Government of Georgia
Asian Development Bank

Environmental Assessment Report

Project Number: 43405
November 2010

Proposed Multitranche Financing Facility
Georgia: Urban Services Improvement Investment Program

INITIAL ENVIRONMENTAL EXAMINATION REPORT
Marneuli Water Supply Improvement Subproject

ABBREVIATIONS

ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
CA	-	Cross section area
CC	-	Civil Contractor
COD	-	Chemical Oxygen Demand
DC	-	Design Consultants
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIB	-	European Investment Bank
EIP	-	Environmental Impact Permit
EMP	-	Environmental Management Plan
EMS	-	Environmental Management Specialist
GRC	-	Grievance Redress Mechanism
HDPE	-	High Density Poly Ethylene
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IPMO	-	Investment Program Management Office
Kg	-	Kilogram
Km	-	Kilometer
kW	-	Kilo Watt
LPCD	-	Liters per Capita per Day
M	-	Meter
MDF	-	Municipal Development Fund
MFF-IP	-	Multitranche Financing Facility Investment Program
mg/l	-	milligram per liter
Mm	-	Millimeter
MoESD	-	Ministry of Economy & Sustainable Development
MoEPNR	-	Ministry Environment Protection & Natural Resources
MoRDI	-	Ministry of Regional Development & Infrastructure
OSPF	-	Office of the Special Project Facilitator
OCRP	-	Office of the Compliance Review panel
PCB	-	Polychlorinated Biphenyls
RCC	-	Reinforced Cement Concrete
SC	-	Supervision Consultant
SF6	-	Sulfur Hexafluoride
SIEE	-	Summary Initial Environmental Examination
SOP	-	Standard Operating Procedures
uPVC	-	Un-plasticized Poly vinyl Chloride
UWSCG	-	United Water Supply Company of Georgia
WSS	-	Water Supply & Sanitation

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EXECUTIVE SUMMARY

1. It is proposed to improve the water supply system in Marneuli under the Asian Development Bank (ADB) funded Urban Services Improvement Investment Program, which is under preparation stage. This Investment Program, implemented in six towns, including Marneuli, will develop the water and sanitation services, which will improve quality of life and optimize the social and economic development. Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) and United Water Supply Company of Georgia (UWSCG) is the Implementing Agency (IA) of this Program. This subproject will be implemented from mid-2011 and likely to be completed by the end of 2012. Since the subproject is unlikely to have significant adverse impacts, it is classified as environment Category B, and accordingly an Initial Environmental Examination has been conducted. This is a summary of the IEE Report.

2. Marneuli, situated at 29 km southeast of Tbilisi, is the administrative centre of Marneuli District in Kvemo Kartli region. The service levels of water supply are very low with partial coverage, intermittent supply, unequal supply and low terminal pressure. This subproject will improve the service standards, with a daily supply of potable water in adequate quantity (200 lpcd) at requisite pressure. The subproject is design to meet the projected demand of 2040. This will be achieved by: (i) rehabilitating existing bore holes, reservoirs and pumping stations; (ii) constructing new reservoirs and pumping stations, (iii) laying of a new transmission from Orjonikizde headworks to Narimanov Pumping Station, and (iv) construction disinfection and laboratory facilities. These improvements will benefit Marneuli Town and villages in the urban periphery.

3. There are no sensitive environmental resources in the project area in general and near the subproject sites in particular. Most of the proposed infrastructure works will be located within the existing facilities of UWSCG, some of which are located within the town and some outside. Narimanov (reservoirs and pumping improvement works), Jhandari (reservoirs and pumping improvement works) and Garadakh (reservoir works) are located in the town, while Orjonikidze head works (bore well, reservoir and pumping improvement works) is located outside. Since the existing pumping main from Orjonikidze headworks to Narimanov runs through private agricultural lands, a new alignment alongside the field roads has been identified, to avoid the private land acquisition. There are no sensitive environmental features in the alignment.

4. The Marneuli water supply improvement subproject is relatively small in scale and involves straightforward construction and low-maintenance operation, in an environment that is not especially sensitive, so it is identified that there will be no major adverse impacts. The likely impacts are mostly short-term, localized and can either be easily avoided or mitigated.

5. Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other ground disturbance. However the routine nature of the impacts means that most can be easily mitigated. Impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance of residents, traffic and activities by the construction work. These are common impacts of construction in urban areas, and there are well developed methods suggested for their mitigation. These include: (i) Utilizing surplus/waste soil for beneficial purposes; (ii) Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc); (iii) Providing prior public information and work planning in consultation; (iv) Planning transport routes/schedules carefully and awareness creation in drivers; (v) Following standard and safe procedures for public and worker safety, and (vi) Avoiding nighttime construction activities and enclosing the construction area at Garadakh, which is located within a residential neighborhood.

7. The improvement works will also involve replacement of old transformers, which are likely to contain PCBs. Therefore appropriate measures in terms of testing and disposal of PCB containing oil to authorized facilities has been suggested.

8. During operation of any activity, the impacts mainly arise from resource utilization and waste generation. The main risk of operating an improved water supply system is that increased abstraction of groundwater will deplete the water resource. Unsustainable extraction of groundwater may lead to degradation of groundwater quality, impacts on local vegetation, land subsidence and reduction in water holding, etc. Depletion of water resource will also lead to closure of the system and wastage of investment. There are no waste streams anticipated from this water supply system.

9. Situated on the banks of the Khrami River, Orjonikidze headworks is in the main aquatic horizon composed of “alluvial sediments closest to river bottom and floodplain”, which is a very good groundwater source. However no further data on resource status, yield, draw-down, etc are available as groundwater is not subjected to monitoring, a main reason for which could be that the groundwater is fairly abundant, usage is limited, and there are no known events of groundwater degradation or land subsidence.

10. In the absence of recorded data, the following critical information collated from the local farmers and UWSCG staff, has been used to establish the source sustainability: (i) no decline in the water table since last 50 years, and (ii) Orjonikidze headworks is in operation since 1956, and in 1980s it supplied 24,000 m3 per day of water safely. The designed extraction of 10,800 m3 per day for subproject is just 45% of this safe yield. Regardless of this, certain safeguard measures are suggested to further ensure the sustainability: conducting aquifer pumping tests during design stage; selecting boreholes for rehabilitation based on drawdown curves; and controlling groundwater extractions in the vicinity through government licensing system.

11. Degradation of source water quality is identified as another risk that may have impacts on public health. The present groundwater quality is good. Since the site is located on the banks of Khrami, the degradation of river quality could affect the groundwater, and therefore certain long-term sustainability measures are included: liaison with MoEPNR to establish a monitoring station on Khrami River at the headworks and regular monitoring of groundwater quality.

12. There is also an identified safety and health risk in operating chlorinators, and necessary measures are already included in the subproject. Few measures are suggested to enhance the subproject benefits through avoiding transformers and electric equipment containing harmful substances, and employing local people in construction work. The subproject is likely to have several positive benefits. The citizens will be provided with a constant supply of better quality water, which will improve the quality of life.

13. To ensure that all the mitigation measures as suggested are implemented, a program of environmental monitoring is prepared. Department of Quality Management and Environmental Protection (DQMEP) of UWSCG will oversee and be responsible for implementation of mitigation and monitoring measures. Provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

I. INTRODUCTION

A. Background

1. The proposed Urban Services Improvement Investment Program is intended to optimize social and economic development in select urban areas (provincial capitals and secondary towns) through improved urban water and sanitation (WSS) services. This ADB funded Multitranche Financing Facility Investment Program (MFF-IP) complements the government's emerging vision for the WSS sector, formulated in its sector development strategy and road map, policy framework and reform implementation plan, and a business climate that encourages increased donor investment. This support will also complement ongoing donor efforts to improve and expand Georgia's urban WSS services. ADB identifies support to developing the country's municipal infrastructure a key contributor to enhancing sustainable economic growth, with the cross cutting themes of governance, regional cooperation and environmental protection. ADB's support can contribute to: (i) sector reforms; (ii) strengthening the link between financing local infrastructure projects and decentralization reforms; (iii) stimulating local economic development; and (v) improving the quality of life of urban population

2. *WSS Services in Georgia*. The service levels of urban water supply and sanitation systems in Georgia at present are not satisfactory. Piped water supply service is available to less than 75 percent of urban population. Most of the serviced population suffers with inefficient service levels – inadequate and intermittent supply with low terminal pressure. Due to old systems, most of the pipelines are profusely leaking, and water lost in the system is as high as 50-70 percent. Similarly, less than 50 percent of the urban population is connected with the underground sewerage system, and the rest depend on individual disposal systems like pit latrines, septic tanks etc. Sewage treatment facilities are almost non-existent and collected waste is disposed untreated into rivers/streams raising environment and public health concerns.

3. This Investment Program focuses on investments in improvement of basic urban infrastructure (i.e. water supply and sewerage). Besides, it will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. This Program will be implemented in 4 tranches over a period of 8 years beginning in 2011. The Executing Agency (EA) is the Ministry of Regional Development and Infrastructure (MoRDI), Government of Georgia; and the Implementing Agency (IA) is the United Water Supply Company of Georgia, a wholly-owned company of Government of Georgia under MoRDI. The proposed investments under Tranche-1 include improvement of water supply systems in urban areas of Marneuli, Zugdidi and Mestia.

4. The Marneuli water supply improvement subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A). According to ADB procedures, the impacts of the subproject were assessed by the Initial Environmental Examination, conducted according to ADB Safeguard Policy Statement (2009).

B. Extent of the IEE Study

5. This is the Initial Environmental Examination (IEE) Report for the Marneuli Water Supply subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. It is one of the three IEE documents prepared for Tranche 1 subprojects. These were prepared in July-October 2010 by an International and a Domestic Environmental Specialist via inputs of 2.5 months each.

6. This IEE study is conducted based on the feasibility study proposals. Certain details may therefore change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs, so certain aspects (such as layout plans, sizes of infrastructure, etc) are not available at this stage.

7. This IEE study is conducted based on secondary information and data from various sources and field observations. Field surveys were limited to essential baseline factors such as source water quality.

8. Since there are no significant, irreversible, or complex issues involved, no specialized techniques were required to be employed. All impacts were simple, easy to identify and mitigation measures were readily available.

C. Report Structure

9. This IEE Report is organized into seven sections including this introductory section:

Section 2 establishes the project need, rationale and alternatives
Section 3 describes project components and construction & operation details
Section 4 discusses impacts on physical and biological environment
Section 5 discusses impacts on socio-economic environment
Section 6 provides Environmental Management Plan and Monitoring Plan, and
Section 7 emphasizes on IEE recommendations and concludes the report

II. PROJECT RATIONALE AND NEED

A. Type of the Project

10. This is an urban water supply improvement sub-project. It involves augmentation of an existing water supply source, providing a disinfection facility, construction of new or rehabilitation of old/damaged pipelines, construction of new or rehabilitation of existing water storage reservoirs and construction of new or rehabilitation of existing water pumping facilities.

B. Need of the Project

11. As discussed earlier, the service level of urban water supply in Georgia at present are not satisfactory. Services are not available to entire population and the serviced areas suffer with inefficient service levels. Systems are old and inefficient. The situation is no different in the program town of Marneuli. This sub-project is needed because the present water supply infrastructure in Marneuli inefficient is inadequate to the needs of the growing population.

12. United Water Supply Company of Georgia[1] (UWSCG) provides water supply in the Marneuli Municipality. It's Service Centre in Marneuli serves Marneuli Town and 14 villages. Water supply is groundwater based. Water is abstracted from three well fields (head works), two owned by UWSCG and one by a private company. Kolagiri headworks, located at 8.5 km west of the town on the bank of River Khrami, produces 8,000 m3/day of water from 18 boreholes and an underground infiltration gallery. Orjonikidze headworks is located at 9.5 km south of the town on the bank of River Khrami, and produces 5,400 m3/day from an underground infiltration gallery; there are 15 bore holes in the facility but all are non-functional. The private source is located near the Orjonikidze on the other bank of Khrami River. UWSCG purchases 1,250 m3/day of water from this source.

13. The piped water supply system in Marneuli involves pumping of groundwater into reservoirs located at various locations in the city. Distribution system from reservoirs to consumers is partly by gravity and partly by pumping. Each of three sources serves separate areas. While water from private source is supplied to villages, the supply from the other two sources serves the majority of the town population and some of the surrounding villages.

14. The present water supply system covers about 65% of the population (90% of city population and 60% of village population). In Marneuli Town, about 50 percent population receives water thrice a week for 4-5 hours, and the rest receives twice a week for 4-5 hours. In villages the scenario is different; the villages which are located close to transmission main receive water daily (for 10-12 hours) while the rest of the villages are supplied 2-3 days a week for 4-5 hours.

15. In addition to partial coverage and intermittent supply, the water supply system in Marneuli also suffers with unequal supply and low terminal pressure, with some areas receiving less water at very low pressure. Losses in the system are very high due to old/damaged pipeline and lack of regular or periodic maintenance. The losses in the system are as high as 60%. Consequently, per capita water supply at consumer end is very low. While the water is produced at a rate of 280 liters per capita per day (LPCD) at the source, the supply at consumer end is very low at 112 LPCD.

[1] A government company under Ministry of Regional Development and Infrastructure

16. Although the groundwater at the head works is available in good quantity, of late, the water production from the boreholes has reduced considerably. This is mainly due to lack of maintenance, and repairs and rehabilitation of bore holes and pumps. All boreholes in Orjonikidze head works and some in Kolagiri water works are non-functional as perforated casings in the boreholes are silted up. Production is also reduced due to the use of low efficiency, old and poorly maintained pumps. Storage facilities are inadequate and existing ones require repairs and rehabilitation.

17. The present sub-project is therefore designed to improve the service standards of water supply in Marneuli – daily supply of potable water in adequate quantity (200 lpcd) at requisite pressure.

C. Location

18. This sub-project is located in Marneuli Town, the administrative headquarter of Marneuli District, in Kvemo Kartli region of southern Georgia. Geographically, it is located at 44^{o} 47'58" E and 41^{o} 29'24" N, 35 km southwest of the capital Tbilisi. Regional location of Marneuli is shown in **Map 1**.

19. The proposed infrastructure improvement works will be located within the existing water supply facilities of UWSCG, some of which are located within the town and some outside. Narimanov (reservoirs and pumping improvement works), Jhandari (reservoirs and pumping improvement works) and Garadakh (reservoir works) are located in the town, while Orjonikidze head works (bore well, reservoir and pumping improvement works) is located outside. There will also be an 8.3 km transmission main outside the town, which will be buried alongside the existing field roads. Locations of these are sites are shown in **Map 2**.

D. Implementation Schedule

20. Detailed design of the subproject will begin in October 2010 and should be completed by March 2011, after which construction will take over a year, so all work should be completed by the middle of 2012.

Georgia Urban Services Improvement Project - Marnueli

Location of Project Town

Legend

- Country Boundary
- State Boundary
- District Boundary
- Project Town

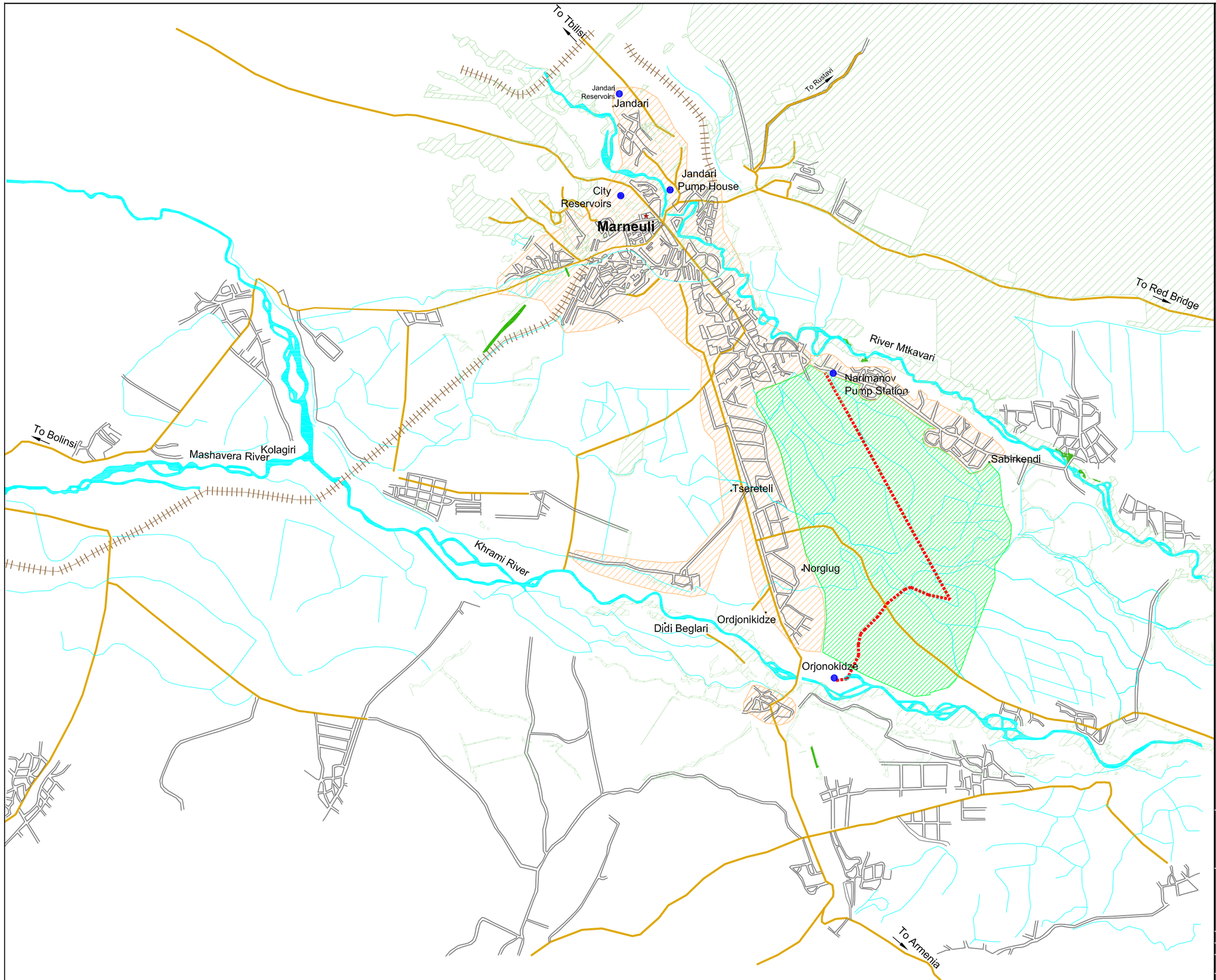
Client: **Ministry of Regional Development and Infrastructure Unlted Water Supply Company of Georgia**

Consultant

Drawn:	Checked:
Date:	Approved:
Scale:	

Georgia Urban Services Improvement Project - Marneuli

Location of Project sites



- Major Roads
- Minor Roads
- Waterbodies
- Pumping Main Alignment
- Minor Roads
- Forest
- Bushes, Pasture, and Waste lands
- Agricultural Land
- Habitations
- Project Site

Client: **Ministry of Regional Development and Infrastructure United Water Supply Company of Georgia**

Consultant

Drawn:	Checked:
Date:	Approved:
Scale:	

E. Project Alternatives

21. The project development concept for improvement of Marneuli water supply gives priority to water Demand Management (DM) measures, which are resource and cost efficient. Following DM measures are proposed to improve the existing system efficiency:

- repairs/replacement of leaking pipes and reservoirs,
- leak detection & rectification,
- improved monitoring through hydraulic zoning and metering

22. Inclusion of above DM measures likely to reduce the losses from present 60% to 20%. This is estimated to decrease the present gross daily water demand (2010) from 24,486 m^3 to 12,243 m^3 and ultimate demand (2040) from 32,762 m^3 to 16,381 m^3. Thus, the DM measures will reduce the demand by 50%. However, the projected demand will still be higher than the supply necessitating augmentation of supply.

23. Following **Table 1** presents the analysis of various alternatives considered to meet the estimated gap in service delivery. Implementation of Option-1 (supply augmentation from existing groundwater source) will achieve the desired objectives of the project with less cost. The Option-2 (new surface source), which will have higher costs and larger environmental implications, and Option-3 (no project), which cannot achieve the objectives, are ignored.

Table 1: Project Design Alternatives

Subproject	**Option – 1**	**Option – 2**	**Option – 3**
Improvement of water supply in Marneuli	**Supply Augmentation from Existing Groundwater Source**	**Augment water supply through alternative surface water source**	**No project**
Technical and economic analysis	This option involves rehabilitation of the non-functional bore wells, improvement in pumping system to abstract more water to meet the ultimate demand. This option has the following pros & cons: • Rehabilitation within the existing facilities; capital costs will be less • Groundwater is available in abundant at existing source • Groundwater quality is good, requires only disinfection • Due to pumping, the operational cost of this system will be high • Estimated capital cost: $ 28 million • Estimated annual O&M cost: $ 0.46 million	This option involves sourcing water from Fartskhisi Dam, located 25 km west of Marneuli This option has the following pros & cons: • Water is abundant and can be supplied by gravity to the town • Requires treatment • Estimated capital cost: $ 121 million Estimated annual O&M cost: $ 0.47 million	Water will be supplied at present rate of 112 LPCD against a minimum requirement of 200 LPCD. This may lead to consumers either using unprotected own sources or reducing the usage, both of which may lead to public health issues. Without the project, the production may further go down as the efficiency of pumps, which is already quite low at less than 50% may further go down. Reduced efficiency means increased energy consumption for the same output.
Environmental Analysis	At Orjonikidze head works groundwater extraction would go up from 5,400 m3/day to 10,800 m3/day. Lithology of the site shows that top layer of about 0.5 m is characterized by predominantly clayey soil, below which lies a zone consisting of sand and gravel, extending to over 100 m depth. This is the principle aquifer consisting of alluvial sediments and quaternary period sediments. Recharge to this aquifer is primarily from river and upland areas. Groundwater in this aquifer is abundant. Depth of water table is 5m bgl, and there was no observed decline in the past. Considering the above, there likely to be no negative environmental impacts due to this option. The extraction will not affect any other uses (for economic or environmental purpose). There is no likely effect such as land subsidence or degradation of water quality	As dam already exists, water extraction from dam itself will have no negative environmental implications. This will however involve laying of gravity transmission main through forest and private lands.	-

24. Having selected Option-1 for implementation, other alternatives within this are considered for selection of appropriate locations. However, except proposed transmission main, all new and rehabilitation works are located within the existing facilities owned by UWSCG, where adequate land is available. Following alternatives have been considered for transmission main from Orjonikidze to Narimanov (**Table 2**).

