partial short term closure of Vaja Pshavela Avenue. Local traffic will also be disrupted by more routine construction traffic, in particular trucks visiting the sites to deliver materials or remove waste.

5.2.9.2 Mitigation measures

348. To avoid traffic congestion and access problems the following mitigation actions are recommended:

a) Provide signs advising road users that construction is in progress

b) Employ flag persons to control traffic at the station sites for safety reasons when construction equipment is entering or leaving the work area.

c) Provide sufficient lighting at night within and in the vicinity of construction sites.

d) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours.

e) Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers.

f) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.

5.2.10 HEALTH AND SAFETY OF THE WORKERS AND THE PUBLIC

5.2.10.1 Impacts

349. Construction works unavoidably expose workers to occupational health and safety risks. Activities to mention in this respect are excavations; working with heavy equipment; working in confined spaces; working on and along roads; heavy lifting; storage, handling and use of dangerous substances and wastes; working under noisy conditions. In this project working underground will be a new experience for many workers and there are many potential risks. For instance, toxic airs generate when drilling soil and rock, poor ventilation, fire, land subsidence and flood hazards.

350. Not only laborers working for the project but also the people from adjacent communities may be exposed to these health and safety risks.

5.2.10.2 Mitigation measures

351. Training in special skills, environment, emergency and safety regulation will be provided for workers before hiring, especially for those that will work underground. Safety equipment will be available on sites such as helmets, masks, fire extinguishers, flash lights, medicines, etc. The underground section construction process needs to be supervised and monitored much more carefully in order to be able to detect the early sign of subsidence. People from outside will be restricted from entering the construction sites in order to avoid accidents. Construction sites shall be cleaned regularly and provided with adequate sanitary equipment in order to reduce risk of spreading diseases.

5.2.11 CULTURAL HERITAGE AND ARCHAEOLOGY

5.2.11.1 Impacts

352. The principal risk of construction impacts on archeology and cultural heritage is from ground disturbance during the remaining excavation. According to the outcome of the baseline study, certain archeological sites, particularly tombs of the Late Bronze and Antique Ages, are located in the Project area (tomb No.9 and tomb No.10 of Namgala Mitsa – see Chapter 4.2.6). It is possible therefore that some other tombs may be located in the area that will be affected by the construction of station University blind alleys.

353. Tbilisi has a long history of human activity. Although there are no anticipated direct impacts to any known cultural relics by project construction, there could still be potential for chance finds of archaeological properties during construction.

5.2.11.2 Mitigation measures

354. In view of this risk, a Chance Finds Procedure should be developed by the Contractors, to ensure that any important archaeological material is properly recognized, recorded and preserved if necessary.

355. Chance find procedure:

356. Construction Contractor should engage an archaeologist (archaeological supervisor) for conducting daily supervision activities during excavation activities.

357. Besides that, archaeological supervisor instructs the workers to report him immediately in case of any chance finding of potential archaeological relics.

358. In case of finding any artefacts of potential archaeological value, following steps are taken:

- Construction workers are obliged to stop works and immediately report to the Archaeological Supervisor.
- 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
- 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.
- 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.
- 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.
- 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.
- 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.

5.3 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES DURING OPERATION PHASE

5.3.1 AIR QUALITY

359. Once Metro Line No.2 and University Station is operating, it is estimated that the air quality of Tbilisi will be improved as the project will displace car vehicles currently used along the route (Carbon dioxide reduction and air quality improvement).

360. During the operation period, there will be no direct adverse impact to the air environment in Tbilisi because the Metro system only use electric locomotive units. However, in a broader view, the use of electric trains will have indirect impacts to the air environment at sites generating the electricity. The reduction in vehicle emissions that occurs as a result of rail line operation will more than offset the emissions associated with generation of the system's electrical power supply.

5.3.2 NOISE AND VIBRATION

5.3.2.1 Impacts

361. Baseline noise levels along the Vaja Pshavela Avenue during the day are already quite high and the environment is generally dominated by urban traffic. There might therefore be a small reduction in noise when the metro extension is operating, as traffic volumes are expected to decrease.

362. As the system is operating in a tunnel, noise should not be an issue, except for the noise from untreated tunnel ventilation systems. As these systems are fixed entities, there is no difficulty in designing adequate acoustical measures so that they do not disturb the community where they surface.

363. No potential vibration impact is expected on buildings located near the project area from the running of the metro trains, due to specific track forms and continuously welded rails, which allows to avoid significant effects due to vibration and groundborne noise

364. Vibration from the operation of the trains is also considered to be negligible as the Tbilisi Metro Line 2 will be operating at a depth of -50 m. Experience elsewhere in the world on tunnel projects has indicated that no significant vibration impacts are expected for buildings at this depth.

5.3.2.2 Mitigation measures

365 Tunnel ventilation systems have suitable noise control measures incorporated into their design to reduce mechanical noise to acceptable levels in the surrounding community.

366. The rails are fastened with resilient fasteners and continuously welded further that reduces vibration and noise.

5.3.3 SOLID WASTE

5.3.3.1 Impacts

367 The operation of Metro Line 2 and University station will generate wastes from workers/employees and passengers. These solid wastes will be managed in an appropriate way when the Metro Line No.2 is operating.

5.3.3.2 Mitigation measures

368. Mitigation measures are as follows:

i) Waste collection bins or receptacles shall be provided in various areas at the underground stations, such as offices and areas accessed by passengers.
ii) Garbage shall be regularly collected and shall be disposed consistent with local regulations
iii) University Station shall be provided with toilets and septic tanks to handle sewage generated by workers and passengers.

5.3.4 RISKS ON SAFETY AND HEALTH

369. To protect the health and safety of workers and general public during operation of underground facilities, "Tbilisi Metro" shall ensure that the following plans have been developed and adequately resourced:

- Occupational Health and Safety Plan for tunnel facilities operation (rail and station) and train staff in the implementation of such plan.
- Emergency Response Plan (e.g., in case of fire, collision. Derailment, floods, power outage, equipment breakdown, accidents, etc.) covering operation of underground rail and stations. "Tbilisi Metro", shall train staff in the implementation of such plan.

6 ANALYSIS OF ALTERNATIVES

370. The ADB Safeguards require that an Initial Environmental Examination (IEE) contains an outline of the main alternatives studied by the beneficiary and an indication of the main reasons for its chosen option, taking into account the environmental effects. Usually this section examines alternatives to the proposed project site, technology, design, and operation—including the no project alternative—in terms of their potential environmental impacts.

371. From the beginning of this Project there was no alternative to the extension scheme and alignment, as any alternatives would have been considered and dismissed long ago in 1980-ies, when the Tbilisi Metro extension scheme has been planned, designed and started.

372. The construction of the Metro Extension from Delisi station to University started in 1985 and was interrupted in 1993. Then the construction was resumed in 1998 and in 2000 Vazha Pshavela Station was opened and operated on single track using one of the twin tunnel tubes between Delisi and Vazha Pshavela.

373. Tunnels between Vazha Pshavela and University stations are constructed but the civil works are not finalized (watertight injections and internal finishes). The main cavern of the University Station has been constructed, together with the inclined tunnel for the moving staircase. The atrium at the surface has a single underground level, the excavation is an open-cut and the structures are partially constructed.

374. At the feasibility stage in the process of preparation of this IEE, the only one alternative that could be considered for the Project, is the “no project” alternative: to leave the uncompleted metro construction as it is, with the risk of groundwater lowering, impact from exposed soils at the existing construction sites, lost investments and incremental costs of conservation.

375. Usually, following the methodology for the evaluation, the main alternatives considered for the metro schemes are evaluated using a multi-criteria analysis. The criteria and objectives with respect to the proposed Project are:

(i) Compliance with transport and landuse (Tbilisi Masterplan) strategy;
(ii) Minimizing environmental impacts (geology and groundwater, congestion and associated pollution, disturbance to landscape and community, other);
(iii) Generating social and economic benefits;
(iv) Delivering good quality transport integration;
(v) Optimizing capital and operating costs;
(vi) Delivering a safe and operationally efficient system;
(vii) Achieving efficiency and minimizing risk during construction.

376. For the above criteria, even not presenting it in the comparison table, is clear that all answers for the "With Project" alternative will be positive ("yes") and the answers for the "Without Project" alternative will be negative ("no"). Two most important criteria for the comparative analysis of "with project" and "without project" alternatives are: a) minimizing environmental impacts and b) optimizing capital and operational costs.

377. The major positive impact of the "with project" alternative will be completion of a major construction project that has been suspended for many years, and as a result there should be: less disturbance to the Saburtalo landscape and district community; less risk of groundwater lowering; less air pollution and dust; less congestion due to reduction in usage of vehicles; increased accessibility to affordable and comfortable transport; and improved traffic safety at Vaja Pshavela Avenue.

7 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

378. Consultations with some of stakeholders, like Tbilisi City Hall and TTC, were held during monthly project meetings.

379. On May 9, a meeting with Tbilisi population was held in the Vake District Gamgeoba building. The meeting was aimed at informing the population and especially the project affected area inhabitants of the possible negative and positive impacts on the environment during project implementation and suggesting the respective environmental and social safeguard measures for avoiding or mitigating the above-mentioned impacts.

Figure 38.- Informative notes of the population meeting

380. The meeting was attended by:

- 31 residents of the neighboring buildings, chairmans of condominiums;
- Representatives of the Municipal Development Fund of Georgia:
  - Head of the Project Appraisal Unit Mr. Paata Iakobashvili,
  - Adviser to the Executive Director of the Municipal Development Fund of Georgia on Environmental and Resettlement Issues Ms. Rusudan Chochua
  - Environmental specialists Nino Nadashvili and Ana Rukhadze,
- Technical Director of the Metro Mr, Levan Mekhrishvili,
- "Euroestudios" representative Ms. Diana Paksashvili.

381. The list, including name, surname, address, contact information and signature of people attending the meeting, is given below:

"INFORMATION MEETING WITH POPULATION"

ON THE "TBILISI METRO SECOND LINE EXTENSION AND CONSTRUCTION OF UNIVERSITY STATION" PROJECT

May 9, 16:00 hr, 2014

N	სახელი და გვარი	მისამართი	საკონტაქტო ინფორმაცია	ხელმოწერა
1	[illegible]	[illegible]	595-77-67-10.	[illegible]
2	[illegible]	[illegible]	593-91-03-58. 2-30-08-11	[illegible]
3	[illegible]	[illegible]	593 64-73 15	[illegible]
4	[illegible]	[illegible]	2-30-30-36	[illegible]
5	[illegible]	[illegible]	599-58-20-16	[illegible]
6	[illegible]	[illegible]	599172423.	[illegible]
7	[illegible]	[illegible]	232-71-24	[illegible]
8	[illegible]	[illegible]	591-416-516	[illegible]
9	[illegible]	[illegible]	2-31-46-16	[illegible]
10	[illegible]			
11	[illegible]	[illegible]	2-30 22 50	[illegible]
12	[illegible]	[illegible]	555-988-453	[illegible]

N	სახელი და გვარი	მისამართი	საკონტაქტო ინფორმაცია	ხელმოწერა
13	[illegible]	[illegible]	599 22 10 81	[illegible]
14	[illegible]	[illegible]	593 031080	[illegible]
15	[illegible]	[illegible]	595921108	[illegible]
16	[illegible]	[illegible]	555-68-22-48	[illegible]
17	[illegible]	[illegible]	599541939	[illegible]
18	[illegible]	[illegible]	597-41-57-67	[illegible]
19	[illegible]	[illegible]	595703007	[illegible]
20	[illegible]	[illegible]	577181028	[illegible]
21	[illegible]	[illegible]	599302639	[illegible]
22	[illegible]	[illegible]	591172847	[illegible]
29	[illegible]	[illegible]	5(99) 962496	[illegible]
30	[illegible]	[illegible]	599684998	[illegible]

31.	[illegible]	[illegible] 31.	555556265	
32	[illegible]	euroestudios	558902891	
33.	[illegible]	[illegible] № 8	IRAKliKENKiSHVili[illegible]	
34	[illegible]	[illegible]	arukhadze@mdf.org.ge	
35	[illegible]	[illegible] 79/81 "TTC"	577.52.540	
36	[illegible]	[illegible]	599 150-160	
37.	[illegible]	[illegible]	599 23 7530	

382. The meeting was opened by Mr. Paata Iakobashvili. He gave a speech on the project in general, briefly described it and emphasized that the project will be implemented by means of ADB funding. He presented the information on the date of project commencement, its current state and activities planned under the project. He also clarified the exact location of the project site, and types of construction works to be undertaken. At the end of his speech, Mr. Iakobashvili stated that the University Station will be one of the most modernized and up-to-date stations throughout Georgia.