Table 2: Location and Design Alternatives within the Selected Option

Component	**Alternative 1: Replacing in Existing Alignment**	**Alternative 2: New Alignment**
Alignment for Transmission Main from Orjonikidze to Narimanov	Existing alignment passes through private agricultural lands under cultivation and crosses a number of irrigation canals. Implementing this option would involve • land acquisition, resettlement and livelihood impacts • additional costs and likely delay in implementation	Various alignment alternatives were considered and suitable option is selected to avoid private land. The new pipeline will be laid along the ROW of existing roads. There are no sensitive environmental features in the new transmission alignment. Tree cutting unlikely, except removal of shrubs and bushes in some stretches

F. Consultation

25. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Stakeholders of this project include:

- People who live, and work near construction sites of facilities in Marneuli
- Custodians and users of socially and culturally important buildings in the same areas
- UWSCG as implementing agency
- Other government regulatory institutions
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in Marneuli in general; and
- The ADB, as funding agency

26. Two forms of public consultation have been used during preparation of the IEE, to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

- A public meeting was held in Marneuli Town in October 2010, to which stakeholders were invited. Participants were informed about the aim of the subprojects and the benefits together with their likely impacts and the ways in which they would be mitigated. Participants were invited to discuss their views and concerns, which were then incorporated into the IEE. **Appendix 2** contains a summary of the meeting;

- Ad hoc discussions were also held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

27. This IEE Report in Georgian language will be distributed to the interested public. Report will be available for review in Tbilisi (at UWSCG Head Office), and Marneuli (at UWSCG Service Centre, the Town Hall and the Public Library). It will also be disclosed to public by making it available on websites of UWSCG, MRDI and ADB, together with the IEEs prepared for the other subprojects.

G. Licenses & Approvals Required

28. Environmental assessment of various activities and development projects in Georgia is governed by the Law on Environmental Impact Permits (EIP), which has entered into force in January 2008. This Law notifies the list of the activities and projects, which will be subjected to ecological expertise and require Environmental Impact Permit. The Law also makes the public participation mandatory in the process of environmental assessment, ecological expertise and decision making on issuance of an environmental impact permit. Under this Law, various projects/activities have been divided into four categories based on their size, importance and potential environmental impact, and sets out permitting process for each category.

29. None of the components of the proposed water supply improvement subproject in Marneuli are notified in the Law on EIP and therefore environmental impact permit is no required.

30. Groundwater abstraction and use in Georgia require permit and license from Department of Natural Resource Licensing, the Ministry of Economy and Sustainable Development (MoESD), Government of Georgia.

31. *ADB Review and Approval*. For Category B projects the Draft IEE report are reviewed by ADB's Operational Department (in this case Central & West Asia Department) and after addressing their comments, if any, the EA then officially submits the IEE reports to ADB. Completed reports are made available on the ADB website.

III. PROJECT DESCRIPTION

32. There are some ongoing and proposed works for improvement of water supply in Marneuli Municipality through various sources of funding – Municipal Development Fund (MDF), European Investment Bank (EIB) and Local government funds. Given this scenario, and the requirement for a comprehensive improvement to meet the ultimate demand (2040), a feasibility study was conducted and the project is formulated for implementation under the proposed ADB funded Investment Program. Works are proposed to be implemented in multi tranche funding. The following **Table 3** shows the subproject and components selected for implementation under tranche-1, for which, according to ADB requirement, this IEE is conducted. Layout plans of facilities are shown in **Map 3**, **Map 4** and **Map 5**. Photographs of project sites are appended in **Appendix 1**.

A. Sub Project Components

33. This subproject focuses on augmentation of water supply from Orjonikidze head works including replacement of transmission system, and augmentation of storage and pumping systems in the town. The descriptions shown in **Table 3** are based on the present proposals. Since the project is at feasibility stage, although the proposed capacities are expected to be substantially correct, certain details such as dimensions of reservoir may change in the detailed design stage.

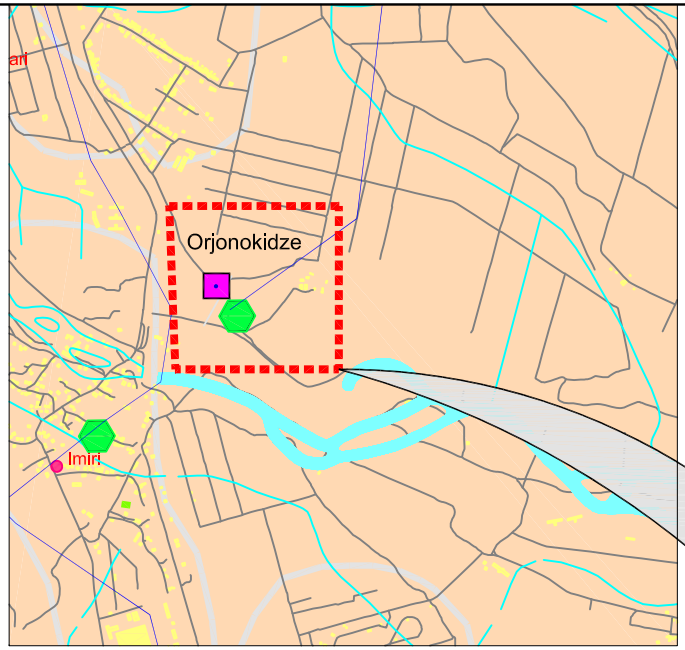
34. This subproject is designed in such a way that the existing infrastructure is used to a maximum extent, through necessary rehabilitation. The new infrastructure will complement existing infrastructure. While the existing infrastructure is capable of meeting the existing demand upon rehabilitation, the new infrastructure will help in expansion and improvement of system efficiency.

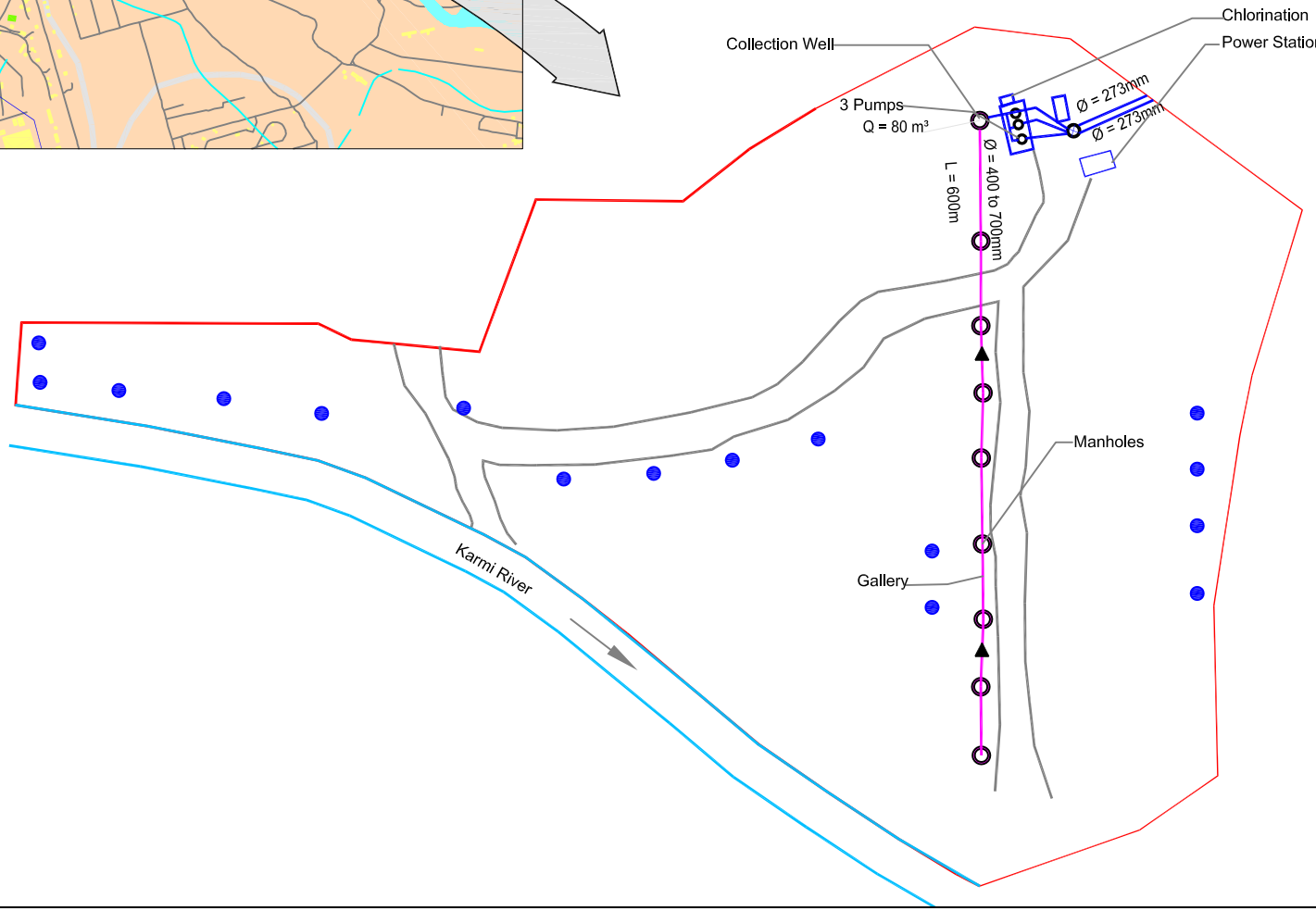
Table 3: Proposed Subproject & Components

Infrastructure	Function	Description	Location
Rehabilitation of existing 9 currently non-functional boreholes at Orjonikidze head works	To provide additional 5,400 m^3 of water daily	Diameter of borehole: 0.4 m Depth: 40 m Water table depth: 5 m bgl Borehole casing: perforated uPVC pipe inserted to a depth of 40 m	Orjonikidze head works located on the bank of River Khrami. This site is owned by UWSCG. Total area of this site is 31 ha.
Replacement of pumps for 9 bore holes	Abstract water from 9 boreholes and pump into reservoir	Number of pumps: 9 Capacity of each pump: 90 m3/hour at 30 m head Total capacity: 16 kW	Same as above
Construction of new reservoir	To provide for water storage	RCC underground reservoir Capacity: 300 m3 size:10m x 10m x 3.5m	Same as above
Rehabilitation of existing incomplete 1000 m3 reservoir	To provide for water storage	RCC underground reservoir Capacity: 1,000 m3 size:20m x 10m x 5.5m	Same as above
Rehabilitation of chlorination plant	Disinfection of water	Repairs to civil works, provision of safety equipment,	Same as above
Water testing lab	Regular monitoring of water quality	Construction of laboratory facility (50 m^2 building) and provision of equipment	Same as above
Replacement of	Power supply to	Replacement of 2	Same as above

Infrastructure	Function	Description	Location
transformers	pumping equipment	transformers (630 kW & 40 kW) for bore holes and transmission pumps	
Replacement of transmission pumps	Convey water from head works to Narimanov reservoirs for further supply	Number of pumps: 5 Capacity: 300 m3/hour each at 55 m head Total capacity: 75 kW	Same as above
Bulk flow meters at Orjonikidze	Monitor water flow: production from bore holes and supply	Bulk meters will be installed in various pipes (11 no.s)	Same as above.
Fencing of the head works site	Safety & protection of facility	Wire fencing will be erected for a length of 2,908 m around 31 ha site	Same as above
Replacement of pumping main	Convey water from the Orjonikidze head works to Narimanov Reservoir	500mm Diameter HDPE over a length of 8.3 km.	The existing alignment runs through private agricultural lands. New alignment has been selected, in which the pipeline will be buried along roads. The new alignment will increase the length by 1.6 km (from 6.7 to 8.3 km)
Rehabilitation of two existing reservoirs at Narimanov	To store water for further supply	RCC underground reservoir (2 no,s) Capacity: 500 m3 each size: CA - 125 sq. m, and 4.5 m deep	Within the existing facility at Narimanov in Marneuli. This facility is owned by UWSCG.
Construction of new reservoir at Narimanov	To store water for further supply	RCC surface (on-ground) reservoir Capacity: 500 m3 size: CA - 125 sq. m, and 4.5 m height	Within the existing facility at Narimanov in Marneuli. Adequate land available. This facility is owned by UWSCG.
Replacement of pumps & rehabilitation of pumping station at Narimanov	Provide water pressure for distribution	Number of pumps: 2 Capacity: 400 m3/hour each at 120 m head Total capacity: 218 kW	Same as above.
Bulk flow meters at Narimanov	Monitor water flow: production from bore holes and supply	Bulk meters will be installed in various pipes (3 no.s)	Same as above.
Replacement of transformers at Narimanov	Power supply to pumping equipment	Replacement of transformer (100 kW)	Same as above
Replacement of	Pump water from	Number of pumps: 2	Within the existing

Infrastructure	Function	Description	Location
pumps at Jandari Pumping Station	Jandari pumping station to Jandari reservoir for further supply	Capacity: 110 m3/hour at 50 m head Total capacity: 25 kW	pumping station at Jandari in Marneuli. This facility is owned by UWSCG.
Construction of new reservoir at Jandari Pumping Station	To store water for further supply	RCC surface (on-ground) reservoir Capacity: 500 m3 size: CA - 125 sq. m, and 4.5 m height	Same as above; adequate land is available in the facility. Site is located on the bank of River Alageti, which flow through the city.
Rehabilitation of two existing city reservoirs at Garadakh	To store water for further supply	RCC surface (on-ground) reservoir Capacity: 1,000 m3 each size: CA - 250 sq. m, and 4 m height	Located on a hill in the town. Site owned by UWSCG
Construction of new reservoir at Garadakh	To store water for further supply	RCC surface (on-ground) reservoir Capacity: 3,000 m3 size: CA - 750 sq. m, and 4 m height	New reservoir will be constructed near the existing ones on the same hill. Adequate vacant land is available. Site owned by UWSCG





Georgia Urban Services Improvement Project - Marnueli

Orjonikidze Headworks

Legend:-

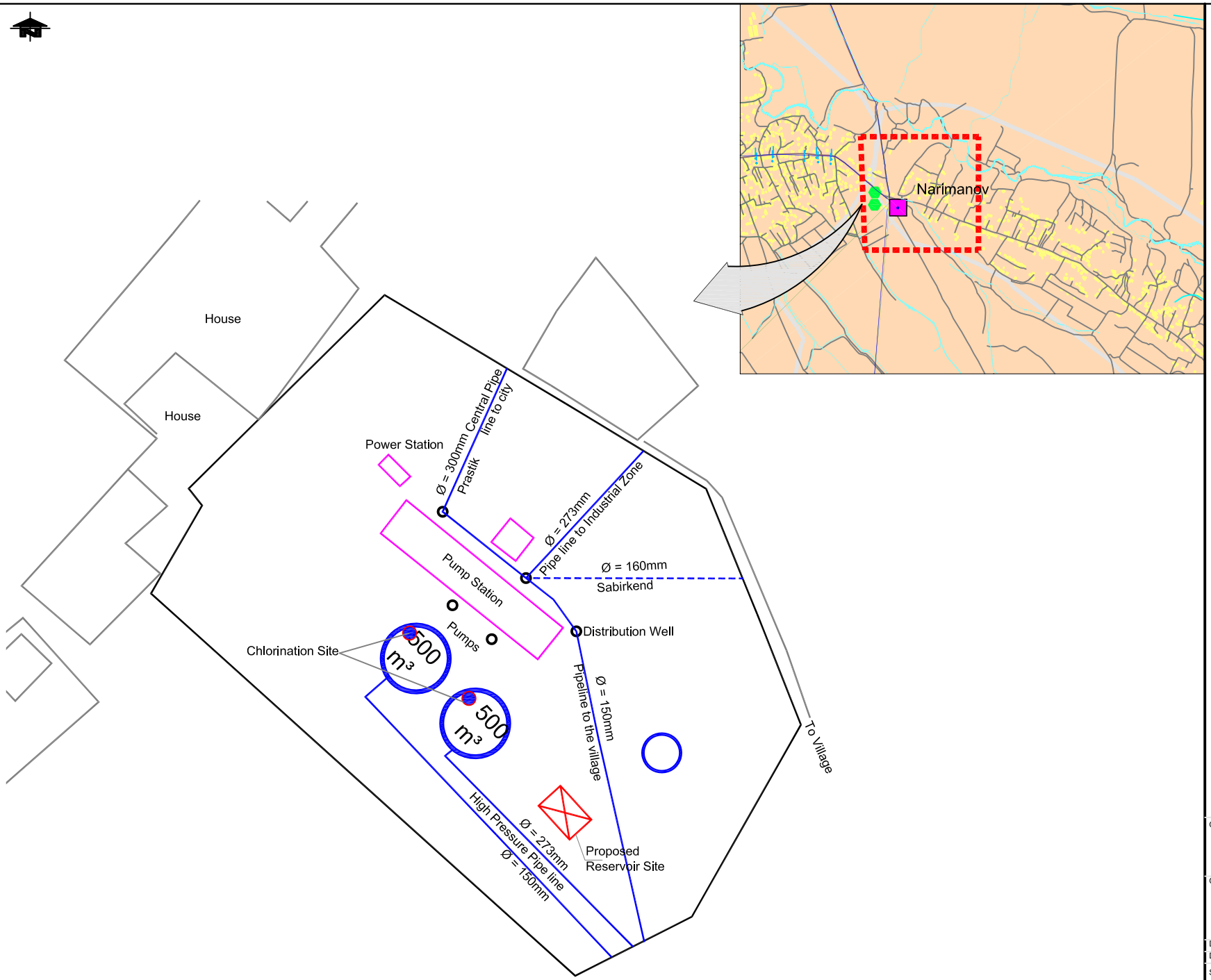
- Roads
- Waterbodies
- Nonfunctional Borewells
- Gallery

Client: **Ministry of Regional Development and Infrastructure United Water Supply Company of Georgia**

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS



Georgia Urban Services Improvement Project - Marnuell

Narimanov Pump Station

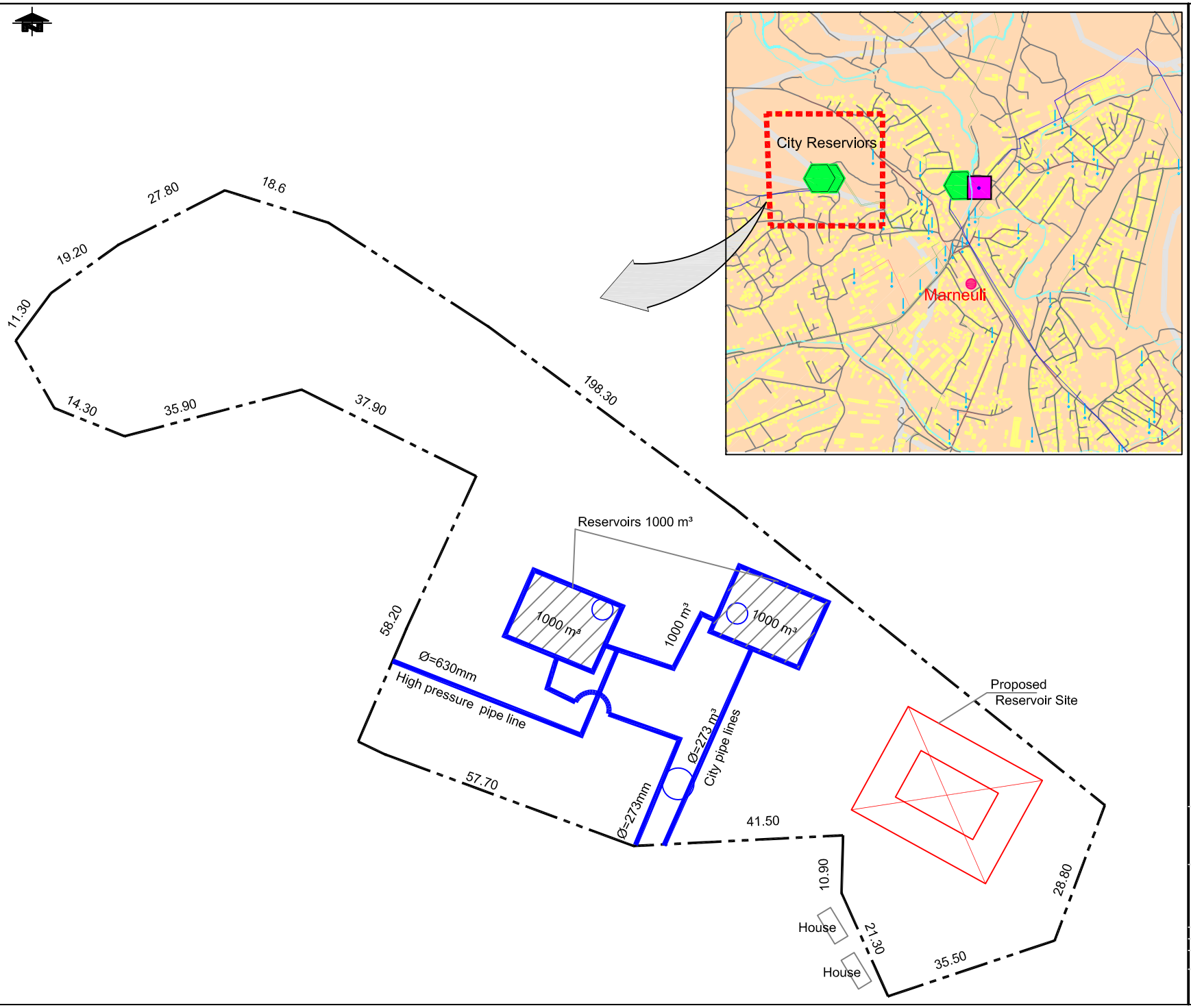
Client: **Ministry of Regional Development and Infrastructure United Water Supply Company of Georgia**

Consultant

Drawn: Checked:

Date: Approved:

Scale: NTS



Georgia Urban Services Improvement Project - Marnuell

City Reservoirs at Garadakh

Client: **MInIstry of Reglonal Development and Infrastructure UnIted Water Supply Company of Georgla**

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

B. Construction Activities

35. As indicated in **Table 3** above, there are five main elements in the subproject: rehabilitation of bore holes; replacement of pumps and electrical equipment; rehabilitation and construction new reservoirs; laying of transmission mains, and miscellaneous small scale works (fixing of bulk meters, construction/repairs to chlorination/laboratory facility, fencing etc). Construction practices of these works are briefed below:

36. *Rehabilitation of bore holes*. The existing perforated pipes in the bore holes, which allow water into the hole for pumping, have been silted up and the flow is reduced considerably. Rehabilitation work will involve the removal of perforated slotted pipe from the bore hole and installing a new one, and filling the new filter media (sand) in the void between the pipe and the bore hole (diameter of bore hole is 400 mm and diameter of perforated pipe is 300 mm). Prior to lowering of new perforated pipe, bore hole will be cleaned/desilted using a hydraulic rig/drilling machine to make the section uniform diameter of 400 mm. The pipe will be removed and placed using the same machine. This is expected to generate about 0.5 m3 of silt, which will be disposed in a low-lying area within the headworks site.

37. *Replacement of Old and Installation of New Pumps and Transformers*. This work will involve removal of old pumps and transformers and installation of new ones. Additional pumps will also be installed in the pumping stations, where required. New pumps and transformers will be brought to site on trucks, and installed using small pulley or hydraulic crane. Old pumps, motors, transformers will be kept in store in the site for disposal by Central Office through selling to recycling companies. Since it is likely that the old transformers of Soviet-make contain oils with PCBs, laboratory tests will be conducted to confirm and oils will be disposed appropriately. The construction work also involves repairs and rehabilitation of civil works for pumping station at Narimanov. These are minor works such as plastering, painting and repairs to floor and roof etc. This work is not expected to generate much debris.

38. *Rehabilitation of Existing Reservoirs*. Rehabilitation works involve exposed and corroded bars and concreting, cement plastering and replacement of damaged fixtures. At Garadakh site, which is located on a hill, the filled earth around the tanks will be removed for rehabilitation work, and after the completion of work refilled with new soil material. Rehabilitation work will be simple and conducted mostly manually. Construction material such as sand, aggregate, steel & cement will be brought to site on truck, and placed near by the site. Concrete will be mixed with the help of concrete mixer and the concrete will be placed into void manually. This rehabilitation work is not expected to generate considerable debris.

39. *Construction of New Reservoirs.* New reservoirs at Narimanov, Jhandari and Garadakh (this is on a hill) will be constructed on ground surface. This work will involve excavation for foundations (3-4m deep), placing of reinforcement rods in wooden shutters and pouring of concrete in voids to form foundations, floor, walls and roof. Cement mortar plaster will be applied to walls (outside and inside), floor and roof for a smooth finish. Inlet and outlet pipes and fixers/valves will be installed. The excavated earth will be refilled around the foundations and excess soil will be transported to a disposal site. At Garadakh site there are two dilapidated/old concrete reservoirs (500 m^3 each) and four steel reservoirs (125 m^3 each), which need to be dismantled for construction of new reservoir. This work is expected to generate 300 m3 concrete debris and steel. Debris will be sent to a disposal site and steel will be sold for recycling. At Garadakh site, the hill is rocky overlain by soil cover of about 1-1.2 m thick; for foundation the soil cover will be removed, and foundation will be laid on hard rock strata. Excavation for foundation will be done by backhoe digger or manually, where required. Pneumatic handheld drills will be used to dismantle the old

reservoirs and the material will be removed and loaded on to trucks with backhoe. Concrete will be mixed in a mixer and a needle (pen) vibrator will be used for compaction of concrete around the reinforcement.

40. *Laying of Transmission Main.* The transmission main from Orjonikidze to Narimanov is laid in the new alignment, which runs along the existing field roads and a motarable road. Pipes will be buried in a trench along these roads. Trenches will be dug using a backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed alongside, and the pipes will be placed in the trench manually. Pipes will be joined, after which excavated soil will then be replaced.. A sand layer of 5 cm thick will be laid on top of the pipe, after which the trench will be refilled with excavated and compacted manually. The size of trench will be 1.7 m deep (0.5 m pipe + 1.2 top cover) and 0.8 m wide. The excavation is expected to generate 11,288 m3 soil, after construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material. This activity is expected to generate about 2,000 m3 of waste/surplus soil.

41. *Miscellaneous Works.* These works include constructing wire fencing (length 2.9 km), construction of a laboratory building (50 m2 area), repair to civil works (plastering, painting, doors) and installation of chlorinator, installation of bulk flow meters in Orjonikidze head works and installation bulk meters at Narimanov pumping station. Concrete works will be done as detailed above. Bulk meters will be installed within the pipes. These works are very minor and simple, and not expected to generated significant waste/debris.

42. *Source of construction materials*. In Marneuli sand and aggregate is sourced from licensed mines areas along Khrami River. Construction waste is disposed at Kizilaglo disposal site, about 10 km from Marneuli.

C. Operation of Improvement Water Supply System

43. Regular operation of water supply system in Marneuli involves groundwater abstraction, disinfection with chlorine, pumping to reservoirs in city, and distribution from reservoirs partly by pumping and partly by gravity. Operation will also involve laboratory analysis of water supplies.
Inputs required will mainly be electrical power supply for pumping systems and office buildings. All other works (like operation of valves) will be done manually by the staff.

44. Water abstraction from Orjonikidgze will increase from 5,400 to 10,800 m^3 per day after improvement. Pumps will be operated for 9 hours a day.

45. The main operational requirement will be the handling and application of chlorine into the water supplies. Average dose of chlorine will be about 5mg/l; daily usage of chlorine will be 54 kg. Chlorine cylinders (called tonners, with capacity about 900 kg) will be procured from nearest manufacturing unit and stored at the site. Normally tonners sufficient for a month will be stored in the facility. One tonner will last for 16 days and there will be 3 tonners in all at the facility at any point of time – two in the chlorination facility (1 working + 1 standby) and one in store.

46. Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being use breaks are very rare, and leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way as the pipe was laid, after locating the leaking section.

IV. IMPACTS ON THE PHYSICAL & BIOLOGICAL ENVIRONMENT

A. Introduction

47. Marneuli Municipality is situated in the Kvemo Kartli Region of southern Georgia. Situated at 44°47'58" East longitude and 41°29'24" North latitude and 420 m above MSL, Marneuli Town is the administrative center of Marneuli Municipality and Marneuli District. It is located at 29 km southeast of Tbilisi. International borders with Azerbaijan and Armenia are located 30 km south of Marneuli.

48. Extending to an area of 935.2 km2, the Marneuli Municipality comprises Marneuli Town and 83 villages, which are combined into 17 administrative-territorial units. It borders the municipalities of Tetritskaro, Gardabani and Bolnisi, and Azerbaijan in the south-east, and Armenia in the south. Two highways of international significance pass through the municipal territory. The railway line connecting Armenia passes through Marneuli. The strategically important the Baku-Tbilisi-Cayhan Gas Pipeline and other gas supply lines traverse the territory.

49. Situated in fertile alluvial plains of Khrami Rivers, and with availability of good irrigation facilities, Marneuli Municipality is agriculturally very prosperous. Cattle breeding is also predominant. This region is said to have been producing half of the total Georgia's production of vegetables, meat and milk products.

50. With this background, the following sections evaluate the impacts on physical and biological environment due to the proposed project. Each subsection first describes the baseline profile followed by impact identification and assessment during construction and operation. Mitigation measures are also discussed in conjunction with the impacts.

B. Topography, Geology & Soils

1. Baseline Conditions

51. *Topography*. Despite its small area, Georgia presents one of the most varied topographies within its geographical boundaries. Georgia lies mostly in the Caucasus Mountains, and its northern boundary is partly defined by the Greater Caucasus range. The Lesser Caucasus range runs parallel to the Turkish and Armenian borders and the Surami and Imereti ranges connect the Greater Caucasus and the Lesser Caucasus, create natural barriers in the region. Marneuli Municipality is located in the accumulative depression of Kvemo-Kartli Region in southern Georgia. Topography is predominantly undulating and dotted with low range hills. Topography in the south, towards River Khrami is predominantly plain. Comparatively, Marneuli Town is on the higher elevation than its surroundings. Town mostly drains into River Alageti.

52. *Geologically*, Marneuli Municipality is in the Madneuli-Poladauri sub-zone of Bolnisi zone. This sub-zone is characterized by Eocene volcanic and sediment strata; Oligocene and Oligocene-Miocene terrigenic, and in small areas Pliocene and Upper Cretaceous carbonate-volcanic formations. One of the reservoir site in the town is located on a hill. This is a low-range hill characterized by basalt trap, overlain by a soil cover of 1-1.2 m. This hill was once used for basalt mining. According to seismic zoning map, Georgia is classified into Zone 6 to Zone 9 (in increasing order of seismic intensity) and Marneuli falls under Zone 7 (strong seismic intensity zone). However, there is no recent history of earthquakes in Marneuli.

53. *Soil*. Located in the alluvial plains of Khrami River, area possesses fertile agricultural lands. The project area mainly consists of brown and brown carbonate soils. Brown soils are

characterized high clay content and humus composition fluctuates between 3-10 %. Geo-chemical potential of these soils is acid in reaction, which weakens with the depth and changes into neutral. In brown carbonate soils, carbonate material presence is significant, which is clear from the name. Lothological information indicates that the depth of soil along the river for about 1-1.5 km wide is very deep and extends to over 100 m, with top thin layer characterized by clayey soil, followed by sand and gravel layer. The depth of soil in the town is shallow (5-10 m), while towards south it is very deep (>100m)

2. Impacts during Construction

54. During construction, impacts on topography and geology are mainly to due to invasive nature of excavation activities. Therefore there are no impacts envisaged on these factors due to rehabilitation works, which do not require excavation. Excavation works will also disturb the soil. All works including rehabilitation will generate construction waste and debris, disposal of which may have certain negative impacts on soils.

55. New reservoirs at Narimanov and Jhandari will be constructed on ground surface, while Reservoir at Orjonikidze will be conducted underground. Reservoir at Garadakh will be constructed on top of a hill adjacent to existing reservoirs. These works are confined to small sites (CA100 m2- 750 m2), which are located within the existing facilities, and therefore no impacts on topography envisaged. The trench excavation for transmission main will be 8.3 km long, which will run along the roads. This may affect the surface water drainage during rains (these impacts are discussed in surface water).

56. Reservoir works do not involve any deep excavation and cutting/disturbance to underground rocks, therefore no impacts on geology envisaged. Similarly, the depth of excavation for laying of transmission main will be shallow (1.7 m), therefore no impacts envisaged. At Garadakh site, located on the top of a hill, no cutting of rock envisaged since the reservoir is constructed directly on the hard rock, by clearing the top soil. Demolition of old reservoirs will generate metal scrap (mild steel) and 300 m^3 of concrete debris.

57. Construction of new reservoirs is expected to generate 2057 m3 of soil and 300 m3 of debris (at Garadakh site), of which 75% soil will be used for refilling after construction, and remaining soil (514 m3) and debris will be left. Similarly rehabilitation of reservoirs and miscellaneous civil works will also generate debris – roughly this will generate about 100 m3 of debris. .Laying of 8.3 km of transmission main will also involve considerable earthwork (11,288 m3). After construction, a part of the trench will be occupied by the pipe and a sand layer, and therefore this activity will produce around 2000 m3 of waste soil.

58. Therefore this quantity of waste could not be dumped without causing further physical impacts on topography, soil at the point of disposal. It will be important therefore to reduce the amount of dumping by finding beneficial uses for as much waste soil as possible. This will require:

- Using the surplus soil where possible in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas
- Disposing any waste/debris that could not be put to beneficial use in landfill

59. The excavation and refilling works will disturb the soil characters at the sites. However, considering the size, location (within the existing facilities), and present use of sites (vacant or along the roads), impacts on soil due to excavation are negligible. However, it tends to loosen the soil, which may lead to erosion of top soil during winds and rains. Therefore the contractor should:

- Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer

3. Impacts during Operation

60. The main operation activity in the improvement water supply system will be increased groundwater extraction. Over exploitation of groundwater resource may lead to major problems like land subsidence and differential settlement. However, considering the abundant availability of groundwater at head works no such impact is envisaged (the issues related to groundwater are discussed in detail under groundwater section).

61. The main requirement for maintenance of the water supply infrastructure will be for the detection and repair of leaks. Repairs will be conducted in essentially the same way that the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary. This activity however is not expected to generate any waste soil nor will have any impacts.

C. Surface Water and Groundwater

1. Baseline Conditions

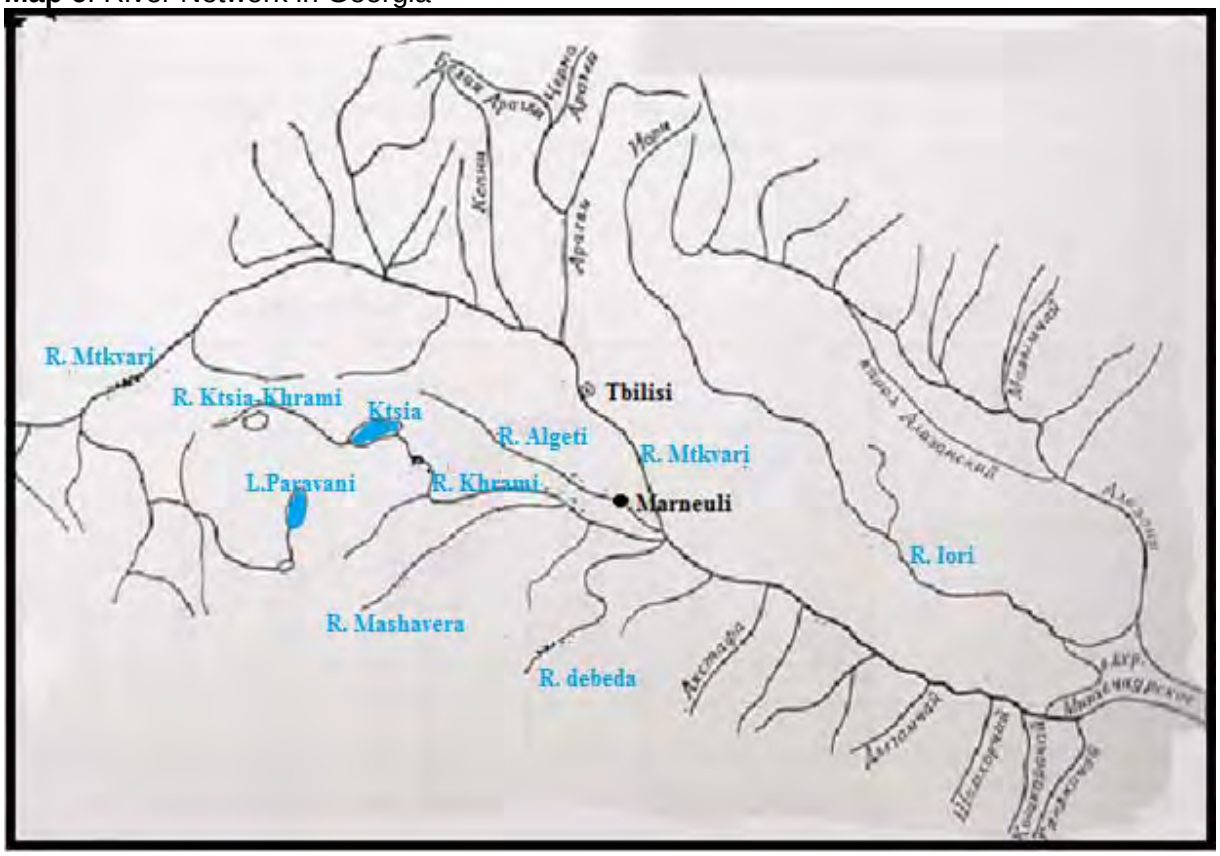
62. *Surface Water*. Georgia is rich in water resources; there are in all 26,060 rivers with a total length of ~ 59,000 km. Besides, there are many thermal and mineral water springs, lakes and man-made water reservoirs. These however are distributed unequally, with major concentration in the western part of the country. Nearly all rivers of East Georgia flow into the Caspian Sea while and the rivers in the west join the Black Sea. These two basins are separated by Likhi Ridge. The biggest river of Georgia is Mtkvari. Originating in Turkey, the river flows through Georgia for about 400 km and enters Azerbaijan and ultimately flows into Caspian Sea. Marneuli is located in the Mtkvari River basin. The river flows at a distance of about 25 km west of Marneuli Town. Three tributaries of the river, Khrami, Algeti and Debeda Rivers, flow through Marneuli Municipality and joins River Mtkvari in the south-east (**Map 6**).

63. The River Khrami, which starts from the springs in Trialeti Ridge (2,422 m above MSL), is 201 km long and has a basin area of 8340 km2 with 2,234 large and small rivers. Important tributaries are Mashavera and Debeda. Mashavera, joins river River Khrami on the southern side of Marneuli Town, at 15 km upstream of Orjinokidze head works site. Debeda River joins on the downstream side of Orjonikizde, near the confluence with Mtkvari.

64. The River Khrami is a perennial river, although flow fluctuates across the year. Flow in the river is maximum in April and minimum in January and August. The river is notorious for changing its course in the upstream, which damages agricultural fields. Bolnisi, a small town, is located along the River Khrami about 30 km upstream of Marneuli. There are no industries in the upstream side for about 50 km. Contrary to downstream of Orjonikidze with extensively cultivated lands, upstream catchment is mostly characterized by barren lands and agriculture is limited. This is mainly due to natural factors such as predominantly undulating/hilly terrain, infertile soil and also unfavorable climate. There are two dams on River Khrami on the upper reaches, from which water is supplied to Khrami hydro power station. Water from dams is also provided for irrigation and drinking purposes. Mining for building materials (sand, gravel and aggregate) is prevalent along the river. There are large-scale mining activities (gold, copper, zinc, etc) at Kazreti in Mashavera River catchment. These are located 33 km upstream of Mashavera and Khrami confluence, which is about 50 km upstream of Orjonikidze headworks.

65. The River Alageti, a tributary of Matkvari, flows through the town from northwest to southeast and joins the River Matkavri in the Southeast. River water is polluted due to discharge of untreated wastewater from Marneuli Town and other upstream areas. The existing Jhandari Pumping Station is located on the bank of the river, where a new reservoir will be built under the subproject.

Map 6: River Network in Georgia



66. **Table 4** shows the water quality of the River Khrami at Orjonikidze headworks in comparison with the national surface water norms[2]. All the parameters are within the permissible limits of surface water norms for domestic and agricultural use, while mercury (Hg) concentration exceeds the limit set for fishing purpose. Past data of Khrami and Mashavera quality (**Table 5**) reflects the water is not suitable for fishing with concentration of metals like iron, copper, nickel and manganese higher concentration the national standards.