383. Ms. Nino Nadashvili thanked those present for attending the meeting. She once again underlined the purpose of their meeting and presented detailed information on the IEE document developed under the project, she also noted that the ADB environmental safeguards' policy instructions and provisions (SPS 2009) as well as the environmental legislation and methodologies currently in force in Georgia were used for elaboration of the document. The IEE incorporates description of the current social and environmental status, assessment of the project impact on the environment, recommended management and mitigation measures and monitoring of the selected parameters.

384. The expected positive impacts inter alia include the following: employment perspectives, releasing traffic congestions, rapid and safe conveyance, decreasing the levels of fuel consumption and carbon dioxide and improvement of the air quality. At the construction stage, the expected negative impacts inter alia include the following: air pollution with CO, NOx, SO_2 and particulate pollutants, which is due to emissions resulting from the operation of construction machinery and equipment; temporary disturbance to the local residents caused by construction related noise; soil and water pollution resulting from accidental leakages, spillage or mismanagement of hazardous substances; waste generation; impact on the flora – the project requires cutting 21 trees in various locations; possible damage to the community utilities, etc. With respect to stability and vibration affecting the buildings - it was noted that vibration will not cause damage to the buildings located in the project area, since the main civil works like tunnel construction – excavation and covering, as well as blasting works were completed in the 1980-ies. The train-induced vibration is considered as negligible, since the 2^{nd} line of Tbilisi metro will operate at 50 m depth.

385. At the meeting the population was also updated in detail on mitigation measures scheduled against the mentioned negative impacts. In particular, it was stated that for protecting air quality, dust control activities will be carried out and the construction site and access roads will be permanently watered; construction sites will be kept clean, construction waste will be sorted by hazardous, nonhazardous and recyclable types; waste incineration will be prohibited and will be subjected to strict control. Construction waste will be disposed on regular basis by the licensed waste management contractor; only registered vehicles holding appropriate permits will be utilized for this purpose; speed limitations will be imposed for construction machinery; noisy operations will be prohibited during night hours; the cut trees will be replaced with threefold number of trees. In case of discovering a bat colony in the tunnel during construction process, experts will be hired for their safe relocation to the appropriate habitat. Permanent monitoring will be carried out during construction works.

386. By the end of the presentation, Nino Nadashvili informed the population of the grievance redresses mechanism, which will be operating in course of project implementation. Before work commencement, a grievance and claim redress committee and coordination center will be established, which will function on the construction site. In case of discontent, the population will be enabled to apply and file claims. The grievance redress committee will address complaints and discontents of local residents.

387. At the meeting, information materials reflecting general properties, layout, planned construction works of the project, as well as the project's possible impact on the environment and its mitigation measures, were handed out to the population.

388. The questions and comments of different participating parties were replied by relevant experts of the project. The questions and answers related to the project are given in Table provided below.

"INFORMATION MEETING WITH POPULATION" ON THE "TBILISI METRO SECOND LINE EXTENSION AND CONSTRUCTION OF UNIVERSITY STATION" PROJECT May 9, 16:00 hr, 2014	
Question/Comment	Expert Answer
When will the construction works commence and what is their duration period?	Mr. Paata Iakobashvili explained that the bidding documentation preparation process is ongoing. Upon completion of this process, bidding will be announced and a winner building company will be revealed to commence construction works. Tentative commencement date is the fall of current year. Expected duration of construction works is 22 months.
Big expenditures are being incurred for the station conservation works, it would actually be better to resume construction works in timely manner and complete the project. Will the project be implemented for sure?	Ms. Nino Nadashvili noted that timely commencement of construction works is in the best interests of every stakeholder - the donor, the country and the population itself. The main objective of the present meeting – informing the population at the initial project stage serves exactly this very purpose – timely completion of the documentation preparation process observing the respective procedures and commencement of civil works.

"INFORMATION MEETING WITH POPULATION" ON THE "TBILISI METRO SECOND LINE EXTENSION AND CONSTRUCTION OF UNIVERSITY STATION" PROJECT May 9, 16:00 hr, 2014	
Question/Comment	Expert Answer
Who is the project executing and funding agency?	The project is implemented by the Municipal Development Fund of Georgia with the credit extended by the ADB.
What kind of organization is the Municipal Development Fund of Georgia?	The Municipal Development Fund of Georgia is a legal entity of public law, state control of which is executed by the Ministry of Infrastructure and Regional Development of Georgia.

389. The participants thanked organizers for providing comprehensive information. Assumed a positive attitude and expressed their wish and expectations regarding project implementation.

Figure 39.- Informative notes of the population meeting

390. Final versions of IEE – both ENG and GEO will be placed at MDF web-page and disclosure links will be send to ADB.

8 GRIEVANCE REDRESS MECHANISM

391. 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.

392. 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 MoE, 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.

393. 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.

394. 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.

395. 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 May 2003, 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.

396. MDF will facilitate the establishment of a Grievance Redress Committee (GRC) and Grievance Focal Points (GFPs) prior to the Construction 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.

397. 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).

398. EA will assist residents of affected territories (Tbilisi municipality) and affected community to identify local representatives to act as Grievance Focal Points (GFP).

399. 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.

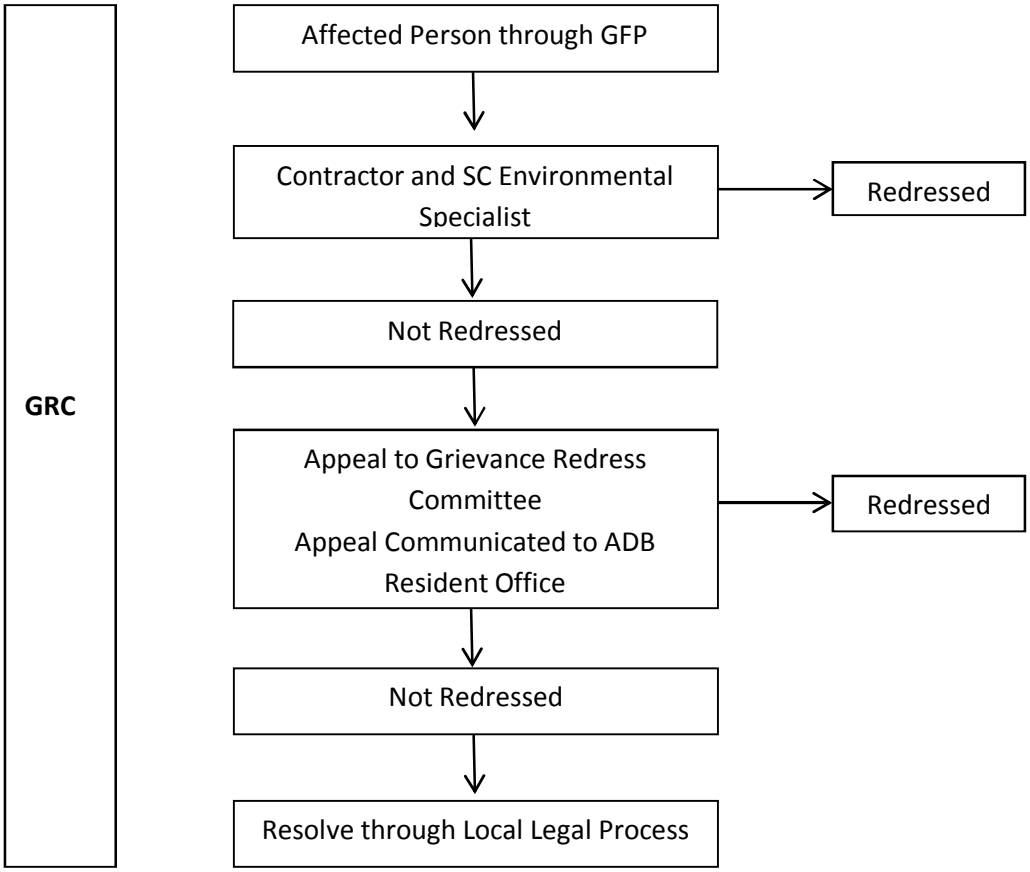
400. The sufficient number of GFPs for the Extension of the Tbilisi Metro line 2 and creation of University Station project is 1 person.

401. 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:

- Introduction of key personnel of each stakeholder including roles and responsibilities,
- 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;
- 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;
- Identification of members of the Grievance Redress Committee (GRC)

402. 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 Figure below:

- Affected persons will lodge their environmental complaint/grievance with their respective community's nominated GFP.
- The GFP will deliver the individual's complaint to the Contractor and SC's Environmental Specialist.
- The Contractor and SC will record the complaint in the Environmental Complaints Register (ECR) in the presence of the GFP.
- The GFP will discuss the complaint with the Contractor and SC's Environmental Specialist and try to resolve it;
- 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 Environment and Natural Resources Protection and/or Ministry of Culture and Monuments Protection
- 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.
- Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.
- 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.
- 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.


GRC
Affected Person through GFP
Contractor and SC Environmental Specialist
Redressed
Not Redressed
Appeal to Grievance Redress Committee
Appeal Communicated to ADB Resident Office
Redressed
Not Redressed
Resolve through Local Legal Process

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 INTRODUCTION

403. The Environmental Management Plan (EMP) documents the impacts identified in the IEE 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.

404. 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.

405. The environmental impacts associated with project have been detailed above in the chapter 5 of this IEE. Mitigation measures required to address the impacts identified in the IEE have been summarized in each of the relevant sections covering the physical, biological and socio-economic environment affected by the project. The impacts identified and the specific mitigation measures proposed to address them have been consolidated into the environmental management matrix presented in chapter 9.4. in a form of matrix, which includes time frames, responsibilities and where applicable, estimated costs for each measure.

406. 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 description 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.

407. An environmental monitoring plan is presented in p. 9.5, 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.

9.2 IMPLEMENTATION ARRANGEMENTS AND RESPONSABILITIES

408. 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 (MDF) and SC are responsible for ensuring monitoring of the project

implementation at the construction stage, while Tbilisi Metro for monitoring at the metro 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

409. MDF as the executing agency will be responsible for the day to day management of the project including implementation of the SEMP. The Environmental and Social Specialists of the MDF, 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).

410. 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 any relevant government agencies (NEA, etc), 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.
(iii) 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.
(iv) Approve the Site-Specific Environmental Management Plan (SEMP) prepared by the Contractor before he takes possession of construction site.
(v) Monitor the contractor's implementation of the SEMP in accordance with the environmental monitoring plan.
(iv) Prepare and submit semi-annual Environmental Monitoring Reports to ADB.
(v) 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.

411. 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 and reveal any deviations from the prescribed actions.