Table 4: Water Quality of Khrami at Orjonikidze

S. No	Parameters	Unit	Value	Reservoir water for Drinking/domestic/agricultural purpose	Reservoir water for fishing purpose
1	Color		10	-	-
2	Odor		2/3	-	-
3	Turbidity	NTU	25	-	-
4	Sulphate	mg/l	82.32	500	100.0
5	Chlorides	mg/l	12	350	300
6	Oil Products, total	mg/l	0.001	0.3	0.05
7	Calcium	mg/l	65.13	-	-

[2] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG

8	Magnesium	mg/l	13.01	-	-
9	Sodium	mg/l	29.1	-	-
10	Zinc	mg/l	0.029	1.0	0.01
11	Iron, total	mg/l	0.11	0.3	0.005
12	Total coliform	MPN	1400	-	-
13	E-coli	MPN	1200	-	-
14	pH		8.4	-	-
16	Total solids	mg/l	462	-	-
17	Dissolved Solids	mg/l	390	-	-
18	Suspended Solids	mg/l	72	-	-
19	Barium	mg/l	0.08	0.1	2.0
20	Boron	mg/l	0.135	0.5	10.0
21	Arsenic	mg/l	0.0051	0.05	0.05
22	Mercury	mg/l	0.0005	0.0005	0.00001
23	Cadmium	mg/l	0.001	0.001	0.005
24	Manganese	mg/l	-	0.1	0.01
25	Nickel	mg/l	-	0.1	0.0001
26	Nitrate	mg/l	50	45.0	40.0
27	Nitrite	mg/l	0.075	3.3	0.08
28	Selenium	mg/l	0.01	0.001	0.0016
29	Copper	mg/l	0.015	1.0	0.001
30	Aluminum	mg/l	0.03	0.5	0.5
31	Lead	mg/l	0.004	0.03	0.1
32	Fluoride	mg/l	0.35	0.05	0.05
33	Chromium	mg/l	0.03	0.1	0.001
34	Antimony	mg/l	0.0005	-	-
35	Cyanide	mg/l	-	0.1	0.05
36	Pesticides	mg/l	0.0015	-	-

Source: Sampling Survey, September 2010

Table 5: Water Quality of Mashavera and Khrami

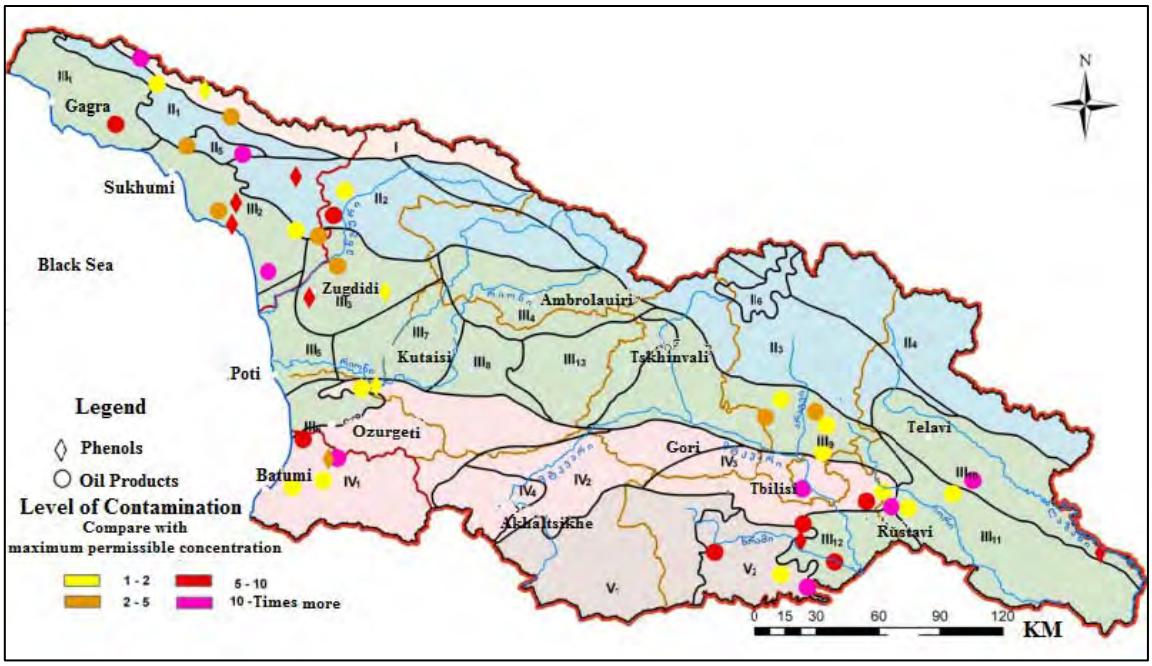
Parameters	Khrami			Mashavera			Surface water standard	Reservoir for Fishing
	Oct-07	Oct-08	Dec-09	Oct-07	Oct-08	Dec-09		
Turbidity	15.00	9.00	11.00	10.00	9.00	9.00	-	-
pH	7.88	8.14	8.01	8.02	8.76	7.68	-	-
DO, mg/l	9.20	9.97	6.89	8.85	8.22	6.68	-	-
COD, mg/l	1.84	1.89	1.61	1.28	0.95	1.60	-	-
Nitrite Nitrogen, mg/l	0.79	0.05	0.08	0.12	0,158	0.00	3.3	0.08
Nitrate Nitrogen, mg/l	15.53	0.39	0.98	-	0.32	4.36	45	40
Ammonium Nitrogen, mg/l	0.15	0.61	1.79	0.09	0.33	0.19	-	-
Orthophosphate, mg/l	3.40	0.08	0.03	0.04	0.08	1.11	-	-
Sulphate, mg/l	133.1	105.2	71.70	18.50	13.90	20.80	500	100
Chloride, mg/l	20.00	14.20	6.30	10.50	4.50	7.00	350	300
Potassium, mg/l	2.90	2.40	1.40	1.10	1.20	1.20	-	-
Sodium, mg/l	28.00	38.00	26.00	10.50	12.00	9.00	-	-
Calcium, mg/l	80.90	58.60	45.60	28.50	40.50	40.30	-	-
Magnesium, mg/l	4.10	11.90	9.70	6.40	7.10	8.80	-	-
Conductivity, mg/l	580.0	402.5	432.00	-	-	356.0	-	-
Mineralization, mg/l	465.5	418.1	328.2	230.0	245.2	235.8	-	-
Iron, mg/l	0.18	-	0.37	0.13	=	0.19	0.3	0.05
Copper, mg/l	-	-	0.01	0.01	=	0.01	1.0	0.001
Cobalt, mg/l	-	-	0,02	-	=	0.00	-	-
Nickel, mg/l	-	-	-	0.02	=	-	0.1	0.0001
Manganese, mg/l e	-	-	0.03	0.16	=	0.01	0.1	0.01

Source: MoEPNR

67. *Groundwater*. Based on the groundwater characteristics, Georgia is divided into five hydro-geological zones, which are further defined into sub-zones/districts. Marneuli is in Zone – III (Artezian basin zone of Georgian belt) and in hydro-geological district- III_{12} (Porous and fractured artezian water basin of Marneuli-Gardabani) (**Map 7**). Marneuli-Gardabani accumulative depression is composed of Quaternary formations beneath syncline depression.

68. The Orjinokidze head works site is located on the left bank of River Krami about 5 km south of Marneuli Town. There are two main aquatic horizons composed of (i) alluvial sediments closest to river bottom and floodplain, and (ii) quaternary period sediments, are mainly located on the bottom and floodplain terraces of the rivers Khrami, Algeti, Debeda and Mtkvar. The width of the alluvial sediment stripe is 1-1.5 km.

Map 7: Hydro-geological Zones



69. There is no data/information available on groundwater table, depth, water availability, extraction, replenishment etc for the project site and surroundings. In the absence, the team held discussion with the local farmers and engineers and staff of UWSCG at Orjonikidze head works. Lithology at the Orjonikidze site indicate that top layer, for about 0.5 m, is characterized by clayey soil, followed by the principle aquifer of sand and gravel that extends over 100 m deep. Groundwater depth is about 5 m, which increases with the distance from River. There has been no change/decline observed in the water table since many years. The change in pre and post monsoon level is about 0.5 m. Predominant recharge source is Khrami River.

70. Orjonikidze headworks was developed in 1956 and augmented in 1970s and 1980s. In late 70s and early 80s this was a major supply source for the industries in Marneuli and Kumisi. Maximum supply from this head works was 24,000 m^3 per day, from the gallery and several bore holes, abstracted at a rate of 1,000 m3 per hour through continuous 24-hour pumping. There was no decline in groundwater observed during that time. Groundwater situation now remains same in fact the use has been declined, as almost all industries were closed down. There are no major groundwater extraction points in the nearby areas. There are no industries, and irrigation is through canals.

71. *Groundwater Quality*. As presented in **Table 6**, most of the groundwater quality parameters at Orjonikidze source are within the permissible limits of drinking water standards[3] set by GoG. However, water shows bacteriological contamination (coliform).

Table 6: Groundwater Quality at Orjonikidze

S. No	Parameter	Unit	Drinking Water Standard	Bore well	Gallery Water
1	Color	cobalt scale	15	5	5
2	Odor	-	2	0	0
3	Turbidity	NTU	3.5	10	10
4	Sulphate	mg/l	250	136.3	148.3
5	Chlorides	mg/l	250	28.6	32.2
6	Oil Products, total	mg/l	0.1	-	--
7	Calcium	mg/l	140	75.15	77.23
8	Magnesium	mg/l	85	14.7	14.96
9	Sodium	mg/l	200	30.7	31.2
10	Zinc	mg/l	3.0	0.03	0.035
11	Iron, total	mg/l	0.3	0.10	0.11
12	Total coliform	MPN	Nil	150	180
13	E-coli	MPN	Nil	100	150
14	pH	-	6.0-9.0	7.4	7.4
15	Total mineralization	mg/l	1,000	680	701
16	Barium	mg/l	0.7	0.08	0.095
17	Boron	mg/l	0.5	0.23	0.23
18	Arsenic	mg/l	0.01	0.0050	0.0053
19	Mercury	mg/l	0.006	0.0005	-
20	Cadmium	mg/l	0.003	0.001	0.0015
21	Manganese	mg/l	0.4	-	0.02
22	Nickel	mg/l	0.07	-	-
23	Nitrate	mg/l	50	20	30
24	Nitrite	mg/l	0.2	0.069	0.031
25	Selenium	mg/l	0.01	0.007	0.005
26	Copper	mg/l	2.0	0.005	0.012
27	Aluminum	mg/l	0.1	0.02	0.025
28	Lead	mg/l	0.01	0.005	0.007
29	Fluoride	mg/l	0.7	0.1	0.2
30	Chromium	mg/l	0.05	0.015	0.02
31	Antimony	mg/l	-	0.0003	0.0003
32	Cyanide	mg/l	0.07	-	-
33	Pesticides	mg/l	0.05	-	0.0001_{track}
34	Total hardness (as CaCO3)	mg/l		590	600

Source: Sampling survey, September 2010

2. Impacts during Construction

72. Excavation can affect local drainage patterns if surface- and groundwater- collects in voids as they are being dug.

73. Jhandari reservoir site is located on the bank of river Alageti. Similarly, there are irrigation channels along the roads, where transmission main will be laid. Pipeline will be laid on the other side of the road without disturbing the channel. However, surface runoff can be collected in the trenches if the exaction is conducted during rains. Also, the silt-laden run-off from the construction areas may pollute the surface water by increasing the turbidity. Therefore the Contractor:

[3] Drinking Water Regulation of Government of Georgia

- Avoid scheduling of excavation work during the rainy season
- Complete pipe laying work in excavated stretches and refill before onset of monsoon
- Complete the excavation and foundation during dry season
- In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil,
- Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site
- Ensure that drains are not blocked with excavated soil

74. The possibility of groundwater collecting in the excavated trenches is negligible at most sites due to the fact that groundwater table is deeper than the excavation depth. The depth of excavation for transmission line is below 2 m, while that for reservoirs is 3-4 m. The depth of groundwater Table near Orjonikidze is 5 m, while in the rest of the area it is deep.

75. The transmission main alignment crosses a small depression or pond, in which water accumulates during heavy rains. Pipeline will be laid on small concrete pedestal across the pond. The construction in the pond may have certain negative impacts, which need to be mitigated with the following :

- Conduct pipeline work when the pond is dry
- No activities such as storing material, concrete mixing shall be carried in the pond
- After completion of work, any left-over materials/soil cleared and refilled areas properly consolidated

3. Impacts during Operation

76. During the operation stage no effects on surface water envisaged. However as this a groundwater based water supply system, the effects on groundwater resource due to extraction needs to be assessed. Also, the likely pollution of groundwater source is also needs to be reviewed.

77. Generally the main risk to the physical environment of operating an improved water supply system is that increased abstraction of groundwater (in this case) will deplete the water resource. Unsustainable extraction of groundwater may lead to degradation of groundwater quality, impacts on local vegetation, land subsidence and reduction in water holding, etc. Depletion of water resource will also lead to closure of the system and wastage of investment.

78. However, the risk of groundwater depletion at the proposed site is considered negligible due to the following:

- Groundwater resource Orjonikizde, on the banks of Khrami River, is said to be abundant; this site is located in the main aquatic horizon composed of “alluvial sediments closest to river bottom and floodplain”, which is a very good source of groundwater
- There has been no marked decline observed in the water table, which is stable at 4-5 m since at least last 50 years.
- There are no major groundwater extraction points within a range of 2 km
- The headworks is in operation since 1956; maximum water extracted in the past (1980s) was 24,000 m^3 per day without any decline in static groundwater level; in the absence of any data, this can be considered as a safe yield at a rate of 1,000 m3 per hour for 24 hours continuous pumping

- The total groundwater abstraction for the project will be 10,800 m^3, which is just about 45% of the above stated safe yield

79. Nevertheless, to be safe with the project design the following measures shall be implemented to check the aquifer yield, safe distance between the bore holes and the gallery which abstracts water at shallow depth. The following shall be integrated into the project design:

- Conduct aquifer (groundwater) pumping tests at the site to estimate yield, draw down and recuperation, and transmissivity and storativity of the aquifer
- Based on the tests, review the current location of gallery with respect to bore holes; if necessary, appropriate actions such as avoiding the rehabilitation of boreholes under influence shall be considered
- Future extractions in the vicinity for any other purpose shall be controlled through groundwater permitting by the Government

80. Degradation of source water quality is another risk in operation of water supply system that may have impacts on public health. In the present case, quality of groundwater is good. There are no activities/industries with problematic discharges within the vicinity of the site. Nearest industrial area is located in Rustavi, about 10 km southeast of the site.

81. Since the site is located on the bank of River Khrami and therefore it is likely that the changes/degradation of river water quality will lead to degradation of groundwater quality. Present water quality of River Khrami shows no signs of any major pollution, except bacteriological pollution and nitrates. There are no industries in the catchment, except gold mining activity in Mashavera catchment, which is again located very far from the site (~50 km). So no significant impacts on groundwater quality are envisaged.

82. Since the groundwater is abundant there is no likely degradation of water quality due to extraction for project. The impact of future contamination of groundwater due to external factors (like river pollution), which may lead to supply of unsafe water and ultimately raise public health concerns, has also been discussed in the section on “Socio-Economic Impact”.

83. An important aspect of increased water supply is that of increased sewage generation, which needs to be treated and disposed properly without causing any impacts. In case of inadequate facilities, disposal of untreated sewage into rivers/streams is common and therefore it offers a potential impact to surface and groundwater.

84. At present, there is no proper sewerage system in Marneuli. Although there is a system covering about 20% town population (which is about 9% of Municipality population), there is no treatment facility and untreated sewage is disposed into Alageti River. Remaining population in the town and the villages depend on pit latrines and/or septic tanks.

85. With the current project, water supply will be increased further. The increase in water supply will increase the sewage generation from 5,860 m3 to 9,100 m3, as shown in the following **Table 7**.

Table 7: Increase in Sewage Generation due to the Subproject

Parameter	**Unit**	**Value**
Current Situation		
Gross water supply (at source)	m3/day	14,650
Water losses	%	60%
Net water supply (at consumer end)	m3/day	5,860

Parameter	Unit	Value
Sewage generation	m3/day	4,395
Sewage collected but disposed without treated	m3/day	879
Sewage uncollected	m3/day	3,516
With the Sub- project		
Gross water supply (at source)	m3/day	20,050
Water losses	%	55%[4]
Net water supply (at consumer end)	m3/day	9,100
Sewage generation	m3/day	6,825
Sewage collected but disposed without treated	m3/day	1,365
Sewage uncollected	m3/day	5,460

86. Without any proper sewage collection, treatment and disposal system, the increased sewage will have negative impacts on receiving water bodies It is therefore necessary that:

- Existing sewerage system is improved with treatment facilities, which can treat the sewage to Georgian standards and dispose safely
- Sewerage system is extended to cover 100% population
- The above measures shall be implemented along with the water supply system improvement

D. Climate & Air Quality

1. Baseline Profile

87. *Air Quality*. Ambient air quality monitoring is conducted at only seven locations in Georgia. None of these are located in Marneuli, as there are no major air polluting sources like industries. There are mining areas and crushers (aggregate) located along the River Khrami on the southwestern outskirts of Marneuli town. These generate dust, however are located far from the town. Vehicular pollution is the probably only source of air pollution. Although traffic is less, internal roads in part of the town are in very bad condition, and vehicle movement tends to produce a lot of dust. Main roads, however, are surfaced and are in good condition.

88. According to the available statistics, Kvemo-Kartli region produces highest quantity (about 20% of country total) of air polluting substances (only SPM is included) into the air from various industrial activities. It produces about 24,711 tons, in which about 80% is controlled, while 20% is released into the atmospheric air. Although Marneuli is situated in this region, none of the air polluting industries are located in the vicinity. The main air polluting industries in Kvemo- Kartli are cement, fertilizers and steel rolling, half of which are in Rustavi Town, 15 km northeast of Marneuli.

89. *Climate*. Humid subtropical climate prevails in Marneuli. The wet periods generally occur during Spring and Autumn while Winter and the Summer months tend to be dry. Marneuli experiences hot summers and relatively cold winters. The average annual temperature is 12° C; January is the coldest month (monthly average 0-0.3° C) and July is the hottest (monthly average 23.9° C). Absolute minimal and maximum temperatures recorded are -25° C and 40° C respectively. Marneuli area receives low rainfall compared to rest of the country; annual rainfall ranges between 490-550 mm. May is the wettest month

[4] It is designed to reduce the total water losses in the system from present 60% to 20% through improvements in transmission & distribution system. The present subproject in Tranche-1 however improves only transmission system of Orjonikidze head works. On the assumption that 25% of total system losses occur in transmission and 75% in distribution, it is estimated that, with this subproject, the total losses in the system will be reduced to 55% from current 60%.

while December in driest. Maximum number of snowy days is 70. Snow occurs normally in December and January; average thickness is less than 10 cm. Wind predominantly blows from north and east. In summer, predominant wind direction is south-east. Average annual wind speed is 2.4 m/sec. Maximum average monthly wind speed is reported in February-March, minimum in December. Based on the data from Marneuli observation station, following figures show monthly average minimum and maximum temperature, precipitation and wind direction and frequency.

Figure 1: Monthly Average Minimum & Maximum Temperature (degrees C)

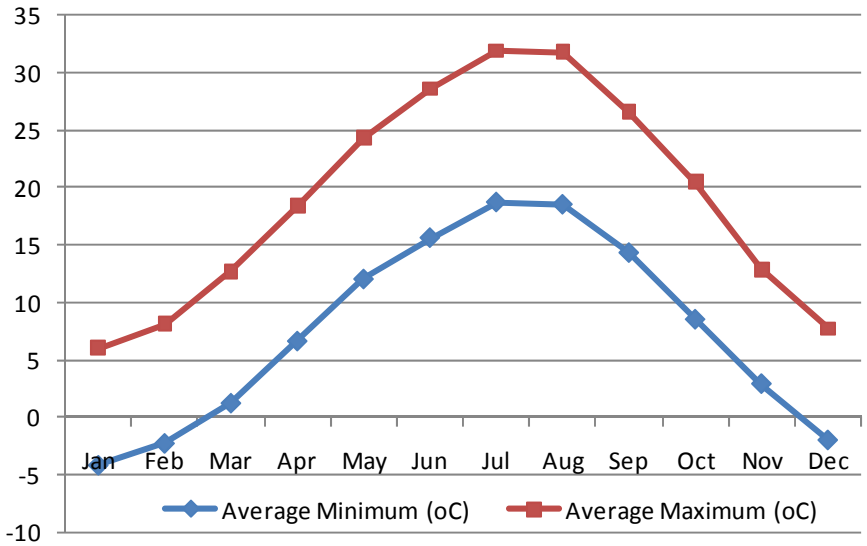


Figure 2: Monthly Average Precipitation (mm)

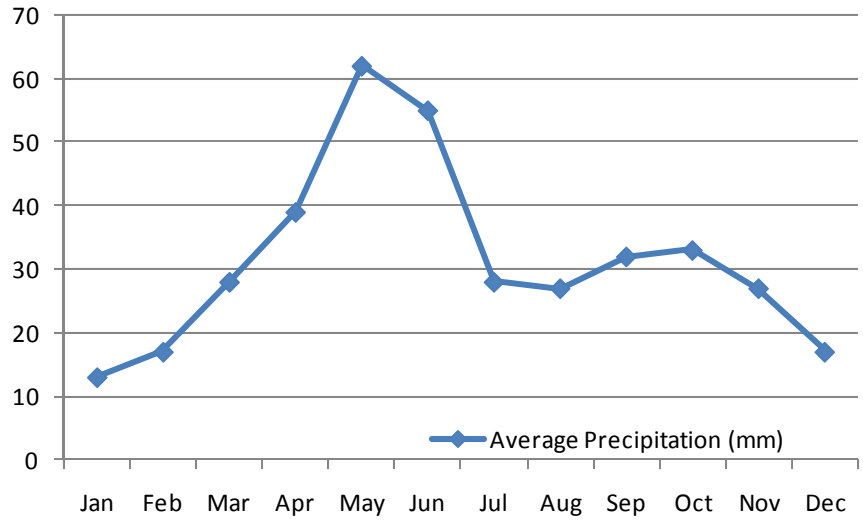
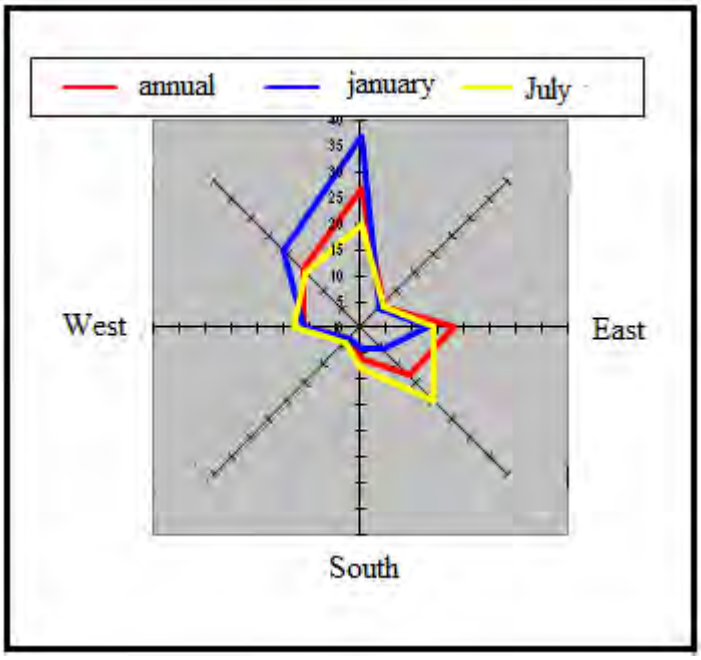


Figure 3: Normal Wind Direction



2. Impacts during Construction

90. The activities that could cause impact on ambient air quality are (i) dust generation from construction activity and (ii) air emission from construction equipment (like excavators, crane) and material and waste transport vehicles. While the first one is limited to civil construction activities, second one is applicable to all construction activities.