412. The SC will include a full-time national environmental specialist to assist the EA supervise and monitor implementation of the EMP during construction.

413. 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.

414. 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.

415. 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 in Environmental Science or related discipline and have experience in environmental management of infrastructure projects.

416. 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

9.2.1 SITE-SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN (SEMP)

417. 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.

418. 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.

419 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.

9.2.2 REPORTING

420. 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.

- Details of any environmental incidents
- Status of all non-conformance identified during audits and inspections that are identified by non compliance notices.
- Complaints from the public and proactive community relations activities
- Monthly Accident Report
- Waste volumes, types and disposal
- Details of any contaminated areas that have been identified and rehabilitated.
- Details of any archaeological discoveries.
- Details of any ecological issues.
- Other relevant environmental issues.
- Action plan for corrective measures

421. The Contractor will have a duty to immediately report to the SC if any serious environmental breach has occurred during construction e.g. building damages, serious oil spills etc.

422. 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 inmediately

423. MDF as the Executing Agency will submit semi-annual reports to ADB reflecting project progress and compliance with the safeguards requirements. This reports will include SC monthly reports and short explanatory note of MDF specialists.

424. ADBs responsibilities in regard to implementation of environmental safeguards requirements for the project 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.

9.3 COSTS OF ENVIRONMENTAL MANAGEMENT PLAN

425. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal construction contract.

426. The costs of environmental activities associated with the construction (62.123,8 GEL) will be included in the contract for Construction Contractor, and 11.439,54 GEL in contract with the Supervision Company (Noise and air quality measures). In total the planned environmental activities will cost around 73.609,89 GEL.

427. **Waste Management.** The waste management cost is divided in:

- Collect of solid waste (construction waste and domestic waste): 44.378,50 GEL
- Collect of hazarous waste: 1.242,41 GEL
- Transport of spoils from excavation to dump: 10.621,93 GEL

Total cost: 56.242,84 GEL

428. **Top soil storage and replacement:** the storage of topsoil in stockpiles and the reistatement of top soil are estimated to cost:

- Top soil storage: 1.012,00 GEL
- Top soil replacement: 356,50 GEL

Total cost: 1.368,50 GEL

429. **Landscape plan and protection of flora.** As a result of construction activities, 21 trees along the project area will be destroyed and 46 will need protection. Compensatory planting of

the species should be facilitated with the proportion of 1:3, so that 63 trees will be planted. The total cost of this program is estimated as follows:

- Removal of trees: 3.747,60 GEL
- Ripping and scarifying: 218,50 GEL
- Hidroseeding: 851,00 GEL
- Tree planting, including stakes: 4.444,09 GEL
- Protection of trees: 741.24 GEL

Total cost: 10.006,63 GEL

430. **Cultural and archaeological site protection.** Includes permanent monitoring by an archeologist during excavation activities. The cost of this measure is estimated in 2.542,14 GEL.

431. **Air quality prevention measures**: To reduce gaseous and dust emission during construction, the contractor shall implement different measures: use vehicles & equipment registered and with the necessary permits, forbide the burning of wastes at the construction site, materials transported to site shall be covered... All measures concerning pollution prevention shall be included in the SEMP redacted by the Contractor and submitted to the MDF for supervision, prior to initiation of any construction works.

432. In order to monitorize air quality parameters (PM, NO_2, CO_2 and CO) 4 measures of air quality parameters are considered in the budget. The cost of these measures is estimated in 6.101,26 GEL.

433. **Noise quality prevention measures**: Mitigation measures to be implemented by contractors to reduce noise and vibration levels shall be also included in the SEMP.

434. In order to monitorize air noise ambient, 7 measures of noise levels are considered in the budget. The cost of these measures is estimated in 5.338,28 GEL.

Items	Cost (GEL)	Budget line
Mitigation measures		
Waste management (includes collect of solid wates, hazardous wastes and transportation of spoils from excavation to dump)	56.242,84	Construction Contractor
Top soil storage and reinstatement of top soil	1368,50	Construction Contractor
Landscape Plan and protection of flora (including removal of trees)	10.006,63	Construction Contractor
Cultural and archaeological sites protection	2.542,14	Construction Contractor
Monitoring		
Mesarurement of air quality parameters	5.338,28	SC Contractor
Mesarurement of ambient noise	6.101,26	SC Contractor
Total: 81.599,65 GEL		

9.4 ENVIRONMENTAL MANAGEMENT MATRIX

Construction phase:

Environmental impacts	Sites / Timeframe	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Air quality impacts due to gaseous and dust emissions	Construction site Camp site Access roads / Construction period	a) Use only vehicles and equipment that are registered and have necessary permits. b) Burning of wastes generated at the construction sites, work camps and other project-related activities shall be strictly prohibited. c) Construction equipment and vehicles shall be well-maintained so that their noise and emissions do not cause nuisance to workers or local people. d) All vehicles will be checked and repaired in case of need to eliminate increased emission due to damaged parts. e) Protective equipment will be provided to workers as necessary. f) Keep stockpiles moist and cover vehicles with tarpaulin sheets or other suitable materials to minimize dust emission and prevent spillage of materials (e.g., soil, cement, stone, sand, aggregates, etc.). g) Provide temporary covers (e.g., tarpaulins, grass, etc.) on long term materials stockpiles. h) Provide truck-washing facilities to prevent truck-out of mud and dust onto city streets. i) All construction equipment and machinery shall be fitted with emission control equipment in full compliance with the national regulations. j) Ensure water spreading to suppress dust particularly during dry and windy weather. k) Impose speed limits on construction vehicles to minimize road dust.		Construction contractor	MDF SC
Noise and vibration impacts due to operation of construction equipment/ vehicles and various construction activities	Construction sites Demolition activities/ Construction period	To control noise impacts the following mitigation actions are recommended: a) Truck drivers and equipment operators shall minimize the use of horns. b) Position any stationary equipment that produce high noise levels as far as is practical from sensitive receptors; c) All construction equipment and vehicles shall be well maintained, regularly inspected for noise emissions, and shall be fitted with appropriate noise suppression equipment consistent with applicable national and local regulations. d) Use only vehicles and equipment that are registered and have necessary permits. e) No noisy construction-related activities will be carried out during the night. f) Impose speed limits on construction vehicles to minimize noise emission		Construction contractor	MDF SC

Environmental impacts	Sites / Timeframe	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Spoils generation from excavation works (5.247,99 m^3) at underground station sites	Underground University Station, crossover complex…/ Excavation period	Contractor will submit a spoil disposal plan (as a part of the SEMP) to the MDF and MoEP for approval. The spoil plan should show the location of proposed sites (landfill or borrow pits) to be used and the measures to be taken to rehabilitate these pits upon finalization of the Project. The capacity of disposal sites shall be adequate to accept the quantity of spoils without alienating areas outside the site boundaries. Trucks transporting spoils shall be tightly covered with tarpaulin or other suitable materials to minimize dust emission and spills.	Transport of spoils from excavation to dump: 10.621, 93 GEL	Construction contractor	MDF SC
Generation of solid wastes (construction waste and domes-tic waste), inclu-ding 4,250.00 m^3 of different types of materials will be generated as a result of the demolition activities	Camp site University station/ Construction period	Regarding the generation of solid waste, the waste procedures included in SEMP prepared by the contractor should contain, at least, the following mitigation actions: a) Provide garbage bins and facilities within the project site for temporary storage of construction waste and domestic solid waste. b) Separate solid waste into hazardous, non-hazardous and reusable waste streams and store temporarily on site in secure facilities with weatherproof flooring, security fencing and access control and drainage/ wastewater collection systems. c) Ensure that wastes are not haphazardly dumped within the project site and adjacent areas d) Undertake regular collection and disposal of wastes to sites approved by local authorities or contract municipal waste operators for disposing household waste, garbage and small amounts of nonhazardous construction waste etc..	Collect of solid waste (construction waste and domestic waste): 44.378,5 GEL	Construction contractor	MDF SC

Environmental impacts	Sites / Timeframe	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Generation of hazardous waste	Camp site/ Construction period	Constructing Contractor shall collect all hazardous waste residuals, such as oil, solvent, material used in oil spill cleanups… and store them within appropriate covered skips, and pass it to a licensed operator, having environmental permit on operation of the hazardous wastes. Regarding the generation of hazardous waste, the waste management procedures included in SEMP prepared by the Contractor should contain, at least, the following mitigation actions: a) Store fuel and hazardous substances in paved areas. If spills or leaks do occur, undertake immediate clean up. b) Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored. c) Train relevant construction personnel in handling of fuels and spill control procedures. d) Ensure all storage containers are in good condition with proper labeling. e) Regularly check containers for leakage and undertake necessary repair or replacement f) Store waste oil, used lubricant and other hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. g) Transport and off-site disposal of such wastes shall be consistent with national and local regulations.	Collect of hazarous waste: 1.242,41 GEL	Construction contractor	MDF SC
Topsoil losses due to improper storage and handling	University station During top soil removal at University station	<u>Top soil protection</u>: The storage of topsoil in stockpiles, no more than 2 m high with side slopes at a maximum angle of 45º. Dedicate storage locations that prevent the stockpiles being compacted by vehicle movements or contaminated by other materials. Top soil collection: 100 m^3 x 3.98 €/m^3 = 398 € <u>Reinstatement of Topsoil</u> Topsoil removed from University station will be used for reinstatement of the topsoil in adjacent zones affected by the project activities or other zones designed by the municipality. Top soil replacement: 100 m^3 x 1.40 €/m^3 = 140 €	Top soil collection: 1.012 GEL Top soil replacement: 356,5 GEL	Construction contractor	MDF SC

Environmental impacts	Sites / Timeframe	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Trees that are directly (need to be cut) or indirectly (need to be protected) affected by the project	Trees marked on plan 16.2 / During trees removal and tree planting	As a result of construction activities, 21 trees along the project area will be destroyed and 46 will need protection. Compensatory planting of the species should be facilitated with a proportion bigger than 1:3, so that 63 trees will be planted. - Removal of trees: 3.751,80 GEL - Ripping and scarifying: 218,50 GEL - Hidroseeding: 851,00 GEL - Tree planting, including stakes: 4.444,09 GEL - Protection of trees: 741,24 GEL	10.006,63 GEL	Construction contractor	MDF SC
Traffic congestion and access problems	Construction site Access roads / Construction period	To avoid traffic congestion and acces problems the following mitigation actions are recommended: a) Provide signs advising road users that construction is in progress b) Employ flag persons to control traffic at the station sites for safety reasons when construction equipment is entering or leaving the work area. c) Provide sufficient lighting at night within and in the vicinity of construction sites. d) As much as possible, schedule delivery of construction materials and equipment as well as transport of spoils during non-peak hours. e) Avoid movements of noisy vehicles during night time in vicinity of sensitive receivers. f) Implement suitable safety measures to minimize risk of adverse interactions between construction works and traffic flows through provision of temporary signals or flag controls, adequate lighting, fencing, signage and road diversions.		Construction contractor	MDF SC
Damage to community facilities: water supply system,	Construction site / Construction period	If transport of materials, operation of construction equipment and various or construction activities damage community utilities (water supply, power supply, communication facilities…), the contractor shall immediately repair any damage Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works.		Construction contractor	MDF SC