91. Since the work will almost certainly be conducted in the dry season, so there is a lot of potential for the creation of dust, from the excavation of dry soil and its storage, and leveling on the ground. As stated earlier, the construction activity will involve significant quantities of earth work. Action will therefore be needed to reduce impacts on air quality at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

- Cover or damp down by water spray on the excavated mounds of soil to control dust generation;
- Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process;
- Bring the material (aggregate and sand) as and when required;
- Ensure speedy completion of work and proper site clearance after completion
- Ensure proper consolidation/stabilization of top surface, when un-surfaced/ /earthen roads are used for construction activity
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site
- Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing

92. Various types of equipment and vehicles would be required for the construction activity. The exhaust emissions from these may degrade the ambient air quality. Considering the scale of work and use of equipment, impact will be insignificant, and will be beyond the scope of this project. However, to enhance the subproject benefits, the Contractor should consider the following:

- Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained
- Ensure that all equipment & vehicles confirms to emission and noise norms

1. Impacts during Operation

93. During the operation stage no major effects on ambient air quality is envisaged. However, it is likely that electrical equipment like transformers may contain harmful substances - insulating oils / gases (e.g. Polychlorinated Biphenyls [PCB] and sulfur hexafluoride [SF6], and fuels. SF6 may also be used as a gas insulator for electrical switching equipment and in cables, transmission lines, and transformers. SF6 is a greenhouse gas with a significantly higher global warming potential (GWP) than CO2. PCBs were widely used as a dielectric fluid to provide electrical insulation. Similarly, hazardous/harmful material may be present in laboratory apparatus/equipment/chemicals. Although this is not major impact considering the magnitude of equipment use, consideration of these in the project will however enhance the benefits.

94. During regular operation none of these substances will be emitted; likely escape into atmosphere may be during repairs and during disposal after life. During design and procurement of equipment the following shall be considered:

- Avoid use of transformers and other electrical equipment containing PCB through alternative (green) models
- Minimize use of SF6 through appropriate selection of equipment
- In unavoidable cases due to non-availability of appropriate equipment the following measures shall be put in place:
  - Conduct awareness programs to workers/lab operators to know which equipment contain hazardous material
  - The repair and maintenance of such equipment shall be conducted only by trained persons and in appropriate facilities; more appropriately the contract for procurement with supplier/manufacturer shall include taking back the equipment after useful life

E. Biological Environment

1. Baseline Profile

95.. About 40 percent of total geographical area of the country accounts for forests. Average density of forests is 163 m^2 per ha. 97 percent of forests situated on mountain, the rest 3% are low-lying and flood plain forests in Kolhida Region and in the Western Georgia.

96. *Flora*. Marneuli municipality has forests covering an area of 14,583 ha, and it is exclusively used for fire wood. The following species are typical for these arid forests: maple, fig tree, buckthorn, smoke tree, and jasmine. Grass steppe (beard grass, needle grass, fescue, germander, gold-of-pleasure, yellow bedstraw, Lucerne, etc) and semi-desert vegetation (Wormwood, glasswort and petrosimonia) is present on the plains. There are varieties of trees along the roads, as wind breakers; main species include Ash, European Ash, Lime and Maple.

97. *Fauna*. There are no large mammal species found in the area. The following are the common species of avifauna and reptiles found in the area.

Table 8: Common birds and reptiles found in Kvemo-Kartli Region

Avifauna		**Reptiles**	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
Northern Goshawk	*Accipiter gentilis*	Tree Frog	*Hyla arborea*
Eurasian Sparrowhawk	*Accipiter nisus*	Green Toad	*Bufo viridis*
Common Swift	*Apus apus*	Toad	*Bufo bufo verucosissima*
Swallow	*Hirundo rustica*	Glass Lizard	*Ophisaurus apous*
Redstart	*Phoenicurus Phoenicurus*	Caspian Green Lizard	*Lacerta strigata*
Blackbird	*Turdus merula*	Meadow Lizard	*Lacerta praticola praticola*
Blue Tit	*Parus caeruleus*	Grass Snake	*Natrix natrix*
Hooded Crow	*Corvus corone*	Smooth Snake	*Coronella austriaca austriaca*
Raven	*Corvus corax*	Tree Frog	*Hyla arborea*
Tree Sparrow	*Passer montanus*		
Goldfinch	*Carduelis carduelis*		

98. *Protected Areas*. There are 14 Strict Nature Reserves, 8 National Parks, 12 Managed Nature Reserves, 14 Natural Monuments and 2 Protected Landscapes in Georgia. These protected areas cover about 7 % of the country's territory. About 75 % of Protected Areas are covered by forests. Primary function of the Protected Areas is protection of natural heritage of the country.

99. The nearest protected area to the project site is Gardabani Managed Reserve (MR). Boundary of this protected area is located at about 15 km southwest of Marneuli. Total area of the reserve is 3,484 ha. This MR was created to preserve forest stands, improve their conditions and protection of the fauna species. Floodplain (of River Mtkvari) forests are the main wealth of the Gardabani managed reserve flora.

100. None of the project sites are located in or close to forests or protected areas. Marneuli Town is an urban area surrounded by land that was converted for agricultural use many years ago. There is no remaining natural habitat in the town, and the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals plus other species able to live close to man. The southern suburb, through which the proposed transmission main passes, is extensively cultivated. There are only trees, shrubs and bushes of above indicated common species along the roads.

2. Impacts during Construction

101. There are no important or sensitive ecological resources in and around the sites. Most of the works will be conducted within the existing facilities. The sites for all the four new reservoirs proposed in the project are located within the existing facilities of UWSCG respectively at Orjonikidze, Narimanov, Jhandari and Garadakh. There are no trees on the sites except bushes and grass of local species.

102. The transmission main pipeline proposed from Orjonikizde to Narimanov runs along the field/dirt roads surrounded by agricultural fields. The pipeline will be laid into the edge of the road. There no major trees but mostly grass and bushes of local species along the alignment, some of which may need to be cleared off for the construction. Following measures shall be implemented:

- Avoid tree cutting by local and small change of layout plan/alignment
- In unavoidable cases, plant two trees of same species for each tree that is cut for construction
- Bushes and grasses shall be cleared only in actual construction area all other preparatory works (material storage, mixing, etc) shall be conducted on barren lands where there is no vegetation.

3. Impacts during Operation

103. The operation and maintenance activities would be conducted within the facilities, and therefore no impacts envisaged on biological environment.

V. IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

A. Economic Resources

1. Baseline Profile

104. *Land use.* As per 2007 statistics, in Marneuli Municipality agricultural lands occupy 65%, 27% is non-agricultural land and the remaining 8% is unused land (waste lands, hills). About 57% of agricultural lands are occupied with pastures. In Marneuli Municipality, most of the land is under government control; only 10.5% of the land is in private ownership.

105. *Agriculture*. The majority of the population Marneuli are ethnic Azeris and the primary form of employment is small-scale agriculture. Few farmers own large chunks of land. The irrigation system is well developed in the area. About 77% of agricultural lands are provided with canal irrigation systems, however due to lack of maintenance, the canals are in bad state. Predominant crops are grains (wheat and corn), vegetables (tomato, potato, eggplant, sweet pepper and onion). Farmers practice crop rotation between grains and vegetables – during winter (November-April), wheat is cultivated while in the rest of the year, corn and vegetables cultivated. Some farmers are also engaged in cattle breeding – for meat and milk products. Marneuli is the major producer of vegetables, meat and milk products in Georgia, and therefore agriculture is identified as a priority sector.

106. *Mining*. The Marneuli Municipality has deposits of basalt stone, including marble, white stone in Sadakhlo, Kvaghori and Gaji. Mining activity is prevalent along River Khrami for sand, gravel and aggregate.

107. *Industry*. Like many other cities in Georgia, Marneuli and adjacent villages were once home to a variety of Soviet-era industries. Most of these industries are now closed down. But in the last few years some new agro-based industries have been established, which include large scale Preserve Factory (fruit processing), and a bread and flour factory. These industries are located along Rustavi Road in the north.

108. *Roads & transport*. Marneuli Municipality has a well developed road network connecting all the villages and Town with bituminous roads. It is well connected with Tbilisi. In the Town, most of the roads are wider and not heavily utilized by the traffic. In the central part, the streets are however narrower, but there is no much traffic either. Public transport facilities are available and connect to all areas. The railway line connecting Armenia passes through Marneuli.

109. *Urban Services*. UWSCG provides water supply to the town and 14 villages Rest of the village population is served from local springs and wells. Groundwater is the main source of water supply. Sewerage system is not well developed, and is provided only to a part of Marneuli Town population. There is no wastewater treatment facility; the collected wastewater is disposed into River Algeti without any treatment. Storm water drainage is available in part of the town. There is a municipal solid waste collection and transportation system in the town, and collected waste is deposited at Kizilaglo landfill, about 10 km from the town.

110. Power Supply. After the independence, Government of Georgia has made efforts to improve the power supply through new generating sources. Hydropower is the predominant source (88%), while rest is from gas based thermal power stations. Marneuli gets power supply from Khrami hydropower stations. Uninterrupted power supply of good quality power supply is available in Marneuli.

2. Impacts during Construction

111. The water supply improvement works will all be conducted on government owned land, so there should be no need to acquire land from private owners, which might affect the income and assets of landowners or tenants. There should also be no effects on other features with economic implications (such as infrastructure, industry and commerce), as there are none of these facilities on these sites.

112. The transmission main pipeline proposed from Orjonikizde to Narimanov runs along the dirt field roads surrounded by agricultural lands. Motarable traffic limited to farm equipment like tractors, and vehicle owned by farmer. Since vegetable cultivation is predominant, which are to be sent to market frequently – even daily during the season, disturbance to access will lead to loss of income to individual farmers. Presence of excavated trench will impede the access. Therefore, the contractor:

- Should not close any road/path for construction purpose; if unavoidable alternative temporary access should be made available
- Should inform local people about the nature and duration of work well in advance so that they can make necessary preparations;
- Provide wooden planks across trenches for pedestrians and metal sheets where vehicle access is required

113. The another aspect of the work that has economic implications is the transportation of material to the site and waste from the site to locations where it can be put to beneficial use as recommended or to the landfill. As estimated the total quantum of waste soil generated from activity is 2,514 m3, and debris 400 m3. This will generate nearly 300 truck trips (average 10 m3 per drip during 1 year construction phase – spread unevenly with more trips during initial stages. In addition there will be truck movements carrying material. This large number of lorry movements could disrupt traffic near the sites and particularly in Marneuli Town. Dust generated during the transport may also impede the commercial and trade activities, which are predominantly located along the main roads. The transportation of material and waste shall be implemented by the Civil Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic (some of which are already included under air quality:

- Plan transportation routes in consultation with Municipality and Police such that heavy vehicles do not enter narrow local roads and sensitive areas of the town, except in the immediate vicinity of delivery sites
- Schedule transportation activities by avoiding peak traffic periods.
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

3. Impacts during Operation

114. As the operation and maintenance activities would be conducted within the existing facilities in no impact envisaged on economic resources. Repairs and leaks of the transmission main pipeline will be minor and localized. In fact, the improvement water supply system will bring various benefits. Availability of good infrastructure facilities will add to the quality of life, and there will be more people interested to live and work, which will bring new investments and boost economic development.

B. Socio-Cultural Resources

1. Baseline Profile

115. *Demography*. The population of Marneuli Municipality was 122,547 in 2007. Project area consists of Marneuli Town and 14 surrounding villages, with a total present population is 48,971 (2010). This has increased from 37,100 in 2002, registering an annual compounded growth rate of 3.13%. It is projected that the population will grow to 65,523 by 2040.

Table 9: Population of Project Area

Year	Population			CAGR
	Town	Villages	Total	
2002	20,050	17,050	37,100	-
2010	21,300	27,670	48,971	3.13%
2040	26,653	38,869	65,523	-

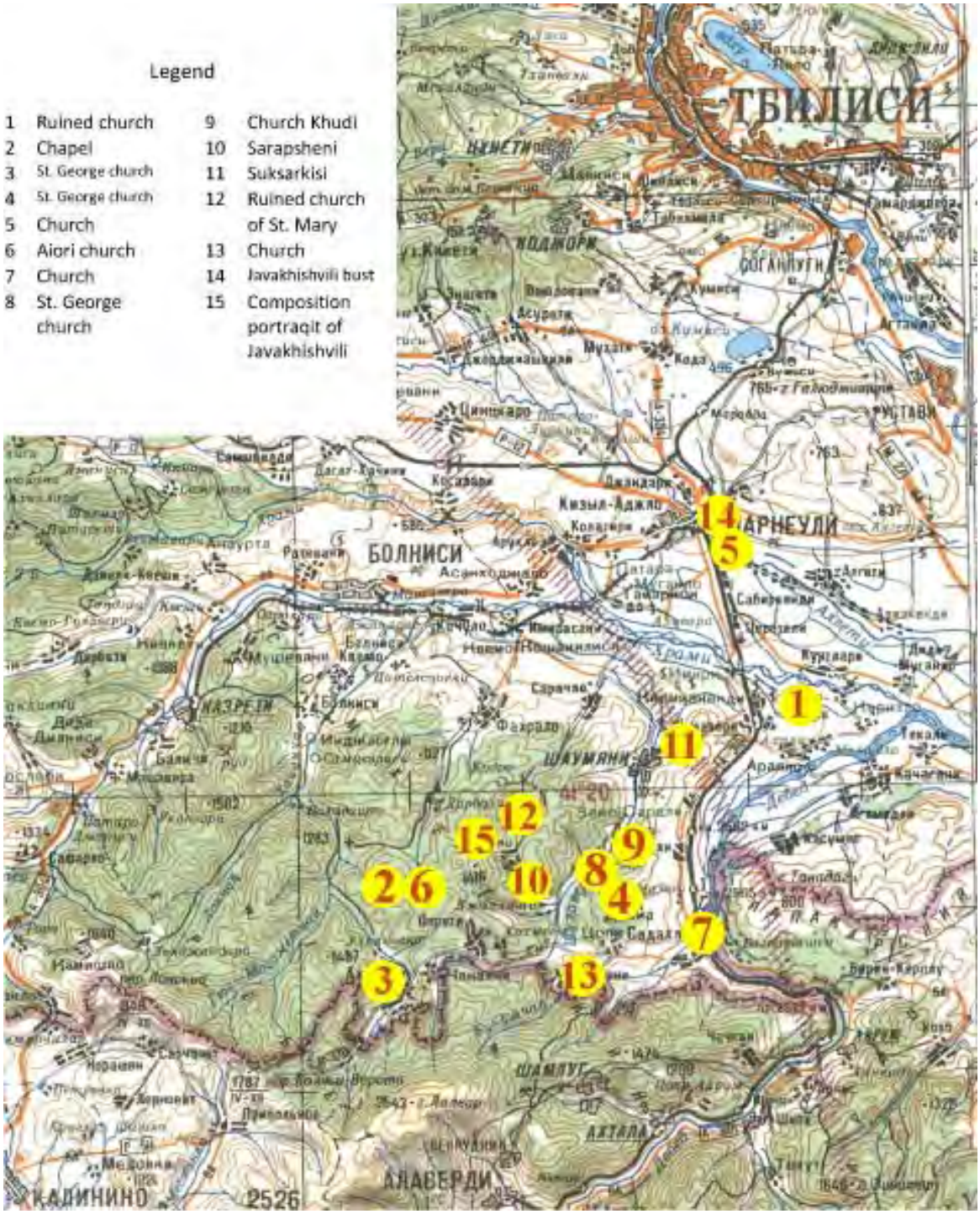
116. *Population Composition*. Majority of the population in Marneuli Municipality constitutes Azeri ethnic population (83.1% in 2002), and the remaining are mostly Georgians and Armenians. While Azeris practice the faith of Islam, the remaining are Christians. Georgians speak national language Georgian, while Azeris and Armenians speak Azhari and Armenian languages respectively. With the efforts of Georgian government and NGOs to develop Georgian language skills in entire population, some of them now can converse in Georgian, although this is limited mostly to urban areas. Majority of the population can speak/understand Russian. There is no population which can be categorized as indigenous. Almost all persons in Marneuli are literate.

117. *Employment*. According to 2007 statistics, economically active people constituted 52.2 percent of the total population in Marneuli. Most of the people are engaged in agricultural activities. About 6 percent are in paid employment; predominant employment sectors are: trade (34.4%), healthcare system (18.2%), processing industry (10.5%) and mining industry (8.4 %).

118. *Education & health facilities*. There are 23 ambulatory-policlinic facilities in the municipality. Malaria is widespread in some villages, said to be due to presence of marshy areas, which have formed as mosquito breeding grounds. Marneuli Municipality has good primary and secondary education facilities; there are 81 schools in the Municipality.

119. *Socio-Cultural Resources & Monuments*. There are 19 houses of culture, 19 libraries, 61 parks and 73 stadiums in Marneuli Municipality. There are no important historical places or monuments in Marneuli. There are 15 places of attraction (**Map 8**), which are frequented by local people. Two of these are located in the project area. A church (not historic) is located at about 100 m for the Garadakh reservoir site.

Map 8: Places of Tourist Attraction in Marneuli



2. Impacts during Construction

120. There are no social-cultural resources (such as schools, hospitals, temples and tourism spots) near the project sites, except at Garadakh, where there is a church on Marneuli Hill. The church is located about 100m from site. It proposed to rehabilitate two existing reservoirs and build a new reservoir on top of the hill located close to the Church. Pipeline construction work will be conducted along the road.

121. The construction impact will include noise and dust, and interrupted access due to movement of heavy vehicles transporting material and waste. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. Existing access road to the church, which can directly connect the site with a main road on the outskirts, will be used for construction. This is necessary since the existing access road to the site narrow and passes through residential area. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above (under the impacts on air quality), including:

- Limiting dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks
- Increasing the workforce in to complete the work quickly
- Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications
- Avoiding dusty and noisy work and movement of vehicles carrying material and waste during sensitive times/peak visitor periods (weekly prayer and other festival times)

122. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:

- Following standard and safe procedures for all activities – such as
    - provision of shoring in deeper trenches (> 2 m)
    - When working on height - testing structures for integrity prior to undertaking work and using appropriate safety belts
- Excluding public from the site – enclosing the construction area and provide warning and sign boards, and security personnel
- Providing adequate lighting to avoid accidents
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc);
- Maintaining accidents records and report regularly
- Allowing only trained and certified workers to install, maintain, or repair electrical equipment
- Ensuring that live- wire power supply work is conducted by trained workers with strict adherence to specific safety and insulation standards.

123. The proposed works involve replacement of existing old transformers (of Soviet-era). These transformers are likely to contain Oils with PCBs and therefore pose a health and environmental risk if handled and/or disposed improperly. The quantum of waste oil generated will be in the range of 600-700 liters. Following measures shall be implemented:

- Test transformers oil for concentration of PCBs at an approved lab by MoEPNR
- If tests are positive (concentration more than 50 PPM), oil shall be stored and disposed to a licensed hazardous facility

124. Marneuli is a not a important historic place. However to avoid any risk of uncovering or damaging archaeological and historical remains during ground disturbance, the following measures shall be put in places as a good measure.

- Contractor shall put in place a protocol in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve:
    - Training to the construction supervisors to identify any suspicious objects
    - Stopping work immediately to allow further investigation if any finds are suspected;
    - Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

125. *Economic Benefits*. There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labor force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labour camps. If temporary labor camps are to be provided, Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

- To the extent possible labor force must be drawn from the local community
- In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people. Following measures shall be followed:
    - Establish the temporary labor camps in consultation with the local authority
    - Shall be located away from water bodies
    - No clearance of trees vegetation shall be allowed for establishment of camp
    - Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc)
    - Contractor shall provide fire wood and no worker shall be allowed to cut any tree
    - Ensure regular and clean maintenance of the camp

3. Impacts during Operation

126. As the operation and maintenance activities would be conducted within the existing facilities, therefore no major impacts on socio-cultural resources envisaged. There is invariably a safety risk when considerable quantities of chlorine are handled - chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies. As detailed earlier, daily usage of chlorine will be 54 kg. Normally chlorine cylinders sufficient for a month will be stored in the facility. There will be 3 tonners in all at the facility at any point of time.

127. The proposed chlorination facility at Orjonikidze is located within the head works campus, with no habilitation areas nearby. Therefore there may not be any public risk but the there will be safety risk to workers. Following measures therefore shall be included:

- Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include:
  - Chlorine neutralization pit with a lime slurry feeder
  - Proper ventilation, lighting, entry and exit facilities
  - Facility for isolation in the event of major chlorine leakage
  - Personal protection and safety equipment for the operators in the chlorine plant
  - Visible and audible alarm facilities to alert chlorine gas leak

- Laboratory facility shall not be housed within the chlorination facility
- Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier
- Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Georgian Languages
- During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures

128. However, there is also a safety risk in operating and maintaining electrical and mechanical equipment (pumps and motors) during operation. Following measures shall be included in the project.

- Prepare standard operating procedures (SOP) and manual for operation of water supply system in general and in specific for electrical, mechanical and laboratory equipment
- Follow standard and safe procedures as per SOP
- Restrict entry into facilities – only authorized persons shall be entered and allowed to operate
- Maintain adequate ventilation and lighting in the facilities
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc);
- Maintaining accidents reports and records
- Allowing only trained and certified workers to maintain, or repair electrical equipment, and that live- wire power supply work is conducted by with strict adherence to specific safety and insulation standards

129. Another impact associated with water supply system is supply delivery of unsafe water into distribution system, which may lead to public health issues. This may occur due to (i) degradation or pollution of source water quality, and (ii) pollution of treated water during transmission and distribution due to leakages.

130. The water supply system in Marneuli is groundwater based, and the present water quality at Orjonikidze head works is potable, and can be used for domestic purpose without any treatment. Therefore water is subjected only to disinfection to provide for bacteriological contamination in the transmission and distribution system. The head works is situated on the back on River Khrami. Although there are no studies to prove, due to its location and strata, river is likely a major source for groundwater replenishment in the head works site.

131. Therefore two measures are required to be part of project design: (i) source protection measures and (ii) regular water quality surveillance program. The following measures shall be integrated:

- Coordinate with MoEPNR to check the pollution of Khrami River; ensure that a water quality monitoring station is established on the upstream side of head works by MoEPNR for regular monitoring; Illegal disposal of untreated wastewater into river from any sources shall be checked
- Conduct regular groundwater quality monitoring tests; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future
- Develop & implement a water quality monitoring program for distribution system according to the Georgian Law[5]
- Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel

132. The improved water supply will bring numerous benefits when it is operated. The main beneficiaries will be the citizens of Marneuli, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor. This will improve the quality of life of people as well as raise standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase. Improvement in infrastructure will bring more economic opportunities.