Environmental impacts	Sites / Timeframe	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Hazards to health and safety of workers and the public due to construction works	Construction site / Construction period	Training in special skills, environment, emergency and safety regulation will be provided for workers before hiring, especially for those that will work underground. The underground section construction process needs to be supervised and monitored much more carefully in order to be able to detect the early sign of subsidence. To avoid this impact the following mitigation actions are recommended: a) Provide first aid facilities that are readily accessible by workers. b) Provide firefighting equipment at the work areas, as appropriate, and at construction camps. c) Provide separate hygienic sanitation facilities/toilets for male and female workers d) Ensure proper collection and disposal of solid wastes within the construction camps consistent with local regulations. e) Provide appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection f) Ensure reversing signals are installed on all construction vehicles. g) Implement precautions to ensure that objects (e.g., equipment, tool, debris, etc.) do not fall onto or hit construction workers. h) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface, etc. i) People from outside will be restricted from entering the construction sites in order to avoid accidents. j) Construction sites shall be cleaned regularly and provided with adequate sanitary equipment in order to reduce risk of spreading diseases.		Construction contractor	MDF SC
Cultural and archaeological sites protection;	Excavation sites / Excavation period	Construction Contractor should engage an archaeologist (archaeological supervisor) for conducting daily supervision activities during excavation activities. Permanent monitoring by the archaeologist during excavation activities. Chance Finds Procedure included in section 5.2.11 of the IEE should be implemented, including: stoppage and suspension of construction activities in case of archaeological findings; Completion of required archaeological works before restarting construction activities; Conservation of remnants.	2.542,14 GEL	Construction contractor through engaged archaeologist	MDF SC

Operation phase:

Environmental impacts	Sites	Mitigation measures	Cost	Responsibility for implementation	Responsibility for monitoring
Noise	Resident areas close ventilation Shaft n.51	Principles and instruments for railway noise reduction to be studied: - Reduce noise generation by smooth wheels on smooth tracks - Composite block brakes, disc or drum brakes - Good maintenance of running surfaces - Fewer wheels - Smaller wheels and/or wheel dampers, optimised geometry -Wheel-mounted disc brakes - Reduce sound radiation by shielding - Wheel-mounted, bogie-mounted or vehicle-mounted shrouds		Tbilisi metro	Tbilisi metro
Vibration	Along the line	Maintenance procedures: effective maintenance programs are essential for controlling ground-borne vibration. When the wheel and rail surfaces are allowed to degrade the vibration levels can increase by as much as 20 dB compared to a new or well-maintained system.		Tbilisi metro	Tbilisi metro

9.5 ENVIRONMENTAL MONITORING MATRIX

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**	**Responsible Institution**
Pre-construction	Site Especific Environmental Plan prepared by contractor	Constructing contractor offices	Review the SEMP, that contractor has prepared	Before starting works	Assure compliance with specifications in the EMP included in the IEE	Minimal Included in supervision contracts	Supervisor Company (SC)
Construction period	Material supply: Possession of official approval or valid operating license of suppliers materials	Supplier of materials	Inspection	Before an agreement for the supply of materials is formalized	Assure compliance with Health and Safety requirements	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Air quality impacts due to gaseous emissions: machinery emissions	Construction site	Inspection	Unannounced inspections during work hours	Assure compliance with pollution prevention measures and with national regulations	Minimal Included in supervision contracts Measurement of air quality parameters: 5.338,28 GEL	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Air quality impacts due to dust emissions: material transport, material stockpiles, speed limit sings…	Construction site and access roads	Inspection	Unannounced inspections during work hours and during material delivery and periodically in dry periods during construction	Assure compliance with pollution prevention measures and with national regulations		MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Noise levels; Equipment; (engine maintenance, usage of mufflers, night time work limitations and other provisions of EMP.)	Construction site	Inspection. Check Contractor's schedule and records of vehicle and equipment servicing and repair. Noise measuring device	Periodic (average once per month) Only in case of complaints	Assure good condition of standard construction machinery and compliance with national regulations	Minimal Included in supervision contracts Measurement of ambient noise: 6.101,26 GEL	MDF (occasionally) Supervisor Company (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	Responsible Institution
Construction period	Traffic safety/ Vehicle/ pedestrian access Visibility/ appropriate signs	Construction site and adjacent Project area	Visual observation: Observe traffic management and sings at several locations within and adjacent to Project area.	At least once every two weeks	Assure compliance with the Traffic congestion and access problems submitted by contractor	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Material and waste storage,	Material and waste storage sites;	Visual observation	During material delivery and periodically during construction (average 1/month),	Assure compliance with construction standards, environmental norms and waste management provisions;	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Waste Management	Construction site	Visual observation	Once per week	Assure compliance with construction standards, environmental norms and waste management provisions;	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Topsoil losses due to improper storage and handling: Top-soil storage at University station. Top soil of 0.15 m depth should be excavated and stored properly	Construction site: university station	Conduct observations of top soil protection and reinstatement of top soil system on site.	Once per week during top soil excavation and reinstatement of top soil	Assure compliance with, construction standards, environmental norms and EMP provisions;	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (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	Responsible Institution
Construction period	Protection of trees and replanting of trees	Construction site (trees indicated in plans 16.03) and replanting Sites	Visual observation	Before starting construction activities trees must be protected and daily during replanting period	Assure compliance with specifications in the IEE and the EMP	Minimal included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Hazards to health and safety of workers and the public due to construction works: Personal Protective equipment, first aid facilities accessible to workers, proper collection and dispo-sal of solid wastes….	Construction site	Visual observation to check out that all measures listed in the EMP are being applied.	Unannounced inspections during work hours	Assure health protection	Minimal Included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Damage to community facilities: water supply system,	Construction site	Review design reports and drawings. Conduct site observations to confirm if/where impact on community facilities	Permanent/daily	Assure compliance with specifications in the project	Minimal included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently
Construction period	Cultural and archeo-logical protection	All earthwork sites (university station)	Observe sites and review reports to ensure findings recorded as specified and identified sites (if any) are protected.	Daily during excavation activities	Assure cultural heritage protection	Minimal included in supervision contracts	MDF (occasionally) Supervisor Company (SC) Permanently

10 CONCLUSIONS AND RECOMMENDATIONS

435. The present report reveals that there will be minor negative and tangible positive impacts due to the construction activities and normal operations of the metro line and station. Recommendations are made to mitigate expected negative environmental impacts. The IEE and included EMP cover all aspects of the Metro Line and Station Project.

436. The introduction of the Tbilisi Metro Line 2 and creation of University station will have many positive impacts to Tbilisi citizens. The major positive impact of the Project will be completion of a major construction project that has been suspended for many years, what optimizes (actually rescues) the initial capital investments. This will produce a number of benefits, including: less disturbance to the Saburtalo landscape and district community; less air pollution and dust; less road congestion due to reduction in usage of vehicles; improved accessibility to affordable and comfortable transport; and improved traffic safety at Vaja Pshavela Avenue. The Project will deliver good quality transport integration and generate social and economic benefits, such as potential growth in the economy of the district, substantial income and employment opportunities, improved living conditions.

437. However, there will be many social and environmental issues that need to be considered especially during construction phase. During this phase, the potential adverse environmental impacts include air pollution, noise and vibration, community and traffic disturbance, disturbance of a colony of bats, solid waste and spoils, ecology, public and safety risks and cultural relics and archaeology. Appropriate solutions for each of the potential adverse impacts have been considered to mitigate the impacts sufficiently.

438. In conclusion, the adverse impacts of the Tbilisi Metro Line 2 and creation of University station will be minimal and can be mitigated through the use of best practices and appropriate technologies. With the implementation of the EMP and the monitoring plan, the project is not expected to have significant detrimental environmental impacts. Internal and external monitoring and audits will be conducted to ensure that standards and regulations are being followed.

439. The most important and practical recommendation for providing an appropriate degree of environmental protection during the Project implementation process is to follow the environmental mitigation and monitoring measures proposed by this IEE.

ANNEXE: ENVIRONMENTAL PLANS

16.01. Project and Station layout: Existing infrastructure and Environmental Settings

16.02. Inventory of trees

16.03 Environmental mitigation measures

REPLACEMENT:

NUMBER WORK	SECTION	DOC.	VERSION	DATE	REASON FOR MODIFICATION	DRAWN BY	VERIFIED
202017	210301	P	04	28-10-2013	DUE TO MDF'S COMMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	05	14-01-2014	DUE TO MDF AND TICS REQUIREMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACED BY:

DRAWING NO: 16.01 SHEET 1 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK 1

FILE NAME: FORMATO.DGN

BEGINNING OF THE PROJECT

Pk 56+00.000

Pk 56+91.000

Pk 58+00.000

Delisi Station

PLATFORM

SCISSOR CROSSING

56+00

57+00

58+00

56+ 0.000

STRAIGHT LINE

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

LEGEND

- TYPE III
- TYPE IV
- TYPE VII
- TYPE IX
- TYPE X
- TYPE XI
- TYPE XII
- TYPE XII-C
- TYPE XII-S
- TYPE XIII (TECHNICAL ROOMS)
- SCISSOR CROSSING
- CHAMBER 2
- CHAMBER 3
- CHAMBER 4

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas

euroestudios

SCALE A-1
1:500
Numerical

Graphic 0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS
LEFT TRACK

DRAWING NO.
16.01
SHEET 1 OF 17

Pk 58+00.000

SCISSOR CROSSING

Pk 59+85.900

TYPE VII

TYPE

58+00

59+00

60+00

61+00

STRAIGHT LINE

R=70000.000

60+ 11.298

STRAIGHT LINE

R=70000.000

60+ 52.938

61+00

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

REPLACEMENT:			
REPLACED BY:			
VERIFIED			
DRAWN BY			
REASON FOR MODIFICATION	DATE	VERSION	DOC.
DUE TO MDF'S COMMENTS	28-10-2013	04	P
DUE TO MDF AND TICS REQUIREMENTS	14-01-2014	05	P
DUE TO MDF REQUIREMENTS	06-05-2014	06	P

NUMBER WORK	SECTION	DOC.
202017	210301	P
202017	210301	P
202017	210301	P

DRAWING NO: 16.01

SHEET 2 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE 2 LEFT TRACK

FILE NAME: FORMATO.DGN

ADB		PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT	DESIGNER: Juan I. Valderas	SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic	DATE: MAY 2014	DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK

euroestudios

DRAWING NO. 16.01

SHEET 2 OF 17

REPLACEMENT:			
NUMBER WORK	SECTION	DOC.	VERSION	DATE	REASON FOR MODIFICATION	DRAWN BY	VERIFIED
202017	210301	P	04	28-10-2013	DUE TO MDF'S COMMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	05	14-01-2014	DUE TO MDF AND TICS REQUIREMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACED BY:

DRAWING NO: 16.01

SHEET 3 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK

FILE NAME: FORMATO.DGN

Pk 61+75.440

Pk 62+65.336

TYPE VII

TYPE X

TYPE IX

TYP

62+00

63+00

64+00

65+00

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

va.Ja-tSavelas IV Sesaxvevi

ADB	PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT	DESIGNER: Juan I. Valderas — euroestudios	SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic	DATE: MAY 2014	DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK	DRAWING NO. 16.01 SHEET 3 OF 17

Vazha-Pshavela Station

Pk 65+29.671

Pk 66+18.947

Pk 67+45.076

Pk 68+06.001

TYPE IX

TYPE X

TYPE VII

TYPE XII

PLATFORM

65+00

66+00

67+00

68+00

R=34000.000

STRAIGHT LINE

65+ 40.753

R=34000.000

STRAIGHT LINE

66+ 44.344

R=34000.000

STRAIGHT LINE

67+ 40.150

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

REPLACEMENT:				
NUMBER WORK	DOC.	VERSION	DATE	REASON FOR MODIFICATION
202017	P	04	28-10-2013	DUE TO MDF'S COMMENTS
202017	P	05	14-01-2014	DUE TO MDF AND TICS REQUIREMENTS
202017	P	06	06-05-2014	DUE TO MDF REQUIREMENTS