133. The improved and expanded water supply system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for local people.

C. Noise & Vibration

1. Baseline Profile

134. Ambient noise is not subjected to monitoring in Georgia, so there is no data on ambient noise/vibration available. Main noise generating sources in the town are transport vehicles and local construction activities; there are no major noise generating activities like industries. Following table shows the subproject sites and their background noise levels (based on site observation) and sensitive receptors, if any.

[5] Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia

Table 10: Ambient Noise & Vibration and Sensitive Receptors at Project Sites

Subproject Sites	Background Noise/Vibration	Sensitive Receptors
Orjonikidze head works	Situated on the bank of River Khrami, the site is located in a rural setting amidst agricultural fields; there is no habilitation; a highway passes at about 200 m from the site. Enuri village is located on the other side of the river at 1 km Except the noise from operation of pumps within the site, the background noise of from the surrounding area is negligible only "lull" prevails most of the time	There are no sensitive receptors like hospitals, schools, religious places.
Pipeline Alignment – from Orjonikidze to Narimanov Pumping Station	Same as above; alignment passes through agricultural area along dirt roads. Traffic on these roads in negligible	There are no sensitive receptors in the vicinity
Narimanov Pumping Station	Narimanov Pumping station is located on the outskirts of Marneuli Town. There are few houses adjacent to the facility.	There are no sensitive receptors in the vicinity except few houses
Jhandari Pumping Station	Jhandari Pumping Stations is located in the town, along a main road connecting Marneuli with Jhandari in the north. Predominant noise is from traffic	There are commercial establishments adjacent to the site; there are no residential areas.
Garadakh (city reservoirs site)	This site is situated on a mountain in the town. There are residential areas around the site. No major noise sources nearby	Nearest house is located less than 50 m from the site. A church is located at 100 m.

2. Impacts during Construction

135. Construction activities are likely to generate noise and vibration. In the present project, haulage of construction materials, and operation of equipment like backhoe loader (80 dB), handheld pneumatic drill (85 dB, for dismantling dilapidated reservoirs at Garadakh site), concrete mixers (80 dB) and concrete vibrators (76 dB) are the primary noise generating activities. This project does not involve high noise/vibration generating activities like pile-driving or rock cutting.

136. Assuming worst case conditions and simultaneous working of two pieces of equipment (backhoe and pneumatic drill) the following table shows the noise levels in comparison with the Georgian noise standards. It may be noted the pneumatic drill will be used only at Garadakh site; for the other sites the maximum noise due to simultaneous use of two equipment (concrete mixer and vibrator) is worked out as 81 dB(A) at 15 m, and will reduce to 65 dB(A) at 100 m. Since the construction noise is intermittent and short-term, the maximum admissible noise levels as per the Georgian standards are considered for assessment of impact.

Table 11: Noise Levels at Various Distances from the Site

Distance for equipment	Backhoe	Hand-held pneumatic drill	Mixer	Vibrator	Combined[6]	Noise Standard[7] *Leq dB(A)*	
m	*Leq dB(A)*					*Day*	*Night*
15	80	85	80	76	86	55 (70)	45 (60)
50	70	75	70	66	76		
100	64	69	64	60	70		
200	58	63	58	54	64		
500	50	55	50	46	56		
1,000	44	49	44	40	50		
2,000	38	43	38	34	44		

137. It can be observed from **Table 11** that none of the estimated noise values exceed the maximum admissible noise level for at 100 m; at Garadakh site this value equals the standard. Except at Garadakh and Narimanov, there are no sensitive areas within 100 m of site. Narimanov facility is located in a big area, protected by a high compound wall, therefore no impacts envisaged on the nearby houses. Workers, however, require appropriate equipment.

138. At Gardakh site, there could be reduction in noise levels as topography of the site is hilly and there are bushes, which can act as natural noise barrier, and which were not considered in the assessment. Since Church is located at 100 m and the nearest house is located at 50 m, the following measures shall be implemented by the contractor:

- Provide prior information to the local people & church authorities about the construction work -nature and schedule of noisy work;
- Schedule noisy activities in consultation and put in place a complaint receiving mechanism
- No nighttime construction activities; sensitivity to noise increases during the night hours in residential neighborhoods; this is applicable to all sites in general and particularly to Garadakh site
- Use less noise generating equipment
- Erect a temporary enclosure (such as with wooden planks) around the demolition site at Garadakh; this will reduce both noise and dust
- Avoid use of noisy equipment like pneumatic drill & back hoe loader at a time
- Within the site, noise equipment like mixers shall be located far away from nearest houses
- Provide personal protection equipment like ear plugs to the workers

139. Another important activity is haulage of construction material and waste to and from site. Except, Garadakh (city reservoir site) all the sites are accessible by wider roads. Pipeline alignment is accessible through narrow field roads, but there are no sensitive receptors in the vicinity. Garadakh site is accessible by a narrow, un-surfaced hilly road, which is in a very bad condition. This road passes through residential areas for about 200 m. It is therefore proposed to use alternative road, which connects a main road directly. This road is however used for Church.

[6] Combined noise of two noise generating equipment (backhoe and pneumatic drill) likely to be used

[7] Tolerable and maximum admissible levels of noise for residential zone as per Decree on Environmental Quality Standards notified in 2001 by the Ministry of Labor, Health and Social Welfare, Government of Georgia; figure shown in bracket are maximum admissible levels.

140. Following measures be included to avoid nuisance due to haulage of material/waste:

- Schedule material and waste haulage activities in consultation with local authorities
- No nighttime haulage activity; limit to day time off peak hours
- Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in this stretch
- Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement

141. As for the construction vibration is considered, none of the activities in the subproject has potential to generate significant and vibration, and there are no sensitive structures in the proximity of the site. Therefore there are no likely impacts.

3. Impacts during Operation

142. There are no sources of vibration from operation activity of water supply system. Noise is likely to be generated from pumping stations. Repairs and maintenance would involve no major construction activities and therefore no noise and vibration impacts.

143. Noise from pumps and motors will be in the range of 65-75 dB, depending on the noise level of each model. Since these pumps are installed in enclosed areas (buildings), there will not be any increase in ambient noise. None of the pumping stations are located close to residential/sensitive areas. There are commercial establishments located adjacent to Jhandari pumping station. The operators and workers of the pumping stations however need to be protected against noise. The following measures shall be included in the project:

- Develop green buffer zone (vegetation/tree cover) around all pumping stations in general, and Jhandari Pumping Station in particular
- Provide personal protection equipment like ear plugs to operators and workers of all pumping stations

D. Cumulative Impacts

144. The project is designed to improve environmental quality and living conditions in Marneuli through the improvement of water supply system. The potential negative impacts identified on various environmental parameters, during both construction and operation, in the previous sections of this report, are localized and temporary.

145. By nature, impacts such as on air quality and on people (due to disturbance, nuisance, and safety risk of construction activity) can have cumulative impacts, as all the construction activities are conducted simultaneously. However, construction sites are not concentrated in a small area, and also each activity is confined to a single site. Further, these are common impacts associated with any construction activity, and as discussed in the earlier sections, there exists proven and easy-to-implement measures to mitigate these impacts.

146. There are no major construction activities being carried out in and around the project sites, and there are no major air pollution sources that could likely add to the impact.

147. During operation, important cumulative impact relates to exploitation of groundwater resources. In the event of various users depending on same and limited resource, the proposed extraction will lead to a cumulative impact. However, such is not the case; groundwater is abundant and there are also no competing uses in the vicinity. Therefore no cumulative impacts envisaged.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

148. Following agencies will be involved in implementing this Water Supply Subproject in Marneuli under the ADB funded Georgia Urban Services Improvement Investment Program:

(i) Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. MoRDI will have overall responsibility for compliance with loan covenants.

(ii) United Water Supply Company of Georgia (UWSCG) is the implementing agency (IA), which will be responsible for administration, implementation (design, construction and operation) and all day-to-day activities under the loan. An, Investment Program Management Office (IPMO) will be established within the UWSCG for all Investment Program related functions. The IPMO will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.

(iii) The IPMO will be assisted by (a) Detailed Engineering Design Consultants (DC), who will design the infrastructure and manage tendering process. Civil works contractors build the infrastructure, and (b) Construction Supervision Consultants (SC), who will supervise the construction process and ensure the quality.

(iv) ADB is the donor financing the Investment Program.

149. UWSCG, specifically its Department of Quality Management and Environment Protection (DQMEP), will bear the responsibility of implementing the subproject in compliance with the Georgian Law and ADB Policy throughout design and implementation phase. Specific tasks would include:

- Updating this IEE to reflect any changes in final project design,
- Submission of revised IEE to ADB, for review and approval; incorporating ADB comments, if any
- Obtaining license from MoESD for groundwater abstraction, and
- Implementation of the EMP including grievance redress

150. Currently DQMEP is staffed with an Ecologist/Environmental Specialist, who also heads the Department. The incumbent Ecologist/Environmental Specialist, with a master's degree in ecology and 7 years of professional experience (including 5 years in Licenses and Permits Department of the MoEPNR), is well versed with the Georgian environmental law, EIA and EIP processes, and other government regulations. With the existing staff, the DQMEP can update the IEE internally[8] and can also coordinate with government agencies for necessary approvals. The DQMEP, however, requires support for implementation of EMP.

151. Implementation of EMP of this subproject require an experienced Environmental Management Specialist (EMS) to spend a total of around three months over the average 6 month design and 15 month construction period, conducting routine observations and

[8] Necessary training will be imparted to DQMEP in ADB safeguard policy, environmental process, etc, as part of the overall Investment Program capacity development program

surveys, and preparing monitoring reports. The EMS will also be responsible for: incorporation of mitigation measures in design and construction; and, baseline and construction-stage environmental quality monitoring. Support of an additional EMS is also required to oversee the EMP implementation, and collating and submitting bi-annual Environmental Monitoring Reports (EMR) to ADB. Since the specialist support is not required continuously, it will be feasible and convenient to an individual consultant to assisting DQMEP in implementing these tasks.

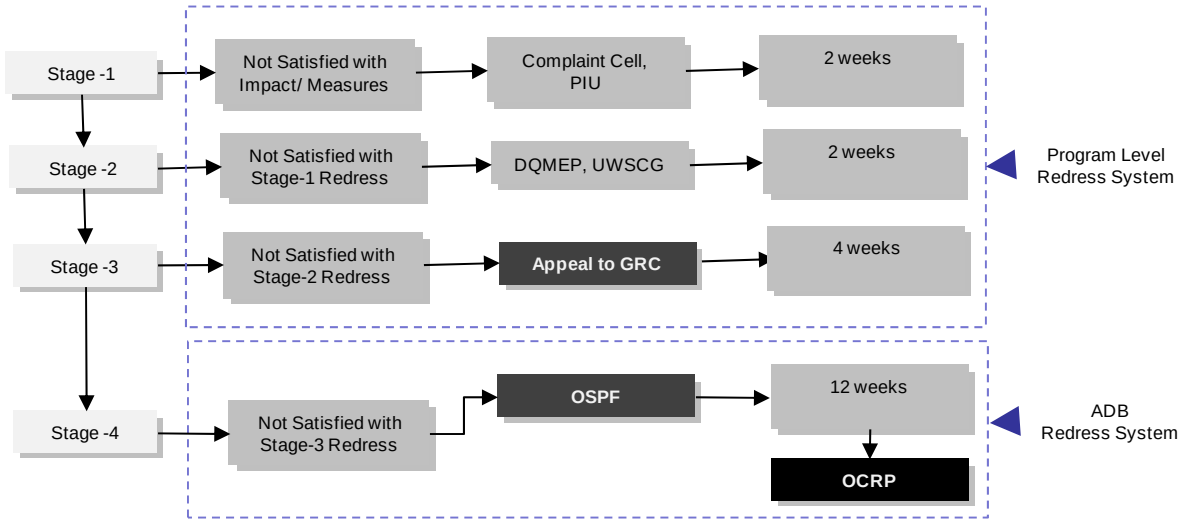
152. DC will be responsible for: incorporation of mitigation measures in design and construction; and, baseline environmental quality monitoring. SC will be responsible for construction-stage environmental quality monitoring and implementation of EMP by the Contractor. DQMEP with the assistance of EMS will review and approve IEE and/or EIA reports and oversee implementation of EMP. The civil works Civil Contractor will implement mitigation measures during construction. Implementation of mitigation and monitoring measures during operation will be the responsibility of DQMEP. Government regulatory agencies such as MoEPNR will also monitor the environmental performance.

B. Grievance Redress Mechanism

153. As the work is being done in inhabited areas, most of the impacts are construction-related, and therefore it is anticipated that improper or inadequate implementation of EMP may lead to disturbance and inconvenience to local people during construction. In order to provide a direct channel to the affected persons for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, UWSCG will establish a Grievance Redress Mechanism. A Complaint Cell and a Grievance Redress Committee will be established in Marneuli Service Centre to function throughout the construction period.

154. The Complaint Cell at the UWSCG Service Center in Marneuli will accept complaints regarding the environment safeguard issues in implementation of the subproject. A four stage grievance redress mechanism is indicated in **Figure 4** below. The grievances received and actions taken will be included into the environmental monitoring reports submitted to ADB.

Figure 4: Grievance Redress Mechanism



(i) Complaints received (written or oral communication) by the Complaint Cell (CC) will be registered in database system, assigning complaint number with date of receipt; Complaint Cell will inform the complainant the time frame in which the corrective action will be undertaken.

(ii) The Complaint Cell and UWSCG Investment Program Management Office (IPMO) will investigate the complaint to determine its validity, and assess whether the source of the problem is indeed subproject activities; if invalid, the Complaint Cell will intimate the complainant and may also provide advice on the appropriate agency to be approached.

(iii) If the complaint is valid, the Complaint Cell will check the environmental management plan (EMP) of the subproject whether this issue was identified and mitigation was suggested; if yes, the Complaint Cell and UWSCG IPMO will direct the civil works Contractor to take immediate actions as per the EMP.

(iv) If this is an unanticipated issue, the UWSCG IPMO will to identify mitigation measures and advise the civil works Contractor accordingly and a corrective action should be taken and a Corrective Action Plan (CAP) prepared.

(v) The Complaint Cell will review the civil works Contractor's response on corrective action and update the complainant within two weeks.

(vi) If the complainant is not satisfied with the action taken by the Contractor within two weeks from the start of corrective action as directed the Complain Cell, the grievance will be directed to the Department of Quality Management and Environmental Protection (DQMEP) of the UWSCG.

(vii) The DQMEP will review the issue with the IPMO and relevant Service Center and may ask for additional information or conduct site visit, and will advise the IPMO and relevant Service Center on actions to resolve the issue.

(viii) The Service Center will submit the interim report in a week to DQMEP on the status of the complaint investigation and follow-up actions, and final action taken report within two weeks of completing the action. The DQMEP will intimate the complainant of the same.

(ix) If the complainant is still dissatisfied with the action taken or decision, he/she may approach the Grievance Redress Committee (GRC, see below) established in the town

155. A GRC will be established to resolve the unresolved issues at Stage 2 and this will function throughout the construction period, and will have hearings on need-basis. GRC will have following members:

- Chairman, Marneuli Municipality or an elected member nominated by the Chairman
- Service Centre Head
- Member of IPMO

156. Considering the anticipated impacts, it is not expected that there is any likely issue which will remain unresolved in the Stage 3 of the process. In the unlikely event of dissatisfaction after Stage 3, the complainant can approach ADB with the complaint. ADB has in place a system under the ADB Accountability Mechanism, where people adversely affected by ADB-assisted projects can voice and find satisfactory solutions to their problems. An affected person can file a complaint (mail, facsimile, electronic mail, or by hand delivery) with:

(i) Office of the Special Project Facilitator (OSPF), ADB, 6 ADB Avenue
Mandaluyong City, 0401 Metro Manila, Philippines
Tel: (63-2) 632-4825; Fax: (63-2) 636-2490; Email: spf@adb.org
Or

(ii) Georgia Resident Mission, which will forward it to OSPF

157. In the event of unsatisfactory redress from OSPF, the complainant can further approach Office of the Compliance Review Panel (OCRP) within ADB headquarters.

C. Environmental Impacts & Mitigation Measures

158. The Following **Table 12** summarizes the environmental impacts and suggested mitigation measures as discussed in previous sections. It also delegates the responsibility of mitigation measures implementation to various project agencies.

Table 12: Environmental Impacts and Mitigation Measures

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
Construction						
Impacts due to excavation and generation of waste soil/debris (soil/)	M	L	• Utilize waste/surplus soil for beneficial purposes - in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas • Dispose the waste/debris that could not be put to beneficial use in landfill	Civil Contractor	All construction sites	Part of construction cost
Erosion of soil from refilled areas	M	L	• Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer	Civil Contractor	Transmission main works	Part of construction cost
Impact on surface water bodies due to construction during rains	L	M	• Avoid scheduling of excavation work during the rainy season • Complete pipe laying work in excavated stretches and refill before onset of monsoon • Complete the excavation and foundation during dry season • In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil, • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site • Ensure that drains are not blocked with excavated soil	Civil Contractor	Jhandari Reservoir and Transmission Line sites	Part of construction cost
Impacts on stream due to laying of pumping			• Conduct pipeline work in the pond when it is dry • No activities such as storing material, concrete mixing shall be carried out in the pond • After completion of work, any left-over materials/soil cleared and refilled areas properly consolidated	Civil Contractor	Transmission main works	Part of construction cost
Impact on ambient air quality due to dust generation	M	L	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion–; • Ensure proper consolidation/stabilization of top surface, when un-	Civil Contractor	All construction sites	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			surfaced/ /earthen roads are used for construction activity • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing			
Impact on air quality due to emissions from construction equipment/ vehicles	I	L	• Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained • Ensure that all equipment & vehicles confirms to emission and noise norms	Civil Contractor	-	Part of construction cost
Removal of vegetation/trees for construction	L	L	• Avoid tree cutting by local and small change of layout plan/alignment • In unavoidable cases, plant two trees of same specie for each tree that is cut for construction • Bushes and grasses shall be cleared only in actual construction area all other preparatory works (material storage, mixing, etc) shall be conducted on barren lands where there is no vegetation.	Civil Contractor	All construction sites	Part of construction cost
Impediment of access to agricultural fields due to laying of transmission main pipeline	L	M	• Do not close/obstruct any road/path for construction purpose; if unavoidable alternative temporary access should be made available • Inform local people about the nature and duration of work well in advance so that they can make necessary preparations; • Provide wooden planks across trenches for pedestrians and metal sheets where vehicle access is required	Civil Contractor	Transmission pipeline site	Part of construction cost
Disturbance/nuisance due to movement of construction equipment/vehicles carrying material/waste in the town	L	L	• Plan transportation routes in consultation with Municipality and Police • Heavy vehicles should not enter narrow local roads and sensitive areas of the town, except in the immediate vicinity of delivery sites • Schedule transportation activities by avoiding peak traffic periods and sensitive times (festivals)	Civil Contractor	All construction sites	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			• Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material at the site by sprinkling water/unloading inside a barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site			
Socio-economic benefits from employing local people in construction work	L	M	• To the extent possible labor force must be drawn from the local community • Contractor should at least source 50% of unskilled labor force from local communities	Civil Contractor	All construction sites	Part of construction cost
Impacts due to import of labor and establishment of temporary labor camps	L	L	• In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people: o Establish the temporary labor camps in consultation with the local authority o Shall be located away from water bodies o No clearance of trees vegetation shall be allowed for establishment of camp o Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc) o Contractor shall provide fire wood and no worker shall be allowed to cut any tree o Ensure regular and clean maintenance of the camp	Civil Contractor	Temporary labor camps	Part of construction cost
Impacts on socio cultural resources due to construction dust	L	M	• Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks • Increase the workforce in to complete the work quickly • Use modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications • Avoid dusty and noisy work and movement of vehicles carrying material and waste during sensitive times/peak visitor periods (weekly prayer and other festival times)	Civil Contractor	Garadakh (city reservoirs) site	Part of construction cost
Safety risk – public and worker	L	M	• Follow standard and safe procedures for all activities – such as o provision of shoring in deep trenches (>2 m)	Civil Contractor	All constructi	Part of construction

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			o When working on height - testing structures for integrity prior to undertaking work and using appropriate safety belts • Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel • Provide adequate lighting to avoid accidents • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc); • Maintain accidents records and report regularly • Allow only trained and certified workers to install, maintain, or repair electrical equipment • Ensure that live- wire power supply work is conducted by trained workers with strict adherence to specific safety and insulation standards.		on sites	cost
Health and environmental risk from disposal of transformer oil	L	M	• Test transformers oil for concentration of PCBs at an approved lab by MoEPNR • If tests are positive (concentration more than 50 PPM), oil shall be stored and disposed to a licensed facility	UWSCG	Transformer replacement sites	US $ 1000
Historical, archeological chance finds during excavation	L	M	• Contractor shall put in place a protocol in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve: o Provide training to the construction supervisors to identify any suspicious objects o Stop work immediately to allow further investigation if any finds are suspected; o Call in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Civil Contractor	All construction sites	Part of construction cost
Impacts on socio cultural resources due to construction noise/disturbance	L	M	• Provide prior public information to the local people & church authorities about the construction work -nature and schedule of noisy work; • Schedule noisy activities in consultation and put in place a complaint receiving mechanism	Civil Contractor in coordination with UWSCG service centre	Garadakh (city reservoirs) site	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			• No nighttime construction activities; sensitivity to noise increases during the nighttime hours in residential neighborhoods; this is applicable to all sites in general and particularly to Garadakh site • Use less noise generating equipment • Erect a temporary enclosure around the demolition site at Garadakh; this will reduce both noise and dust • Avoid use of noisy equipment like pneumatic drill & back hoe loader at a time • Within the site, noise equipment like mixers shall be located far away from nearest houses • Provide personal protection equipment like ear plugs to the workersSchedule material and waste haulage activities in consultation with local authorities • No nighttime haulage activity; limit to day time off peak hour • Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in this stretch • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement			
Operation						
Impact on existing yield of existing groundwater gallery due to rehabilitation of bore holes	M	H	• Conduct aquifer (groundwater) pumping tests to estimate yield, draw down, recuperation, and transmissivity and storativity of the aquifer • Review the location of gallery and bore hole rehabilitation sites based tests results • If necessary, consider appropriate actions such as avoiding the rehabilitation of boreholes under influence • Future extractions in the vicinity for any other purpose shall be controlled through groundwater permitting by the Government	UWSCG	Orjonikidze headworks site	Part of design costs
Impact on surface and groundwater due to disposal of increased volumes of sewage resulting from water	L	M	• Improve the existing sewerage system with treatment facilities, which can treat the sewage to Georgian standards and dispose safely • Extend the sewerage system to cover 100% population • Implement above measures along with the water supply system	UWSCG	-	US$ 44 million as per FS Report

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
supply augmentation			improvement			
Air quality impacts due to spill/leak of hazardous oils, gases (like PCBs and SF6) and radioactive elements used in electrical/ laboratory equipment during repairs	I	M	• Avoid use of transformers and other electrical equipment containing PCB through alternative models (green models) • Minimize use of SF6 through appropriate selection of equipment • In unavoidable cases due to non-availability of appropriate equipment the following measures shall be put in place: o Supplier shall conduct awareness programs to workers/lab operators to know which equipment contain hazardous material o The repair and maintenance of such equipment shall be conducted only by trained persons and in appropriate facilities; more appropriately the contract for procurement with supplier/ manufacturer shall include taking back the equipment after useful life	UWSCG	-	As part of equipment costs
Safety risk due to operation of mechanical, electrical and laboratory equipment	L	M	• Developing standards operating procedures (SOP) and manual for operation of water supply system in general and in specific for electrical/ mechanical equipment, chlorinator and laboratory • Following standard and safe procedures as per SOP • Restricting entry into facilities – only authorized persons shall be entered and allowed to operate • Maintain adequate ventilation and lighting in the facilities • Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc); • Maintaining accidents records and report regularly • Allowing only trained and certified workers to maintain, or repair electrical equipment, and that live- wire power supply work is conducted by with strict adherence to specific safety and insulation standards;	UWSCG	-	Part of project design
Safety risk from handling and application of chlorine	L	M	• Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include: o Chlorine neutralization pit with a lime slurry feeder o Proper ventilation, lighting, entry and exit facilities o Facility for isolation in the event of major chlorine leakage	UWSCG	Chlorination facility	Part of project design

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			o Personal protection and safety equipment for the operators in the chlorine plant o Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be house within the chlorination facility Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Georgian Languages • During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures			
Impacts due to pollution of water source at Orjonikidze	L	M	• Coordinate with MoEPNR to check the pollution of Khrami River; ensure that a water quality monitoring station is established on the upstream side of head works by MoEPNR for regular monitoring; illegal disposal of untreated wastewater from any sources shall be checked • Conduct regular groundwater quality monitoring tests; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future • Develop & implement water quality monitoring program for distribution system • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel	UWSCG	-	Part of project design – water quality testing laboratory is part of design
Impacts due to noise from pumping stations	L	L	• Develop green buffer zone (vegetation/tree cover) around all pumping stations in general, and Jhandari Pumping Station in particular • Provide personal protection equipment like ear plugs to operators and workers of all pumping stations	UWSCG	All pumping stations	Part of project design

H-high; M- Medium and L-Low

D. Environmental Monitoring Plan

159. A program of monitoring will be required to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by Civil Contractors will be conducted by the SC, and overseen by DQMEP's EMS, on behalf of Implementing Agency. Monitoring during operation stage will be conducted by the Operating Agency.

160.. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

161. The following **Table 13** shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies various monitoring activities to be conducted. It describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 13: Environmental Monitoring Plan

Mitigation measures	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Construction Phase					
All construction related mitigation measures	Implementation on site	All construction sites	Observations on/off site; CC records; interviews with people and workers	Weekly	SC
All design related mitigation measures	Inclusion in the project design	-	Design review	As needed	DQMEP
Long Term Surveys					
• Conduct groundwater quality monitoring	Color, pH, Sulphate, Ca, Mg, Na, Zn, Fe, E-coli, TDS, TSS, heavy metals, Mn, Nitrite, Al, F, Pesticides, hardness, Conductivity, Alkalinity, BOD, COD, radioactivity	2 sample from bore well and 1 sample from Gallery	Comparison with the base values (Aug, 2010) and Georgian water standards	Twice a year (pre and post-monsoon)	UWSCG
• Develop & implement water quality monitoring program for distribution system; frequency, parameters and number of samples shall be according to Georgian Law[9]	Parameters as per footnote 9	Monitoring locations as per footnote 9	Comparison with the base values (Aug, 2010) and drinking water regulation (footnote 9)	Frequency as per footnote 9	UWSCG

[9] Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia (Appendix 3)

E. Costing & Budget

162. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal construction contract, so there are no additional costs to be included in the EMP. Costs of design-related mitigation measures (such as construction laboratory or chlorination facility with safety standards or tree buffer zone for pumping stations etc), are included in the budgets for the civil works.

163. Monitoring of implementation of mitigation measures by contractor during construction will be conducted by Environmental Management Specialist part of SC. The review of design and contract to check the inclusion of all design-related mitigation measures will be conducted by Environmental Management Specialist (consultant) of DQMEP.

164. Groundwater yield and quality tests to be conducted as part of design are not included here separately as these will be part of detailed investigation and surveys costs, which are included in the project costs already. Considering the nature, scale and location of works, and likely minimal impacts, there are no costs related to environmental quality monitoring (ambient air, noise, water etc) in the construction phase.

165. Long-term water quality surveys are proposed in operation phase. It is suggested that UWSCG, through the MoRDI, will request MoEPNR to establish a river water quality monitoring station on River Khrami on the upstream side of Orjonikidze. So no costs are considered for item. Costs of source water quality monitoring are included in the below **Table 14**. Water quality monitoring in distribution system will be conducted in the laboratory of UWSCG, which will be constructed as part of the subproject, and therefore no separate costs are included.

Table 14: Environmental Management Costs

Item	Quantity	Unit Cost	Total Cost
Implementation of EMP (1.25 years)		*US $*	*US $*
Environmental Management Specialist (SC)	3 months	10,000[10]	30,000
Environmental Specialist (DQMEP)	0.5 months	10,000	5,000
Total			*35,000*
Ground Water Quality Monitoring (long-term)			
Source water quality – Orjonikidze, costs per year	3 samples	400	1,200
Total			*1,200/year*

[10] Unit cost of domestic consultants include fee, local & air travel, accommodation and subsistence

VII. RECOMMENDATIONS & CONCLUSION

A. Recommendation

166. The environmental impacts of the all infrastructure elements proposed in the water supply improvement subproject in Marneuli has been assessed and described in the previous sections of this document. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

167. Mitigation measures were discussed with engineering specialists, and some measures have been already been included in the designs. This means that the number of impacts and their significance has already been reduced by amending the design. These include:

- Locating the Orjonikizde-Narimanov transmission pumping main within the ROW of existing roads to avoid the need to acquire private land and related resettlement issues
- Locating infrastructure (reservoirs, pumping stations) within the existing facilities
- Inclusion of water laboratory and chlorinator with all safety equipment in the project

168. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. Appropriate avoidances/mitigation/enhancement measures have been suggested for the likely impacts that are identified.

169. During the construction phase, impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance of residents, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Various measures are suggested including:

- Utilizing surplus/waste soil for beneficial purposes
- Measured to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc)
- Providing prior public information and work planning in consultation
- Planning transport routes/schedule carefully; awareness creation in drivers
- Follow standard and safe procedures for public and worker safety
- Avoiding nighttime construction activities

170. Although limited, this environmental assessment process also identified opportunities for environmental enhancement. Certain measures suggested in this regard include:

- Employing the local people in construction work as much as possible to provide them with a short-term economic gain
- Employing local people in operation and maintenance of the improved system
- Minimizing the use of equipment with harmful substances like PCB and SF6

171. Most facilities will operate with routine maintenance, which should not affect the environment. Measures required for safe handling of chlorinators and protection of source water quality through a surveillance program.

172. The main beneficiaries of the improved system will be the citizens of Marneuli Municipality, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor. This will improve the quality of life of people as well as raising standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

173. However, the benefits will be further enhanced if the increased sewage generation resulting from increased water supply is collected and disposed safely. This document identifies that there is no proper sewerage system in the town. To mitigate the likely impact, it is suggested that sewerage system with adequate capacity is developed under this MFF-IP along with water supply. This has already been included in the Program.

174. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged.

175. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project.

176. The recommendation of this IEE process is that all mitigation, enhancement and monitoring activities proposed here shall be implemented in full. This is essential to ensure that the environmental impacts are successfully mitigated. This is the responsibility of UWSCG.

B. Conclusion

177. The environmental impacts of the proposed water supply subproject in Marneuli have been assessed by an Initial Environmental Examination reported in this document.

178. The overall conclusion of the IEE is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

179. There are no uncertainties in the analysis; thus there is no need for further study such as EIA.

Appendices

Appendix 1: Photographs of Project Sites

Photo 1: Existing Bore Well at Orjonikidze Site

Photo 4: Transmission Main Alignment

Photo 2: Reservoir Site at Orjonikidze Headworks

Photo 5: Transmission Main Alignment

Photo 3: Khrami River at Orjonikidze

Photo 6: Agri. Fields along the Alignment

Photo 7: Reservoir Site at Narimanov

Photo 10: Church near Garadakh Reservoir

Photo 8: Reservoir Site at Jhandari Pumping Station

Photo 11: Mining Activity in River Khrami

Photo 9: Reservoir Site at Garadakh

Photo 12: Internal Roads in Marnuli

Appendix 2

Proceedings of the Safeguards Public Consultation Meeting at Marnueli

A public consultation meeting was organized by Government of Mareuli Municipality (GMM) on the request of UWSCG on October 11, 2010. The meeting was organized at the Municipality Office in Marneuli. GMM has invited the elected representatives, non-governmental organizations (NGOs), and general public. Eighteen participants were present in the meeting (List attached in **Table 1**). The purpose of the meeting was to present to the stakeholders the proposed water supply improvement project to be implemented under the ADB funded GUSIIP, its likely environmental impacts and planned mitigation measures and to receive suggestions and feedback on the same.

A presentation on the proposed project and Initial Environmental Examination study was made by ADB TA consultants. Environmental Specialist of UWSCG was also present in the meeting to discuss with the stakeholders. Following were presented and discussed:

- Proposed project activities of Marneuli Water Supply Improvement Subproject
- Policy, legal and administrative structure
- The possible negative impacts on the environment
- Mitigation measures, environmental management and monitoring
- Analysis of Alternatives
- Grievance Redress Mechanism

Stakeholders were most supportive of the project stressing the need to improve water supply in Marneuli and were of the view that the proposed project will improve the environmental quality of the town. Following are the queries/comments of the participants and replies by UWSCG.

Question /Comment of the content	**Comments**
When the project is scheduled for completion?	As mentioned in the presentation full rehabilitation of water projects in Marneuli will be implemented in several stages. The first stage of the environmental impact assessment review of the document which was presented today will be completed in 2012. Full rehabilitation of water supply system completion in Marneuli is scheduled in 2013.
When sewage treatment plant will be constructed	In the first stage, the construction of sewage treatment works are not scheduled. Sewerage works are planned in next stage.
Will be metering the system or not?	For the first stage a common meter will be installed at Orjonikidze and reservoirs, which will account a total amount of supplied water. Personal meter installation will be scheduled for the next level

Table 1: List of Participants

Name of the Participant	Organization	Contact Number
GGiorgi Gaspariani	Marneuli Municipal Council	899171416
Malkhaz Samashvili	Marneuli Municipality, infrastructure architecture and construction services	877235532
AArarat Akopiani	Marneuli Municipality of Shaumiani administrative territorial unit of authority	8992454264
Shaliko Kuprashvili	territorial unit representative of Tsereteli	899946294
Lela Kharshiladze	Marneuli TV	896311798
Akaki Kharshiladze	MMarneuli Municipality	877955287
Zurab Revazishvili	Non-governmental organization''Human Rights Center''	855268108
Davit Davadze	Head Specialist. Marneuli Municipality, infrastructure architecture and construction services.	877955278
Zakir Gurbanovi	Board of Trustee of the village Qizilaplo	899155181
Marshal Bazakimovi	United Water Supply Company of Georgia. Marneuli Technical Service Manager	899563527
Archil Alaxverdovi	United Water Supply Company. Main specialist in energetics of Marneuli	891117794
GGumbat Nazisovi	United Water Supply Company. Group Head of Emergency. Marneuli service	891117874
BBBeka Abdelani	Marneuli Municipality, infrastructure architecture and construction services	855304363
David Abdelani	Non-governmental organization ''Environmental Information Center''	899742970
Tiko	Environmental Expert, UWSCG, Tbilisi	-
Aleksandre Narsia	Marneuli Service Centre, UWSCG	-
Paata Chankotadze	TA Consultant, Asian Development Bank	-
Irakli Kaviladze	TA Consultant, Asian Development Bank	-

Photographs of Consultation Meeting

(Legislative Herald of Georgia 18.12.2007. art. N 179 1973)

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of Justice of Georgia
Registration number
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Decree N 349/N of The Ministry of Labor, Health and Social Affairs of Georgia

December 17, 2007

About Approval of Technical Regulation of Drinking Water

According to "The Public Health Law", "V" sub-paragraph of the article #3 and the first paragraph of the article #23, I give order:

1. To approve the enclosed 'Technical Regulation of Drinking Water".
2. The decree comes into force from the date of publication.

D. Tkeshelashvili

Technical Regulation of Drinking Water

Article **1. General provisions**

1. The Technical Regulation is made on the basis of the Law of Georgia about "Public Health", recommendations of the World Health Organization, European directions, regional characteristics of the country and climate-geographical conditions and sets the safe sanitary norms of human being for drinking water.

2. Liabilities by this Technical regulation should cover the following:

a) Natural or treated water, which is used for drinking, in food and other domestic purposes, in spite of origin and the supply method (distribution network, tank or cistern, bottle or container);

b) Water, which is used in food-stuffs or food-stuff products.

3. Liabilities by this Technical regulation should not cover the following:

a) Curing-mineral waters;

b) Medical water and water with other special targets;

c) Drinking water supplied by some individual source, the capacity of which 10m3/per day serves less than 50 persons not included in commercial or public network.

d) Natural mineral waters, where the mineralization exceeds 1500 mg/L.

4. The following characteristics and their normative size are defined by the Technical Regulation of drinking water:

a) Organoleptic characteristics;

b) Microbiological, inframicrobiological and parasitological characteristics;

c) Chemical characteristics (general characteristics, inorganic and organic substance);

d) Characteristics of radiative safety;

e) Standards of harmful chemical substance, as a result of water treatment;

5. The compliance tests defined by the Technical Regulation, must be carried out as follows:

a) In cases of water distribution systems inside buildings and storehouses, directly from the tap that supplies water to the consumers;

b) In cases of tanks and cisterns from the delivery point;

c) In cases of canning in the bottling point of water and in the selling point;

d) At the point of usage in those enterprises involved with food-stuffs and food products;

6. Any organization implementing the supply service of drinking water, despite the organizational-legal structure and departmental subordination, is liable to carry out the control and monitoring of compliance of drinking water with the defined characteristics under the Technical Regulation; providing accessibility of information and collected data.

7. In cases where the required standards are not met under the Technical Regulation, the supplier of drinking water is liable to carry out appropriate measures, including report to relevant organs, urgent analysis of pollution reasons, restriction of water usage and other measures for the safety of population.

Article 2. Sanitary Requirements on Drinking Water

1. Drinking water must be safe from the epidemical and radiative point of view and by chemical composition; Drinking water must have benevolent organoleptic characteristics.

2. Quality of drinking water must be in compliance with the sanitary standards under this Technical Regulation.

3. The organoleptic characteristics of drinking water must be in compliance with the requirements in the schedule N 1:

Schedule N1

Index	Measuring unit	Standard not more than:
Smell	Numbers	2
Taste	Numbers	2
Coloration	Degree	15
Turbidity	Turbidity unit (by	3,5

	formazin) or mg/L (by kaolin)	 2

4. The existence of outer membrane and water organisms seen with the naked eye is not allowed in drinking water.

5. The following analysis in the schedule #2 (according to the reason) must be carried out for detection and elimination in case of deterioration of organoleptic characteristics of drinking water:

Schedule N2

Index	Measuring unit	Standard not more than:
Sulphate (SO_4^{2-})	mg/L	250
Chloride (Cl^-)	mg/L	250
Oil products, total	mg/L	0,1
Surfactant substance anionoactive	mg/L	0,5
Rigidity	mg–eq./L	7–10
Calcium (Ca)	mg/L	140
Magnesium (Mg)	mg/L	85
Sodium(na)	mg/L	200
Zinc (Zn^{2+}),	mg/L	3,0
Iron (Fe, total),	mg/L	0,3

6. Epidemical safety of drinking water is defined by microbiological, inframicrobiological and parasitological characteristics in accordance with the given standards in the schedule #3.

Schedule N 3

Index	Measuring unit	Standard
Mezophilic aerobes and facultative anaerobes	Colony forming unit/ML 37^0 C 22^0 C	Not more than: 20 100
Total coliformic bacterias	Amount of bacteria in 300 ML	not allowed
E. coli	Amount of bacteria in 300ML	not allowed
Pathogenic microorganisms, including Salmonella	In 100 ML	not allowed
Coliform	Negative colony forming unit in 100ML	not allowed
Pseudomonas aerugiosa (only for pre- aliquoted)	In 250ML	not allowed

Streptococus faecalis	In 250LM	not allowed
Lamblia cysts	Amount of cysts in 50L	not allowed
Dysentery (amoebiasis) cysts	Amount of cysts in 50L	not allowed

7. Amount of mezophilic aerobes and facultative anaerobes must not exceed 100 colony forming unit in 1 ML in case of flood and other natural calamities.

8. Amount of mezophilic aerobes and facultative anaerobes and standards of total coliformic bacteria must not exceed in 95% of tests during 12 months in the water intake points of the water line network.

9. Definition of total coliformic bacterias and E. coli is implemented in the three parallel 100-100 ML tests.

10. Definition of lamblia cysts and Dysentery (amoebiasis) cysts is implemented in the water supply systems of surface sources.

11. Chemical composition of drinking water must satisfy requirements in the schedule #4.

Schedule N 4

Index	Measuring unit	Standard not more than:
Common characteristics		
Hydrogen index	PH	6-9
Permanganate oxidation	mg O_2/L	3,0
Total mineralization (dry remains) mg/L		1000–1500
Nonorganic substance		
Barium (Ba^{2+})	mg/L	0,7
Boron (B,total)	mg/L	0,5
Arsenic (As,total)	mg/L	0,01
Quicksilver (Hg, nonorganic),	mg/L	0,006
Cadmium (Cd, total)	mg/L	0,003
Mangan (Mn, total)	mg/L	0.4
Milobden (Mo, total)	mg/L	0,07
Nickel(Ni, total)	mg/L	0,07
Nitrate(short impact by $NO^-_{3)}$	mg/L	50
Nitrite (long impact by $NO^-_{2)}$	mg/L	0,2
Selenium(Se, total)	mg/L	0,01
Copper(Cu, total)	mg/L	2,0
Lead (Pb, total)	mg/L	0,01
Flourine (F^-)	mg/L	0,7
Chromium (Cr^{6+})	mg/L	0,05
Antimony(Sb)	mg/L	0,02
Cyanide(CN^-)	mg/L	0,07
Organic substance		
Total content of pesticides	mg/L	0,05

12. The control and monitoring must be implemented only on those pesticides, which can be contained in the water supply source. Together with this, the accordance of index must be defined individually for each pesticide and standard of aldrin, dieldrin, hectochlore and heptachlor epoxide content must be 0,030 microgram in Liter.

13. The following pesticides, their metabolites and products of reaction and dissolution are regulated for the provision of safety of drinking water:

a) Organic insecticides;
b) Organic herbicides;
c) Organic fungicides;
d) Organic nematocides;
e) Organic acaricides;
f) Organic alhycides;
g) Organic rodenticides;
h) Organic slymicides;
i) Similar products (including growth regulators).

14. Content of those harmful substances which occur in the water supply sources as a result of economic activity (not listed in the schedule #4), must not exceed quality standards set by the Ministry of Labor, Health and Social Affairs.

15. Radiative safety of drinking water is defined by the accordance of total α and β– radioactive characteristics with the standards in the schedule #5.

Schedule N 5

Index	Measuring unit	Standard not more than:
Total α– radio-activity	bk/L	0,1
Total β –radio-activity	bk/L	1,0

16. Identification of radionuclide in water is implemented in case of exceeding of total radio-activity standards. Estimation of revealed concentrates is implemented according to the radiative safety regulations.

17. Content of harmful chemical substance in the process of water treatment in the water supply system must be in compliance with the requirements given in the schedule #6. Together with this, the index of control is defined according to the concrete treatment technology.

Schedule N 6

Index	Measuring unit	Not more than:

Chlorine remains free	mg/L	0,3 –0,5
Chlorine remains connected	mg/L	0,8–1,2
Chloroform (during chloration)	mg/L	0,3
Ozone remains	mg/L	0,3
Aluminium (Al^{3+})	mg/L	0,1
Formaldehyde (during ozonization)	mg/L	0,05
Acrylamide	mg/L	0,0005
Active silicate acid (with Si)	mg/L ^{3}	10
Polyphosphate (according to PO^{3}_{4-})	mg/L	3,5

18. Duration of the chlorine contact with water during deactivation with free chlorine-no less than 30 minutes, with connecting chlorine-no less than 60 minutes.