DRAWN BY	VERIFIED
JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACED BY:

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK

SCALE: 1:500

DRAWING NO: 16.01

SHEET 4 OF 17

FILE NAME: FORMAT0.DGN

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas — euroestudios

SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK

DRAWING NO. 16.01 SHEET 4 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

Vazha-Pshavela Station

Pk 69+14.001

Pk 69+50.001

Pk 71+00.000

PLATFORM

TYPE XII

TYPE XI

TYPE III

69+00

70+00

71+00

72+00

STRAIGHT LINE

R=90000.000

71+ 85.727

REPLACEMENT:			
VERIFIED	JOS• MARÍA ARANDA	JOS• MARÍA ARANDA	JOS• MARÍA ARANDA
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.01

SHEET 5 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK

FILE NAME: FORMATO.DGN

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas

euroestudios

SCALE A-1
1:500
Numerical

0 10 20 30M
Graphic

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK

DRAWING NO.
16.01
SHEET 5 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

VENTILATION BOX

VENTILATION CHANNEL

VENTILATION WELL. SHAFT #50

AREA 1

AREA 2

AREA 3

AREA 4

Pk 72+70.007

Pk 74+69.080

Pk 74+80.000

Pk 74+93.989

TYPE III

TYPE IV

TYPE III

TYPE IV

CANCELED SANITARY

72+00

73+00

74+00

75+00

72+00

73+00

74+00

75+00

STRAIGHT LINE R=90000.000 71+ 85.727

STRAIGHT LINE R=90000.000 72+ 18.221

	Total
Trees to be protected	22

REPLACEMENT:			
VERIFIED	JOS• MARIA ARANDA	JOS• MARIA ARANDA	JOS• MARIA ARANDA
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.01 SHEET 6 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK

FILE NAME: FORMATO.DGN

ADB

ROYO MDF

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas — euroestudios

SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK

DRAWING NO.: 16.01 SHEET 6 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

University Station

Pk 77+10.074

Pk 77+61.244

Pk 78+72.172

TYPE IV

TYPE XIII
TECHNICAL ROOMS

PLATFORM

TYPE XII-C

ACCESS #1

SHAFT #72

ACCESS #2

ACCESS #3

ACCESS #4

LOW VOLTAGE SUBSTATION

PLATFORM

LEFT RAIL WALL

SLAB TRACK

SHAFT #73

TECHNICAL FACILITIES SUPPLY

RIGHT RAIL WALL

CHAMBER #1

VENTILATION GROVE

76+00

77+00

78+00

79+00

78+92.432

STRAIGHT LINE
76+ 80.883

R=6000.000

R=6000.000
77+ 30.993

R=4000.000

R=4000.000
STRAIGHT LINE
77+ 59.682

REPLACEMENT:							
VERIFIED							
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCIA
REASON FOR MODIFICATION		DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS			
DATE		28-10-2013	30-04-2014	06-05-2014			
VERSION		04	05	06			
DOC.		P	P	P			
SECTION	210301	210301	210301	210301			
NUMBER WORK	202017	202017	202017	202017			

REPLACED BY: JOS• MARIA ARANDA

VERIFIED: JOS• MARIA ARANDA

DRAWN BY: JOS• LUIS G•MEZ, JOS• LUIS G•MEZ, JOS• LUIS G•MEZ, JOS• LUIS G•MEZ, JOS MARIA ARANDA, JOSE MARIA ARANDA, JOS• LUIS G•MEZ, ADOLFO GARCIA

REASON FOR MODIFICATION: DUE TO MDF'S COMMENTS; DUE TO MDF AND TICS REQUIREMENTS; DUE TO MDF REQUIREMENTS

DATE: 28-10-2013; 30-04-2014; 06-05-2014

VERSION: 04; 05; 06

DOC.: P; P; P

SECTION: 210301; 210301; 210301

NUMBER WORK: 202017; 202017; 202017

DRAWING NO.: 16.01

SHEET 7 OF 17

SCALE: 1:500 12-06-2014

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE 202017 210301 P
LEFT TRACK

FILE NAME: FORMATO.DGN

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas

euroestudios

SCALE A-1
1:500
Numerical

Graphic
0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS
LEFT TRACK

DRAWING NO.
16.01
SHEET 7 OF 17

REPLACEMENT:

REASON FOR MODIFICATION	DATE	VERSION	DOC.	SECTION	NUMBER WORK	DRAWN BY	VERIFIED
DUE TO MDF'S COMMENTS	28-10-2013	04	P	210301	202017	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
LUIS GOMEZ JOSE MARIA ARANDA DUE TO MDF AND TICS REQUIREMENTS	14-01-2014	05	P	210301	202017	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
DUE TO MDF REQUIREMENTS	06-05-2014	06	P	210301	202017	ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACED BY:

DRAWING NO: 16.01

SHEET 8 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE LEFT TRACK

FILE NAME: FORMATO.DGN

University Station

AREA 7

AREA 8

AREA 5

AREA 6

AREA 9

Pk 79+18.122

Pk 80+12.150

Pk 80+43.931

Pk 80+73.388

Pk 81+67.122

Pk 81+86.749

TYPE XII-C

TYPE XII-S

CHAMBER 2

CHAMBER 3

CHAMBER 4

CHAMBER 4

END OF THE PROJECT

SLAB TRACK

II RAIL AXIS

RAIL ON CONCRETE

79+00

80+00

80+09,210

80+27,179

81+00

79+00,263

80+45,010

78+92,432

79+00

79+08,232

RAIL AXIS

80+00

81+00

CHAMBER #1

VENTILATION CHAMBER

VENTILATION GROVE

VENTILATION WELL SHAFT #51

STRAIGHT LINE R=10000.000 80+ 49.727

STRAIGHT LINE R=10000.000 80+ 94.448

STRAIGHT LINE R=10000.000 81+ 39.170

STRAIGHT LINE 81+ 86.749

MAIN DRAINAGE PUMPING

#75 VENTILATION WELL Ø500

#74, #74ª WELL Ø500

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

	Total
Trees to be protected	24

		Total
	Trees to be cut down	12
Area 5	Larch (*Larix decidua*)	1
	Horse-chestnut (*Aesculus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 7	Plane tree (*Platanus sp.*)	2
Area 8	Ash tree (*Fraxinus sp.*)	1
Area 9	Walnuts (*Juglans Regia*)	2
	Mature Lime (Tilia sp.)	1
	Ash tree (*Fraxinus sp.*)	1

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas
euroestudios

SCALE A-1
1:500
Numerical
Graphic 0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS LEFT TRACK

DRAWING NO.
16.01
SHEET 8 OF 17

BEGINNING OF THE PROJECT

STRAIGHT LINE

56+00.000

Delisi Station

56+00

57+00

58+00

PLATFORM

SCISSOR CROSSING

Pk 56+00.000

Pk 56+91.000

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

LEGEND

- TYPE III
- TYPE IV
- TYPE VII
- TYPE IX
- TYPE X
- TYPE XI
- TYPE XII
- TYPE XII-C
- TYPE XII-S
- TYPE XIII (TECHNICAL ROOMS)
- SCISSOR CROSSING
- CHAMBER 2
- CHAMBER 3
- CHAMBER 4

REPLACEMENT:			
NUMBER WORK	SECTION	DOC.	VERSION	DATE	REASON FOR MODIFICATION	DRAWN BY	VERIFIED
202017	210301	P	04	28-10-2013	DUE TO MDF'S COMMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	05	14-01-2014	DUE TO MDF AND TFCS REQUIREMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACED BY:

DRAWING NO: 16.01 SHEET 9 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK 1

FILE NAME: FORMATO.DGN

ADB

MDF

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas — euroestudios

SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS RIGHT TRACK

DRAWING NO.: 16.01 SHEET 9 OF 17

REPLACEMENT:			
REPLACED BY:			
VERIFIED			
DRAWN BY			
REASON FOR MODIFICATION			
DATE			
VERSION			
DOC.			
SECTION			
NUMBER WORK			
202017	210301	P	04	28-10-2013	DUE TO MDF'S COMMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA	
202017	210301	P	05	14-01-2014	DUE TO MDF AND TICS REQUIREMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA	
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOS• MAR•A ARANDA	

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

SCALE: 1:500

DRAWING NO: 16.01

SHEET 10 OF 17

FILE NAME: FORMATO.DGN

58+00

59+00

60+00

61+00

59+ 88.995 STRAIGHT LINE

60+ 8.995 A=200.000 R=2000.000

61+ 11.594 R=2000.000 A=200.000

61+ 31.594 A=200.000 A=200.000

61+ 51.594 R=2000.000 A=200.000

SCISSOR CROSSING

TYPE VIII

Pk 59+85.914

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

vaja-fSavelas II Sesaxvevi

ADB		PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT	DESIGNER: Juan I. Valderas, euroestudios	SCALE A-1: 1:500 Numerical; Gráphic 0 10 20 30M	DATE: MAY 2014	DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS RIGHT TRACK — DRAWING NO. 16.01 — SHEET 10 OF 17

REPLACEMENT:			
VERIFIED	JOS• MAR•A ARANDA	JOS• MAR•A ARANDA	JOS• MAR•A ARANDA
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.01 SHEET 11 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

FILE NAME: FORMAT.DGN

61+ 31.594 A=200.000 / A=200.000

61+ 51.594 R=2000.000 / A=200.000

62+ 53.007 A=200.000 / R=2000.000

62+ 73.007 STRAIGHT LINE / A=200.000

62+00 63+00 64+00 65+00

LINE OVERLAP SHEET 1

TYPE X

TYPE IX

TYPE IX

Pk 61+76.177

Pk 62+65.534

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

vaJa-fSavelas IV Sesaxvevi

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas

euroestudios

SCALE A-1
1:500
Numerical
Graphic
0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS
RIGHT TRACK

DRAWING NO.
16.01
SHEET 11 OF 17

Vazha-Pshavela Station

65+ 21.107 STRAIGHT LINE A=200.000

65+ 41.107 R=2000.000 STRAIGHT LINE

66+ 42.887 A=200.000 R=2000.000

66+ 62.887 A=200.000 A=200.000

66+ 82.887 R=2000.000 A=200.000

67+ 84.080 A=200.000 R=2000.000

68+ 4.080 STRAIGHT LINE A=200.000

65+00

66+00

67+00

68+00

TYPE IX

TYPE X

TYPE VIII

TYPE XIII
TECHNICAL ROOMS

PLATFORM

Pk 65+29.858

Pk 66+19.231

Pk 67+45.385

Pk 68+06.367

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

NUMBER WORK	SECTION	DOC.	VERSION	DATE	REASON FOR MODIFICATION	DRAWN BY	VERIFIED
202017	210301	P	04	28-10-2013	DUE TO MDF'S COMMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	05	14-01-2014	DUE TO MDF AND TICS REQUIREMENTS	JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACEMENT:
REPLACED BY:

DRAWING NO: 16.01
SHEET 12 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

FILE NAME: FORMATO.DGN

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas
euroestudios

SCALE A-1
1:500 Numerical
0 10 20 30M Gráphic

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS
RIGHT TRACK

DRAWING NO.
16.01
SHEET 12 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

Vazha-Pshavela Station

69+ 41.985
R=24000.000
STRAIGHT LINE

70+ 11.098
R=24000.000
R=40000.000

71+ 24.436
R=40000.000
STRAIGHT LINE

69+00
70+00
71+00
72+00

PLATFORM
PLATFORM
TYPE XIII
TECHNICAL ROOMS
TYPE XI
TYPE III

PK 69+14.367
PK 69+55.368
PK 71+00.330

REPLACEMENT:			
VERIFIED	JOS• MARÍA ARANDA	JOS• MARÍA ARANDA	JOS• MARÍA ARANDA
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCÍA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TTCS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.01
SHEET 13 OF 17
SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT
DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK
FILE NAME: FORMATO.DGN

ADB | MDF

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Juan I. Valderas
euroestudios

SCALE A-1
1:500
Numerical
Gráphic
0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS
RIGHT TRACK

DRAWING NO.
16.01
SHEET 13 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

VENTILATION BOX
VENTILATION CHANNEL
VENTILATION WELL. SHAFT #50
AREA 3
AREA 2
AREA 1
AREA 4
CANCELED SANITARY

72+ 19.679 STRAIGHT LINE R=90000.000
72+ 58.844 STRAIGHT LINE R=90000.000
74+ 99.097 STRAIGHT LINE R=7000.000
75+ 18.554 STRAIGHT LINE R=7000.000
75+ 64.165 STRAIGHT LINE R=12000.000

72+00 73+00 74+00 75+00

TYPE III | TYPE IV | TYPE VII-G | TYPE III | TYPE IV

Pk 72+70.369
Pk 74+69.09
Pk 74+80.37
Pk 74+94.09

	Total
Trees to be protected	22

REASON FOR MODIFICATION	DATE	VERSION	DOC.	SECTION	NUMBER WORK
DUE TO MDF'S COMMENTS	28-10-2013	04	P	210301	202017
DUE TO MDF AND TICS REQUIREMENTS	14-01-2014	05	P	210301	202017
DUE TO MDF REQUIREMENTS	06-05-2014	06	P	210301	202017

DRAWN BY	VERIFIED
JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
JOS• LUIS G•MEZ	JOS• MAR•A ARANDA
ADOLFO GARCIA	JOS• MAR•A ARANDA

REPLACEMENT:
REPLACED BY:

DRAWING NO: 16.01
SHEET 14 OF 17
SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

FILE NAME: FORMATO.DGN

ADB | EUROS MDF

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas — euroestudios

SCALE A-1: 1:500 Numerical | 0 10 20 30M Graphic

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS RIGHT TRACK

DRAWING NO. 16.01
SHEET 14 OF 17

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

University Station

75+ 64.165 STRAIGHT LINE R=12000.000

76+ 61.684 R=12000.000 R=20000.000

77+ 48.768 STRAIGHT LINE R=20000.000

ACCESS #1

SHAFT #72

ACCESS #2

ACCESS #3

ACCESS #4

LOW VOLTAGE SUBSTATION

PLATFORM

LEFT RAIL WALL

SLAB TRACK

CHAMBER #1

76+00

77+00

78+00

79+00

79+00

76+00

77+00

78+00

79+00

78+92.432

TECHNICAL FACILITIES SUPPLY

RIGHT RAIL WALL

TYPE IV

TECHNICAL ROOMS

PLATFORM

TYPE IV

CHAMB

Pk 77+10.170

Pk 77+61.615

Pk 78+72.480

Pk 79+00.000

VENTILATION GROVE

REPLACEMENT:			
REPLACED BY:			
VERIFIED	JOS• MARIA ARANDA	JOS• MARIA ARANDA	JOS• MARIA ARANDA
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.01 SHEET 15 OF 17

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

FILE NAME: FORMATO.DGN

ADB

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas

euroestudios

SCALE A-1: 1:500 Numerical; Graphic 0 10 20 30M

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS RIGHT TRACK

DRAWING NO.: 16.01 SHEET 15 OF 17

REPLACEMENT:			
VERIFIED	JOS• MARÍA ARANDA	JOS• MARÍA ARANDA	REPLACED BY:
DRAWN BY	JOS• LUIS G•MEZ	JOS• LUIS G•MEZ	ADOLFO GARCÍA
REASON FOR MODIFICATION	DUE TO MDF'S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017
DRAWING NO:	16.01		
SHEET	16 OF 17		
SCALE:	1:500		

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: GENERAL PLAN AND PROFILE RIGHT TRACK

FILE NAME: FORMATO.DGN

University Station

AREA 5

AREA 6

AREA 7

AREA 8

AREA 9

SLAB TRACK

II RAIL AXIS

I RAIL AXIS

RAIL ON CONCRETE

STRAIGHT LINE

R=10000.000

79+00

79+00,263

78+92,432

79+08,232

80+00

80+09,210

80+27,179

80+45,010

81+00

79+ 69.406

80+ 1.022

80+ 32.651

81+ 87.105

END OF THE PROJECT

#75 VENTILATION WELL Ø500

TYPE IV

CHAMBER 1

CHAMBER 2

CHAMBER 4

CHAMBER 4

TYPE XII-S

Pk 79+00.000

Pk 79+18.528

Pk 80+43.581

Pk 80+73.735

Pk 81+67.381

Pk 81+ 87.105

CHAMBER #1

VENTILATION CHAMBER

VENTILATION GROVE

VENTILATION WELL. SHAFT #51

MAIN DRAINAGE PUMPING

#74, #74ª WELL Ø500

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

		Total
	Trees to be protected	24

		Total
	Trees to be cut down	12
Area 5	Larch (*Larix decidua*)	1
	Horse-chestnut (*Aesculus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 7	Plane tree (*Platanus sp.*)	2
Area 8	Ash tree (*Fraxinus sp.*)	1
Area 9	Walnuts (*Juglans Regia*)	2
	Mature Lime (Tilia sp.)	1
	Ash tree (*Fraxinus sp.*)	1

ADB

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas

euroestudios

SCALE A-1: 1:500 Numerical

Gráphic: 0 10 20 30M

DATE: MAY 2014

DRAWING TITLE: PROJECT LAYOUT: EXISTING INFRAESTRUCTURE AND ENVIRONMENTAL SETTINGS RIGHT TRACK

DRAWING NO. 16.01 SHEET 16 OF 17

AREA 7

AREA 8

AREA 5

AREA 6

AREA 9

79+00

79+00,263

78+92,432

79+00

79+08,232

80+00

80+09,210

80+27,179

80+45,010

		Total
	Trees to be protected	24

		Total
	Trees to be cut down	12
Area 5	Larch (*Larix decidua*)	1
	Horse-chestnut (*Aesculus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 7	Plane tree (*Platanus sp.*)	2
Area 8	Ash tree (*Fraxinus sp.*)	1
Area 9	Walnuts (*Juglans Regia*)	2
	Mature Lime (Tilia sp.)	1
	Ash tree (*Fraxinus sp.*)	1

University Station

Tunnel: Presence of a wintering colony of up to 500 Greater Horseshoe bats (Rhinolophus Ferrumequinum)

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: LAYOUT OF THE STATION AND ITS ENVIRONMENTAL SETTINGS

SCALE: 1:250

DRAWING NO: 16.01

SHEET 17 OF 17

NUMBER WORK: 202017

SECTION: 210301

DOC.: P

VERSION: 04 | 05 | 06

DATE: 28-10-2013 | 14-01-2014 | 06-05-2014

REASON FOR MODIFICATION: DUE TO MDF'S COMMENTS | DUE TO MDF AND TIC'S REQUIREMENTS | DUE TO MDF REQUIREMENTS

DRAWN BY: JOS• LUIS G•MEZ | JOS• LUIS G•MEZ | ADOLFO GARCIA

VERIFIED: JOS• MAR•A ARANDA | JOS• MAR•A ARANDA | JOS• MAR•A ARANDA

REPLACEMENT:

REPLACED BY:

FILE NAME: 202017_PLAN_R_500_17.DGN

ADB

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Juan I. Valderas — euroestudios

SCALE A-1: 1:250 Numerical; 0 5 10 15M Gráphic

DATE: MAY 2014

DRAWING TITLE: LAYOUT OF THE STATION AND ITS ENVIRONMENTAL SETTINGS

DRAWING NO.: 16.02

SHEET 17 OF 17

Area	Type of tree	Total
Area 1	Poplar (*Populus sp.*)	1
	Walnut (*Juglans regia*)	1
Area 2	No trees have been planted in this area, but many spontaneous bushes have grown in without human intervention.	
Area 3	Plane tree (*Platanus sp.*)	14
Area 4	Elm (*Ulmus sp.*)	1
	Goldenrain (*Koelreuteria paniculata*)	1
	Pear trees (*Pyrus sp.*)	2
	Walnut (*Juglans regia*)	1

AREA 1

AREA 2

AREA 3

AREA 4

75+00

74+00

TYPE IV

TYPE III

TYPE IV

Pk 74+93.989

Pk 74+80.000

Pk 74+69.080

REPLACEMENT:	VERIFIED	DRAWN BY	REASON FOR MODIFICATION	DATE	VERSION	DOC.	SECTION	NUMBER WORK
REPLACED BY:	JOSE MARIA ARANDA	JOSE LUIS GOMEZ	DUE TO MDF-S COMMENTS	28-10-2013	04	P	210301	202017
JOSE MARIA ARANDA	JOSE MARIA ARANDA	JOSE LUIS GOMEZ	DUE TO MDF AND TTCS REQUIREMENTS	14-01-2014	05	P	210301	202017
JOSE MARIA ARANDA	ADOLFO GARCIA		DUE TO MDF REQUIREMENTS	06-05-2014	06	P	210301	202017

DRAWING NO.: 16.02

SHEET 2 OF 3

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: INVENTORY OF TREES PLANTED IN THE PROJECT AREA

FILE NAME: FORMATO.DWG

ADB

MDF

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Natalia del Palacio

euroestudios

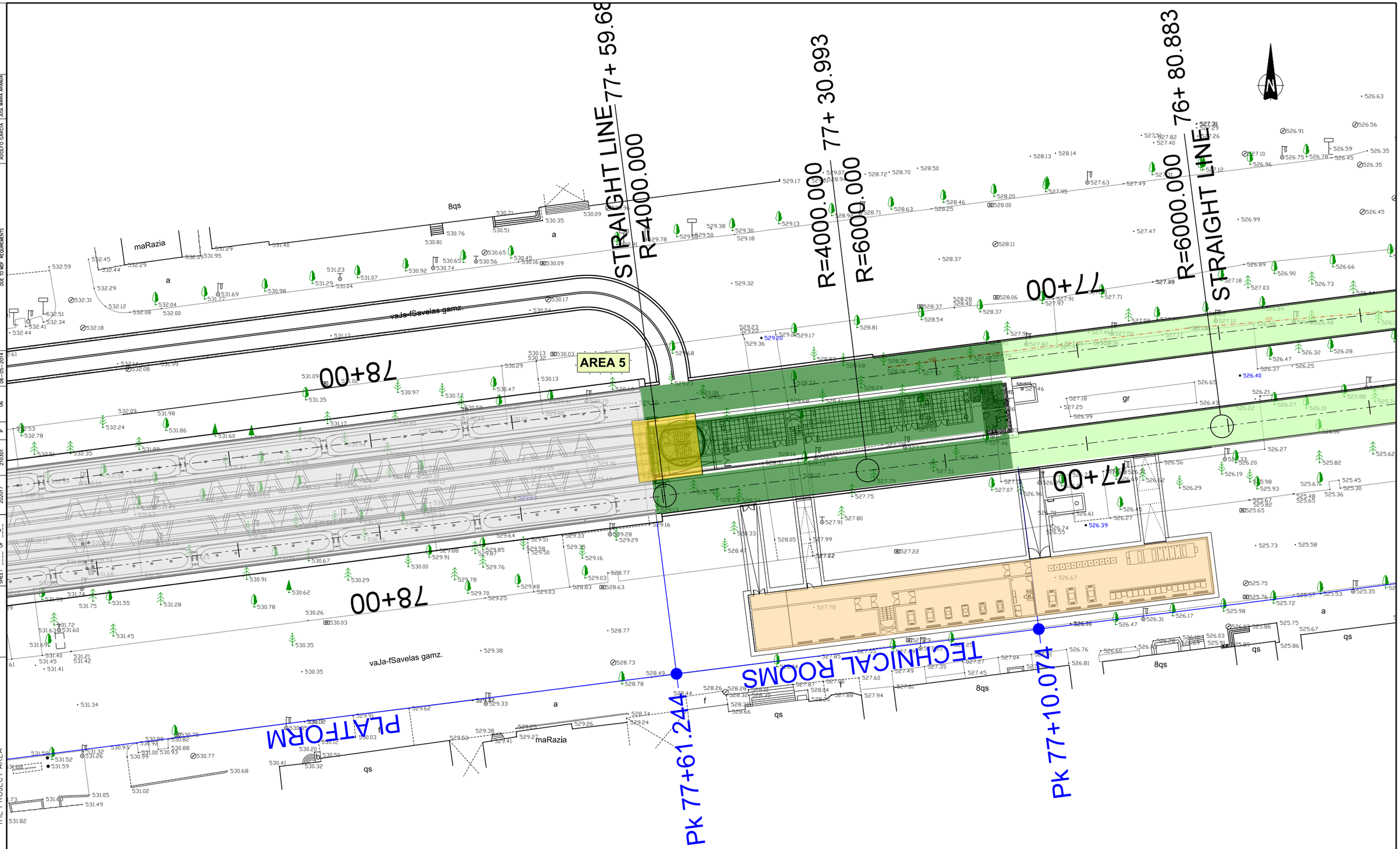
SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic

DATE: MAY 2014

DRAWING TITLE: INVENTORY OF TREES PLANTED IN THE PROJECT AREA

DRAWING NO.: 16.02

SHEET 1 OF 3



Area		Total
Area 5	Larch (*Larix decidua*)	8
	Pine (*Pinus sp.*)	4

REPLACEMENT:							
VERIFIED	JOSE MARIA ARANDA	JOSE MARIA ARANDA	JOSE MARIA ARANDA				
DRAWN BY	JOSE LUIS GOMEZ	JOSE LUIS GOMEZ	ADOLFO GARCIA				
REASON FOR MODIFICATION	DUE TO MDF-S COMMENTS	DUE TO MDF AND TICS REQUIREMENTS	DUE TO MDF REQUIREMENTS				
DATE	28-10-2013	14-01-2014	06-05-2014				
VERSION	04	05	06				
DOC.	P	P	P				
SECTION	210301	210301	210301				
NUMBER WORK	202017	202017	202017				

DRAWING NO:	16.02
SHEET	2 OF 3
SCALE:	1:500
PROJECT:	CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT
DRAWING TITLE:	INVENTORY OF TREES PLANTED IN THE PROJECT AREA
FILE NAME:	FORMATO.DWG

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Natalia del Palacio

euroestudios

SCALE A-1
1:500
Numerical

Graphic 0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
INVENTORY OF TREES PLANTED IN THE PROJECT AREA

DRAWING NO.
16.02
SHEET 2 OF 3

Area	Type of tree	Total
Area 5	Larch (*Larix decidua*)	1
	Horse-chestnut (*Aesculus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 6	Plane tree (*Platanus sp.*)	2
	Ash tree (*Fraxinus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 7	Plane tree (*Platanus sp.*)	2
Area 8	Ash tree (*Fraxinus sp.*)	1
Area 9	Walnuts (*Juglans Regia*)	2
	Mature Lime (*Tilia sp.*)	1
	Ash tree (*Fraxinus sp.*)	1

REPLACEMENT:	VERIFIED	DRAWN BY	REASON FOR MODIFICATION	DATE	VERSION	DOC.	SECTION	NUMBER WORK
REPLACED BY:	JOSE MARIA ARANDA	JOSE LUIS GOMEZ	DUE TO MDF-S COMMENTS	28-10-2013	04	P	210301	202017
	JOSE MARIA ARANDA	JOSE LUIS GOMEZ	DUE TO MDF AND TTCS REQUIREMENTS	14-01-2014	05	P	210301	202017
	JOSE MARIA ARANDA	ADOLFO GARCIA	DUE TO MDF REQUIREMENTS	06-05-2014	06	P	210301	202017

DRAWING NO: 16.02
SHEET 3 OF 3
SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: INVENTORY OF TREES PLANTED IN THE PROJECT AREA

FILE NAME: FORMATO.DWG

ADB

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Natalia del Palacio

euroestudios

SCALE A-1: 1:500 Numerical

Graphic: 0 10 20 30M

DATE: MAY 2014

DRAWING TITLE: INVENTORY OF TREES PLANTED IN THE PROJECT AREA

DRAWING NO.: 16.02

SHEET 3 OF 3

REPLACEMENT:			
VERIFIED	JOSE MARIA ARANDA	JOSE MARIA ARANDA	JOSE MARIA ARANDA
DRAWN BY	JOSE LUIS GOMEZ	JOSE LUIS GOMEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF-S COMMENTS	DUE TO MDF AND TTCS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.03 SHEET 3 OF 4

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES

FILE NAME: FORMATO.DWG

AREA 1

AREA 2

AREA 3

AREA 4

8qs

qas

as

Saxta

	Total
Trees to be protected	22

ADB

PROJECT
CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER
Natalia del Palacio

euroestudios

SCALE A-1
1:500
Numerical

Graphic 0 10 20 30M

DATE
MAY 2014

DRAWING TITLE
ENVIRONMENTAL MITIGATION MEASURES

DRAWING NO.
16.03
SHEET 1 OF 4

REPLACEMENT:			
REPLACED BY:	JOSE MARIA ARANDA	JOSE MARIA ARANDA	JOSE MARIA ARANDA
VERIFIED	JOSE MARIA ARANDA	JOSE MARIA ARANDA	JOSE MARIA ARANDA
DRAWN BY	JOSE LUIS GOMEZ	JOSE LUIS GOMEZ	ADOLFO GARCIA
REASON FOR MODIFICATION	DUE TO MDF-S COMMENTS	DUE TO MDF AND TTCS REQUIREMENTS	DUE TO MDF REQUIREMENTS
DATE	28-10-2013	14-01-2014	06-05-2014
VERSION	04	05	06
DOC.	P	P	P
SECTION	210301	210301	210301
NUMBER WORK	202017	202017	202017

DRAWING NO: 16.03

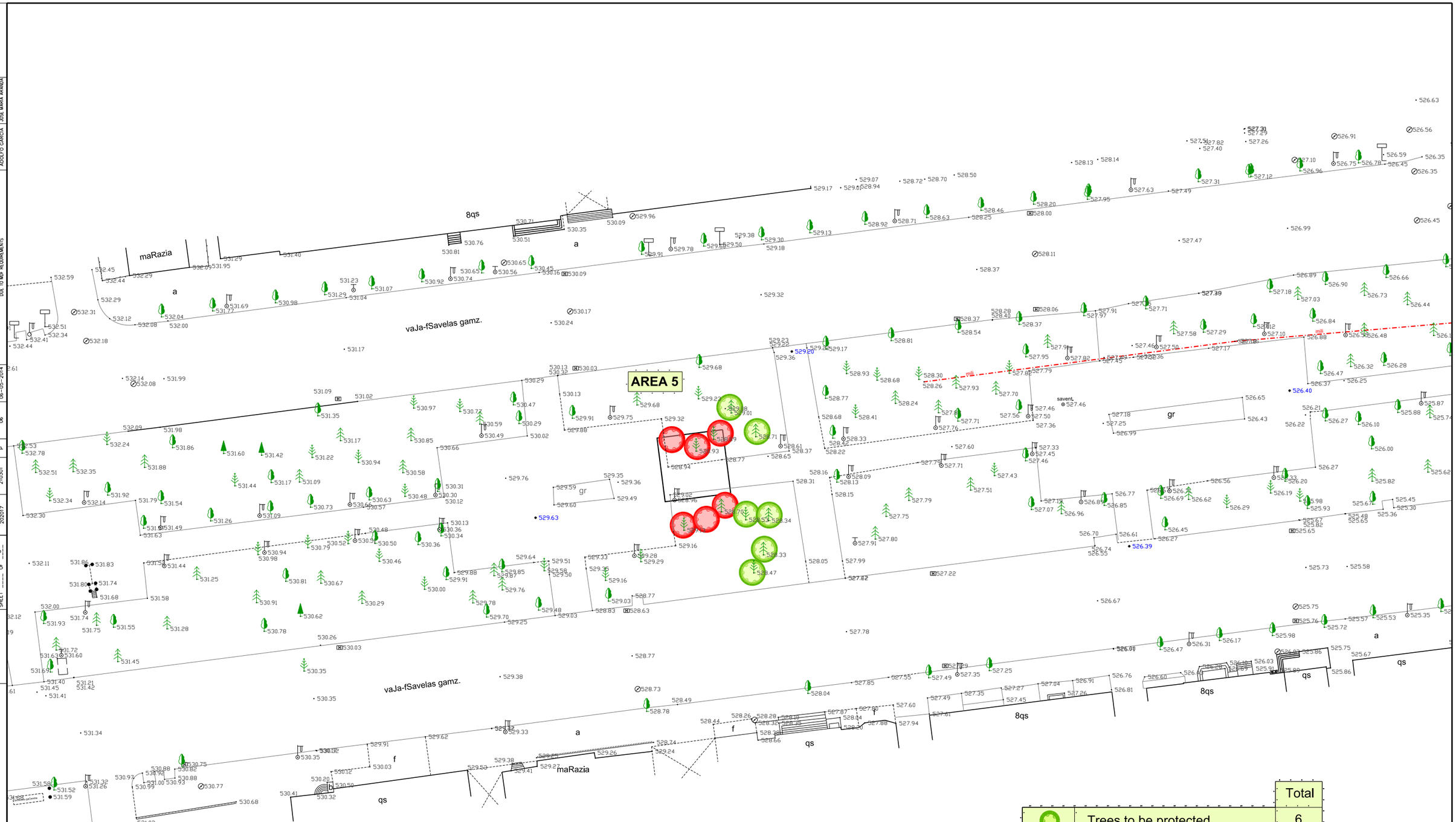
SHEET ____ OF 3

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES

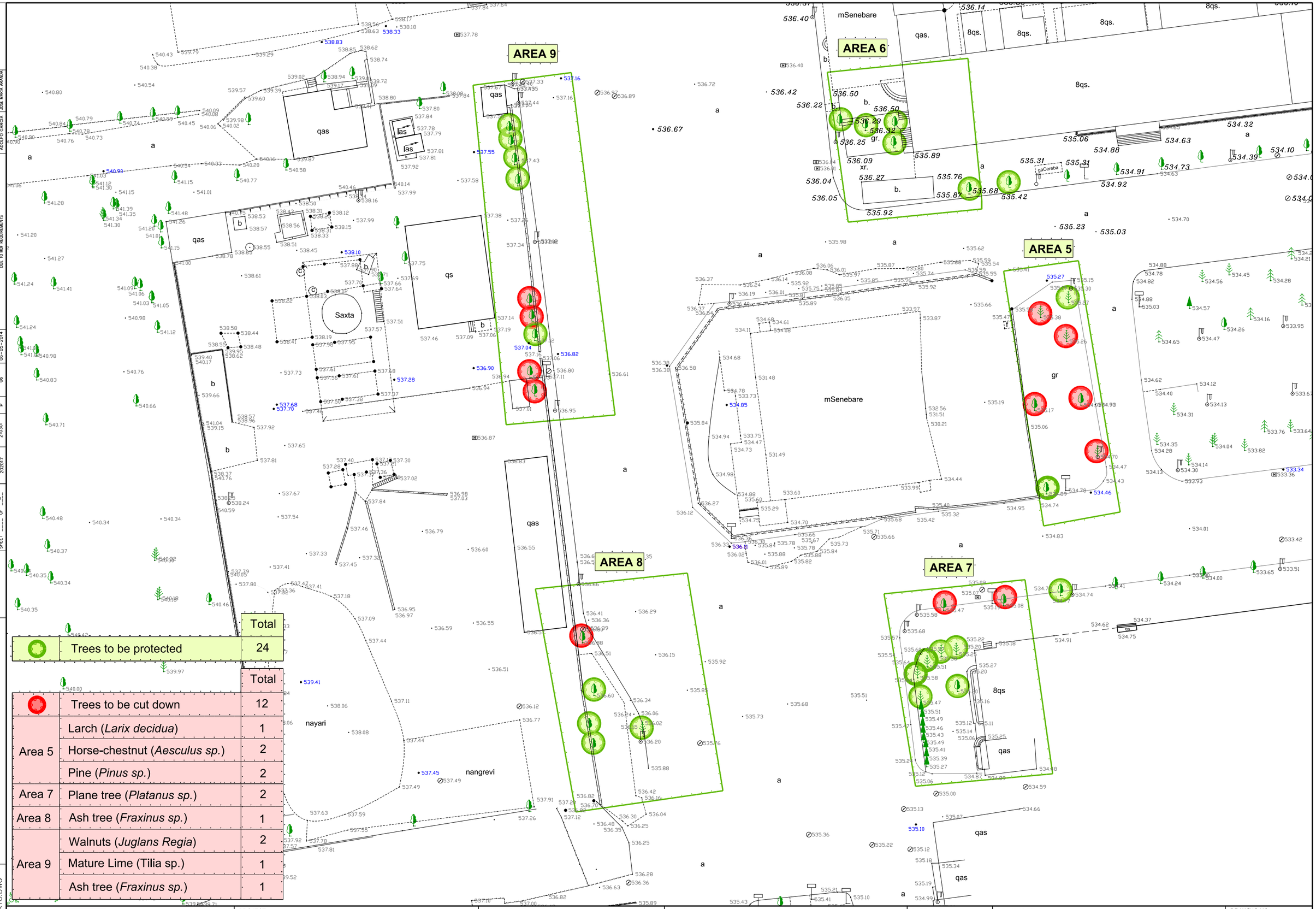
FILE NAME: FORMA TO.DWG



		Total
	Trees to be protected	6

		Total
	Trees to be cut down	6
Area 5	Larch (*Larix decidua*)	4
	Pine (Pinus sp.)	2

ADB	MDF	PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT	DESIGNER: Natalia del Palacio, euroestudios	SCALE A-1: 1:500 Numerical; 0 10 20 30M Graphic	DATE: MAY 2014	DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES / DRAWING NO.: 16.03 SHEET 2 OF 4



Total	
Trees to be protected	24

		Total
	Trees to be cut down	12
Area 5	Larch (*Larix decidua*)	1
	Horse-chestnut (*Aesculus sp.*)	2
	Pine (*Pinus sp.*)	2
Area 7	Plane tree (*Platanus sp.*)	2
Area 8	Ash tree (*Fraxinus sp.*)	1
Area 9	Walnuts (*Juglans Regia*)	2
	Mature Lime (Tilia sp.)	1
	Ash tree (*Fraxinus sp.*)	1

REPLACEMENT:

REASON FOR MODIFICATION	DATE	VERSION	DOC.	SECTION	NUMBER WORK	DRAWN BY	VERIFIED
DUE TO MDF-S COMMENTS	28-10-2013	04	P	210301	202017	JOSE LUIS GOMEZ	JOSE MARIA ARANDA
DUE TO MDF AND TTCS REQUIREMENTS	14-01-2014	05	P	210301	202017	JOSE LUIS GOMEZ	JOSE MARIA ARANDA
DUE TO MDF REQUIREMENTS	06-05-2014	06	P	210301	202017	ADOLFO GARCIA	JOSE MARIA ARANDA

REPLACED BY:

DRAWING NO: 16.03 SHEET 3 OF 4

SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES

FILE NAME: FORMATO.DWG

ADB

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

DESIGNER: Natalia del Palacio — euroestudios

SCALE A-1: 1:500 Numerical; Graphic 0 10 20 30M

DATE: MAY 2014

DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES

DRAWING NO.: 16.03 SHEET 3 OF 4

REPLACEMENT:					
NUMBER WORK	SECTION	DOC.	VERSION	DATE	REASON FOR MODIFICATION	DRAWN BY	VERIFIED
202017	210301	P	04	28-10-2013	DUE TO MDF-S COMMENTS	JOSE LUIS GOMEZ	JOSE MARIA ARANDA
202017	210301	P	05	14-01-2014	DUE TO MDF AND TTC'S REQUIREMENTS	JOSE LUIS GOMEZ	JOSE MARIA ARANDA
202017	210301	P	06	06-05-2014	DUE TO MDF REQUIREMENTS	ADOLFO GARCIA	JOSE MARIA ARANDA

DRAWING NO: 16.03 SHEET 4 OF 4

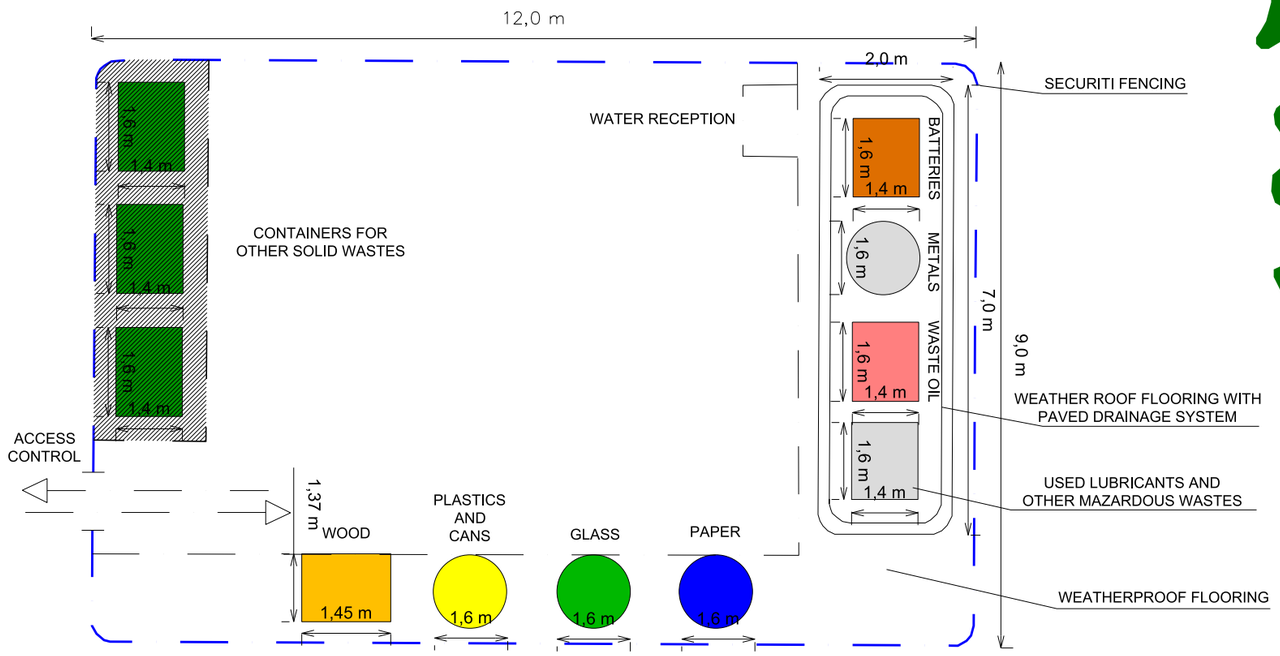
SCALE: 1:500

PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT

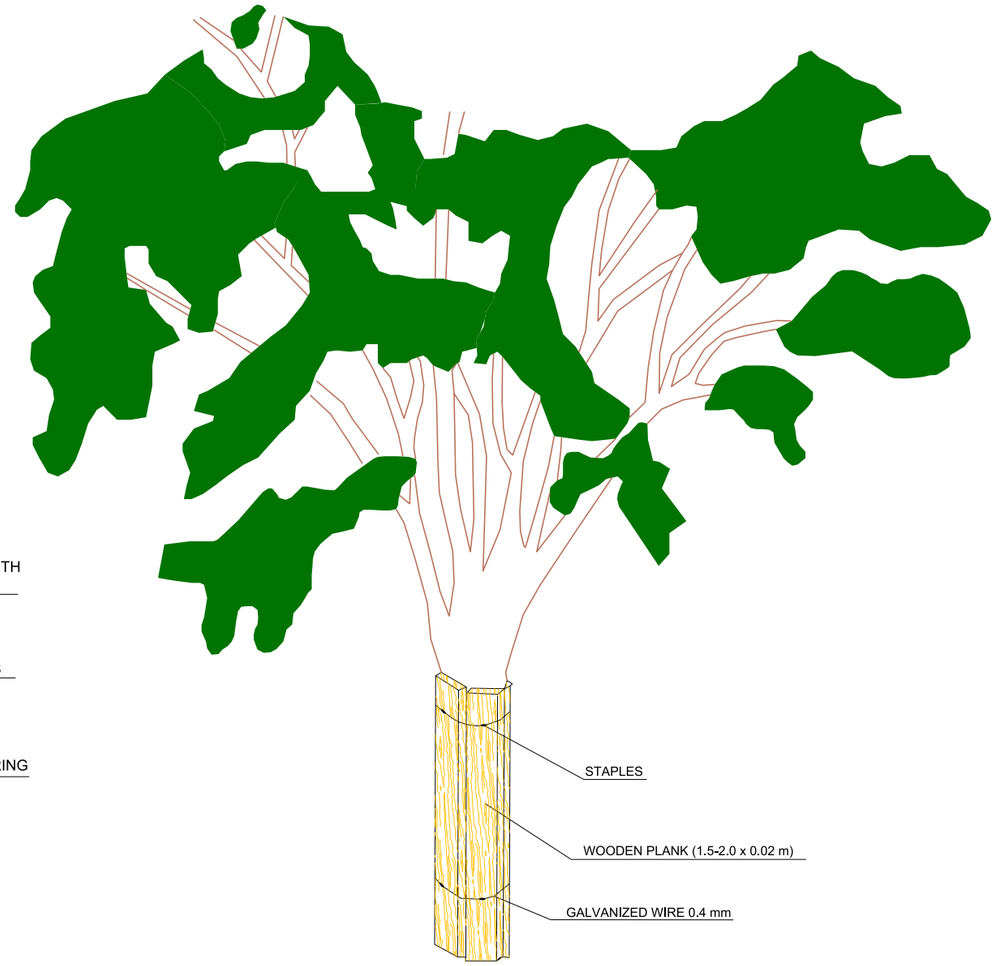
DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES

FILE NAME: FORMATO.DWG

RECYCLING POINT



INDIVIDUAL PROTECTOR



ADB / MDF	PROJECT: CONSTRUCTION MANAGEMENT AND SUPERVISION FOR THE EXTENSION OF THE TBILISI METRO LINE 2 AND CREATION OF UNIVERSITY STATION PROJECT	DESIGNER: Natalia del Palacio, euroestudios	SCALE A-1: 1:500 Numerical; Graphic 0 10 20 30M	DATE: MAY 2014	DRAWING TITLE: ENVIRONMENTAL MITIGATION MEASURES	DRAWING NO.: 16.03 SHEET 4 OF 4