19. The total concentration must not exceed 1,2 mg/L during simultaneous content of free and connected chlorine in drinking water.

20. The control of the ozone remains is implemented after mixing box; The contact of ozone with water-no less than 12 minutes.

21. In case of detection of several chemical substances in drinking water, which are regulated by the same limitative index, total correlation of each must not exceed 1 with the utmost admissible concentration.

Article 3. The Internal Control and Monitoring of Drinking Water

1. The internal control and monitoring of drinking water is implemented by the supplier.

2. The definition characteristics of drinking water and amount of research tests must be in compliance with the requirements in the schedule #7.

3. During the analysis of microbiological and organoleptic characteristics, the water samples are taken once in month in the distribution system of water supply, which supplies water to 20 000 residents.

4. With coordination of the competent state organs, the enhanced control regime must be implemented in case of flood and other natural calamities.

Schedul

e N7

	Number of samples per year/no less than				
Index	Number of consumers connected to the water supply system (thousand consumers)				
	Ground source			Surface source	
	Up to 20	20–100	More than 100	More than 100	More than 100
Microbiological	12	24	365	365	365

Parasitology	(is not implementing)			4	4
Organoleptic	12	24	365	365	365
General characteristics	4	6	12	12	24
Nonorganic and organic substances	1	1	1	4	12
Radiological	1	1	1	1	1
Index/ Connected to the technology of water treatment	Chlorine remains, ozone remains (no less than one in an hour), reagent remains (no less than one in shift				

5. The necessary control samples which must be taken after the repair of the distribution network and other maintenance are not included in the amount of samples defined in the second item.

6. In case of detection of total coliformic bacteria and E. coli in the sample of drinking water, it is necessary to define them urgently in the secondary sample. Chloride, nitrites and nitrates must be defined simultaneously for detection of pollution reasons.

7. In case of detection of total coliformic bacteria and E. coli in the secondary sample, the analysis of water is implemented according to the existence of pathogenic bacterium of intestinal group and (or) streptococus faecalis.

8. All the samples from the ground and surface water supply lines require definition of organoleptic characteristics (except samples for the analysis of neutralizing reagents).

9. The laboratory analysis must be implemented according to the following criteria for the routine monitoring:

a) Organoleptic: smell, taste, coloration, turbidity;

b)Microbiological: Mezophilic aerobes and facultative anaerobes, total coliformic bacterias E.coli ;

c) Chemical: PH, nitrogen forms (ammonia, nitrate, nitrite), chlorides, rustiness, chlorine remains.

Article 4. The State Control of Drinking Water

1. The scheme of the state control and monitoring of drinking water, sequence, characteristics for definition and amount of samples are defined according to the law of the relevant state controlling unit.

2. The samples of drinking water must be taken in accredited independent laboratory in compliance with the law.

Government of Georgia
Asian Development Bank

Environmental Assessment Report

Project Number: 43405
September 2010

Proposed Multitranche Financing Facility
Georgia: Urban Services Improvement Investment Program

INITIAL ENVIRONMENTAL EXAMINATION REPORT
Mestia Water Supply Improvement Subproject

ABBREVIATIONS

ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
CA	-	Cross section area
CC	-	Civil Contractor
COD	-	Chemical Oxygen Demand
DC	-	Design Consultant
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIB	-	European Investment Bank
EIP	-	Environmental Impact Permit
EMP	-	Environmental Management Plan
EMS	-	Environmental Management Specialist
GoG	-	Government of Georgia
GRC	-	Grievance Redress Mechanism
HDPE	-	High Density Poly Ethylene
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IP	-	Investment Program
IPMO	-	Investment Program Management Office
Kg	-	Kilogram
Km	-	Kilometer
LPCD	-	Liters per Capita per Day
M	-	meter
MDF	-	Municipal Development Fund
MFF-IP	-	Multitranche Financing Facility Investment Program
mg/l	-	milligram per liter
Mm	-	millimeter
MoRDI	-	Ministry of Regional Development & Infrastructure
RCC	-	Reinforced Cement Concrete
SC	-	Supervision Consultant
uPVC	-	Un-plasticized Poly vinyl Chloride
UWSCG	-	United Water Supply Company of Georgia
WSS	-	Water Supply & Sanitation

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EXECUTIVE SUMMARY

1. It is proposed to improve the water supply system in Mestia under the Asian Development Bank (ADB) funded Urban Services Improvement Investment Program, which is under preparation stage. This Investment Program, implemented in six towns, including Mestia, will develop the water and sanitation services, which will improve quality of life and optimize the social and economic development. Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) and United Water Supply Company of Georgia (UWSCG) is the Implementing Agency (IA) of this Program. This subproject will be implemented from mid-2011 and likely to be completed by the end of 2012. Since the subproject is unlikely to have significant adverse impacts, it is classified as environment Category B, and accordingly an Initial Environmental Examination has been conducted. This is a summary of the IEE Report.

2. Situated in the north bordering Russia, Mestia is an important cultural and tourism centre in Georgia. The service levels of water supply are low with partial coverage, high system losses, and poor water quality at consumer end. With the government initiative to develop Mestia as a major tourist destination, the water demand is likely to grow significantly. This subproject will expand the system and improve the service standards, with a daily supply of potable water in adequate quantity (200 lpcd). The subproject is designed to meet the projected demand of 2040. This will be achieved by: (i) creating infrastructure to tap water from a new source (Gvaldi River); (ii) laying of transmission pipes and (iii) construction a water treatment plant, a reservoir and laboratory facilities.

3. Situated in the Caucasus, Mestia is surrounded by Greater Caucasus and Svaneti-Abkhazia Ranges. The elevation of the subproject area ranges between 1,400-3,600 m above the mean sea level, and forms upper part of the Enguri River Basin. The town is developed near the confluence of the Mukhura and Mestiachala rivers, tributaries of the Enguri. There are farmhouses and fields around the foothills and in the bottom of the valleys but the majority of the districtE is covered with forests. The region which lies below 1,800 m MSL is covered by mixed and coniferous forests; and from 1,800 meters to about 3,000 m consists of alpine meadows and grasslands, above which lie the zone of snows and glaciers.

4. The subproject activities are partly located in the town and partly in the surrounding hills. The Gvaldi River, the new water supply source, is a tributary of Mestiachala and joins just upstream of Mestia. It is proposed to tap water from the hilly upper reaches. An intake structure, consisting of an underground gallery, will be constructed in the river bed. A transmission pipeline from the intake to Water Treatment Plant site (which is located in lower hills outside the town) will be laid along existing tracks, surrounded by pasture and partly by forests. The pipeline in this section will be laid either above or underground as the topography permits. The pipeline from WTP to existing reservoirs will be buried along a road through the town.

5. The Mestia water supply improvement subproject is relatively small in scale and involves straightforward construction and low-maintenance operation. Although there are forest areas, none of the components will encroach into these areas and all the activities are planned along the existing access roads. Further any disturbance will be limited to construction period. Construction work in river bed is also not likely to have adverse impacts as there are no dependent population and limited aquatic value. The identified impacts are mostly short-term, localized and can either be easily avoided or mitigated.

6. Most of the predicted impacts are associated with the construction process. Impacts mainly arise from the: generation of dust from soil excavation and refilling; disturbance of residents, traffic and activities in the town; increase of silt load in the river; loss of top soil in pasture lands, removal of trees, and from the disturbance to wildlife due to trenches. These are common impacts of construction, and following methods are suggested for their mitigation: (i) Utilizing surplus/waste soil for beneficial purposes; (ii) Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc); (iii) Providing prior public information; (iv) conducting no construction in the river bed in fish breeding season and with minimum interference with the water quality; (v) restoring the top soil after construction, (vi) avoiding tree cutting through location alignment changes, and (vii) undertaking pipe laying work in segments so that work in each segment is completed in a day.

7. There are a number of development activities (for instance, road works) currently under implementation in Mestia. The following measures are suggested so that roads and inhabitants are not subject to repeated disturbance by work in the same area for different purposes: (i) scheduling construction in consultation with the other implementing agencies, and (ii) conducting the road work, where the transmission line is proposed, after the pipeline work.

8. During the operation, the main risk is that the water abstraction will deplete the water resource. Unsustainable reduction may affect downstream uses and may have ecological impacts. On the other hand, unsustainable source may also lead to closure of the system. Originating from a glacier and supplemented by rain and snow, the Gvaldi is a perennial but small river. With the total abstraction 0.073 m3/sec, which is 15% of measured flow (0.5 m3/sec, September), and with no downstream water uses and limited aquatic life, there are unlikely to be adverse impacts. However, the lack of data in winter is a major concern. Although interviews with the locals and local UWSCG staff indicate adequate flow throughout the year, the following measures are suggested to ensure the source sustainability: conducting flow measurement in low flow period (winter) as part of detailed design; and limiting extraction to 2/3rd of absolute minimum flow.

9. Degradation of source water quality is identified as another risk that may have impacts on public health. Since there are no pollution sources or anthropogenic activities in the catchment, there is no future pollution risk. The water quality is good except turbidity, which is normally high during the heavy flow season. The movement of cattle/wildlife in the river may degrade the water quality. Although necessary filtration and disinfection facilities are part of the subproject, fencing the river banks near the headworks is suggested to avoid entry of animals. Regular monitoring of raw and treated water quality is also suggested.

10. There are no health and safety risks associated with the subproject, as the disinfection will be through chlorine in powdered form. Treatment facilities are limited to disinfection and simple filtration, no major waste generation is anticipated. The subproject is likely to have several positive benefits during operation. The citizens will be provided with a constant supply of better quality water, which will improve the quality of life. This will also support the tourism development.

11. To ensure that all the mitigation measures as suggested are implemented, a program of environmental monitoring is prepared. Department of Quality Management and Environmental Protection (DQMEP) of UWSCG will oversee and be responsible for implementation of mitigation and monitoring measures. Provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

I. INTRODUCTION

A. Background

1. The proposed Urban Services Improvement Investment Program is intended to optimize social and economic development in select urban areas (provincial capitals and secondary towns) through improved urban water and sanitation (WSS) services. This ADB funded Multitranche Financing Facility Investment Program (MFF-IP) complements the government's emerging vision for the WSS sector, formulated in its sector development strategy and road map, policy framework and reform implementation plan, and a business climate that encourages increased donor investment. This support will also complement ongoing donor efforts to improve and expand Georgia's urban WSS services. ADB identifies support to developing the country's municipal infrastructure a key contributor to enhancing sustainable economic growth, with the cross cutting themes of governance, regional cooperation and environmental protection. ADB's support can contribute to: (i) sector reforms; (ii) strengthening the link between financing local infrastructure projects and decentralization reforms; (iii) stimulating local economic development; and (v) improving the quality of life of urban population

2. *WSS Services in Georgia*. The service levels of urban water supply and sanitation systems in Georgia at present are not satisfactory. Piped water supply service is available to less than 75 percent of urban population. Most of the serviced population suffers with inefficient service levels – inadequate and intermittent supply with low terminal pressure. Due to old systems, most of the pipelines are profusely leaking, and water lost in the system is as high as 50-70 percent. Similarly, less than 50 percent urban population is connected with underground sewerage system, and the rest depend on individual disposal systems like pit latrines, septic tanks etc. Sewage treatment facilities are almost non-existent and collected waste is disposed untreated into rivers/streams raising environment and public health concerns.

3. The Investment Program focuses on investments in improvement of basic urban infrastructure (i.e. water supply and sewerage). Besides, it will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. This Program will be implemented in 3 tranches over a period of 8 years beginning in 2011. The Executing Agency (EA) is the Ministry of Regional Development and Infrastructure (MoRDI), Government of Georgia; and the Implementing Agency (IA) is the United Water Supply Company of Georgia, a wholly-owned company of Government of Georgia under MoRDI. The proposed investments under Tranche-1 include improvement of water supply systems in urban areas of Marneuli, Zugdidi and Mestia.

4. The Mestia water supply improvement subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A). According to ADB procedures, the impacts of the subproject were assessed by the Initial Environmental Examination, conducted according to ADB Safeguard Policy Statement (2009).

B. Extent of the IEE Study

5. This is the Initial Environmental Examination (IEE) Report for the Mestia Water Supply subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. It is one of the three IEE documents prepared for Tranche 1 subprojects. These were prepared in July-October 2010 by an International and a Domestic Environmental Specialist via inputs of 2.5 months each.

6. This IEE study is conducted based on the feasibility study proposals. Certain details may therefore change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs, so certain aspects (such as layout plans, sizes of infrastructure, etc) are not available at this stage.

7. This IEE study is conducted based on secondary information and data from various sources and field observations. Field surveys were limited to essential baseline factors such as source water quality.

8. Since there are no significant, irreversible, or complex issues involved, no specialized techniques were required to be employed. All impacts were simple, easy to identify and mitigation measures were readily available.

C. Report Structure

9. This IEE Report is organized into seven sections including this introductory section:

Section 2 establishes the project need, rationale and alternatives
Section 3 describes project components and construction & operation details
Section 4 discusses impacts on physical and biological environment
Section 5 discusses impacts on socio-economic environment
Section 6 provides Environmental Management Plan and Monitoring Plan, and
Section 7 emphasizes on IEE recommendations and concludes the report

II. PROJECT RATIONALE AND NEED

A. Type of the Project

10. This is an urban water supply improvement sub-project. It involves development of a new water supply source, providing a disinfection facility, construction of new or rehabilitation of old/damaged pipelines, and construction of new or rehabilitation of existing water storage reservoirs.

B. Need of the Project

11. As discussed earlier, the service level of urban water supply in Georgia at present are not satisfactory. Services are not available to entire population and the serviced areas suffer with inefficient service levels. Systems are old and inefficient. The situation is no different in the program town of Mestia. This sub-project is needed because the present water supply infrastructure in Mestia is inefficient and inadequate to the needs of the growing population and tourists.

12. The United Water Supply Company of Georgia[1] (UWSCG) provides water supply in Mestia. Until recently (Jan 2010), the Mestia Municipality was providing the service. Owing to its location, there are numerous springs, small and big, in the hills around Mestia. These springs are main source of water supply to the town. These sources at present provide 2,600 m3 of water daily. Water is supplied from two head works: Skhedi (developed in 1956) and Tsnriashi (1978).

13. Skhedi headworks, situated 800m south of the town, gets water from three springs, Mebdura, Makhurapi and Skhedi, all within a radius of 500 m, and supplies about 1,100 m3 of water daily. Water from Makhurapi and Skhedi springs is collected in a settling tank, to reduce the turbidity, and then conveyed to a storage reservoir, from where water is supplied to distribution system by gravity. Due to lower elevation, Mebdura spring water is not passed through setting tank but directly connected headworks reservoir. Makhurapi and Skhedi carry high turbidity in heavy flows, during which the settling tank is not very effective. Comparatively less, but Mebdura also carries turbidity. Because of these reasons turbid water enters the distributions system. Water yield changes seasonally depending on temperature (i.e. snow melting) and precipitation. Skhedi headworks supply water to the south, central and western districts of Mestia Town. Although some renovation has been carried out under municipal development fund, water quality problems have not been addressed. Further inclusion of new areas to Skhedi headworks system in 2010, lead to reduction is net supply.

14. The Tsrnashi headworks, located 7 km north of Mestia, provides 1500 m3 of water per day. Water from an underground spring is collected in a RCC tank and conveyed to Lanchavli reservoirs, from where water is supplied to distribution system by gravity. Water is supplied to consumers without any treatment. This system supplies water to northern and eastern districts. Distribution lines of Lalidi, Lareli and Tetnashi are connected directly to the transmission main, which is affecting the supply to the reservoirs and ultimately to the distribution system.

15. The present water supply system covers about 70% of the population. Due to old system water losses are very high (80%), net water supply is about 200 LPCD. Due to lack of treatment facilities, the quality of water supplied to the consumers tend to be when the flow is heavy and water is turbid. Existing water supply coverage is shown in **Map 2**.

[1] A government company under Ministry of Regional Development and Infrastructure

16. Besides the existing inadequacies, the water supply system requires augmentation to meet the growing population. With the government initiative to develop Mestia as an all weather tourist destination, the water demand is likely to grow significantly. As per the government estimates, 20,000 tourists expected to visit daily by 2040.

17. The present sub-project is therefore designed to improve the service standards of water supply in Mestia – daily supply of potable water in adequate quantity (200 lpcd) at requisite pressure.

C. Location

18. This sub-project is located in Mestia Town, the administrative centre of Svaneti Region, in northeastern part of Georgia, bordering Russia. Geographically, it is located at 42^{o} 42'06" E and 43^{o} 04'30" N, about 430 km northwest of Tbilisi. Regional location of Mestia is shown in **Map 1**.

19. The proposed infrastructure improvement works will be located in and around the town. There are four main components of the project: (i) development of water intake headworks at a new source, the Gvaldi River, (ii) a transmission line from new source to new reservoir/treatment plant, and (iii) construction of Water Treatment Plant and reservoir, and (iv) transmission line from treatment plant/reservoir to existing reservoirs at Lanchavli.

20. New headworks site of Gvaldi River located at about 5 km northeast of the town. Site is accessible by a field road however for a length of about 500 m near the site the source is accessible only through privately (community) owned pasture lands. A pipeline will be laid along this access road and through pasture lands. The Water Treatment Plant and Reservoir will be constructed on a government owned site located on a higher elevation in the outskirts of the town. The transmission pipeline will be laid along the road to the existing reservoirs, about 1 km west of town centre on a hill at Lanchavli. Locations of these are sites are shown in **Map 3**.

D. Implementation Schedule

21. Detailed design of the subproject will begin in October 2010 and should be completed by March 2011, after which construction will take about a year and half, so all work should be completed by the end of 2012.

ADB TA 7487 - GEO: Georgia Urban Services Improvement Project Mestia

Location of Project Town

Legend

- Country Boundary
- State Boundary
- District Boundary
- Project Town

Client:
Ministry Of Regional Development and infrastructure
United Water Supply Company of Georgia

Consultant
Wilbur Smith Associates

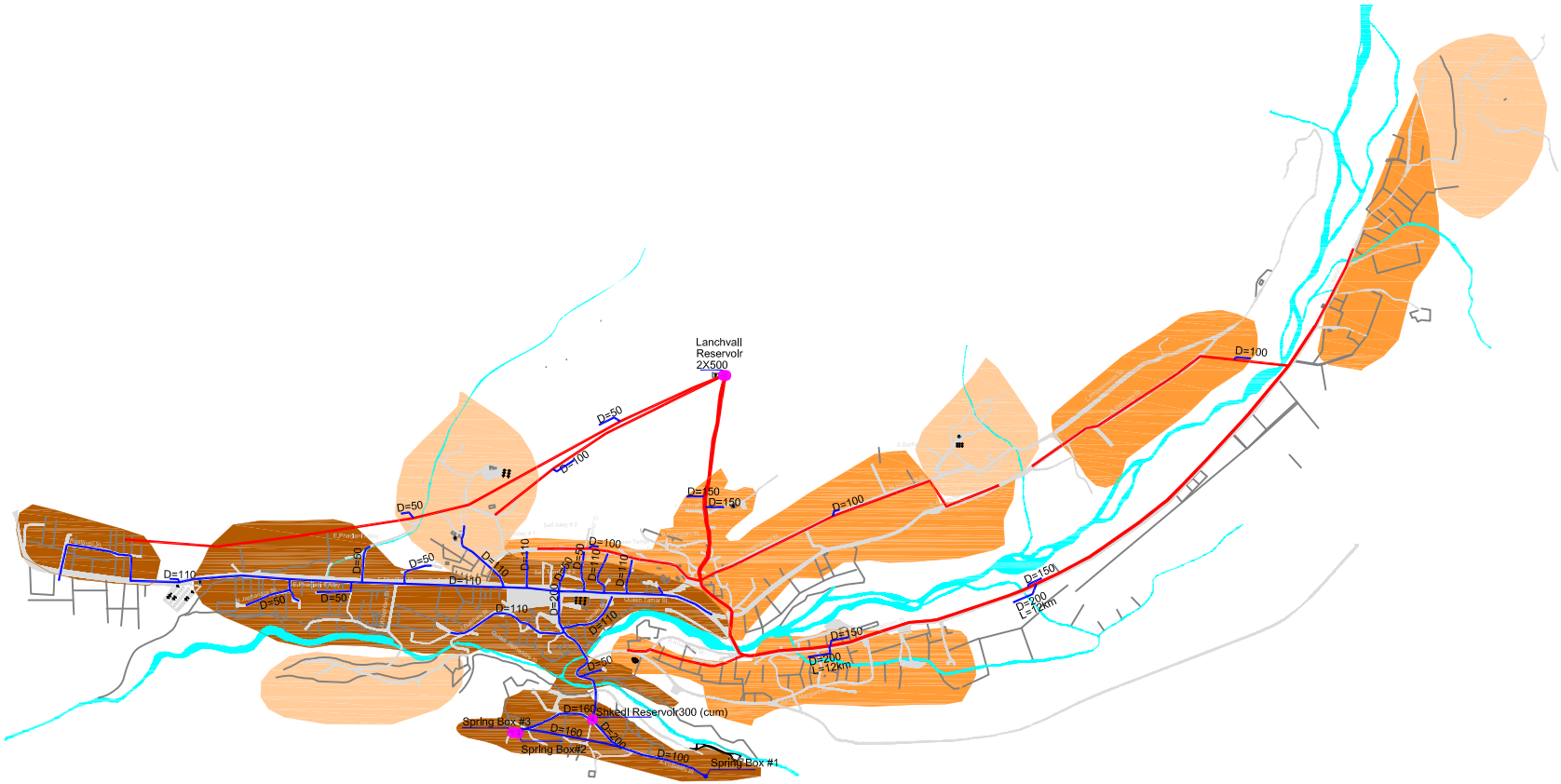
Drawn:	Checked:
Date:	Approved:

Scale:

Map - 1

ADB TA 7487 - GEO: Georgia Urban Services Improvement Project Mestia

Existing Water Supply Coverage by Source



Legend:-

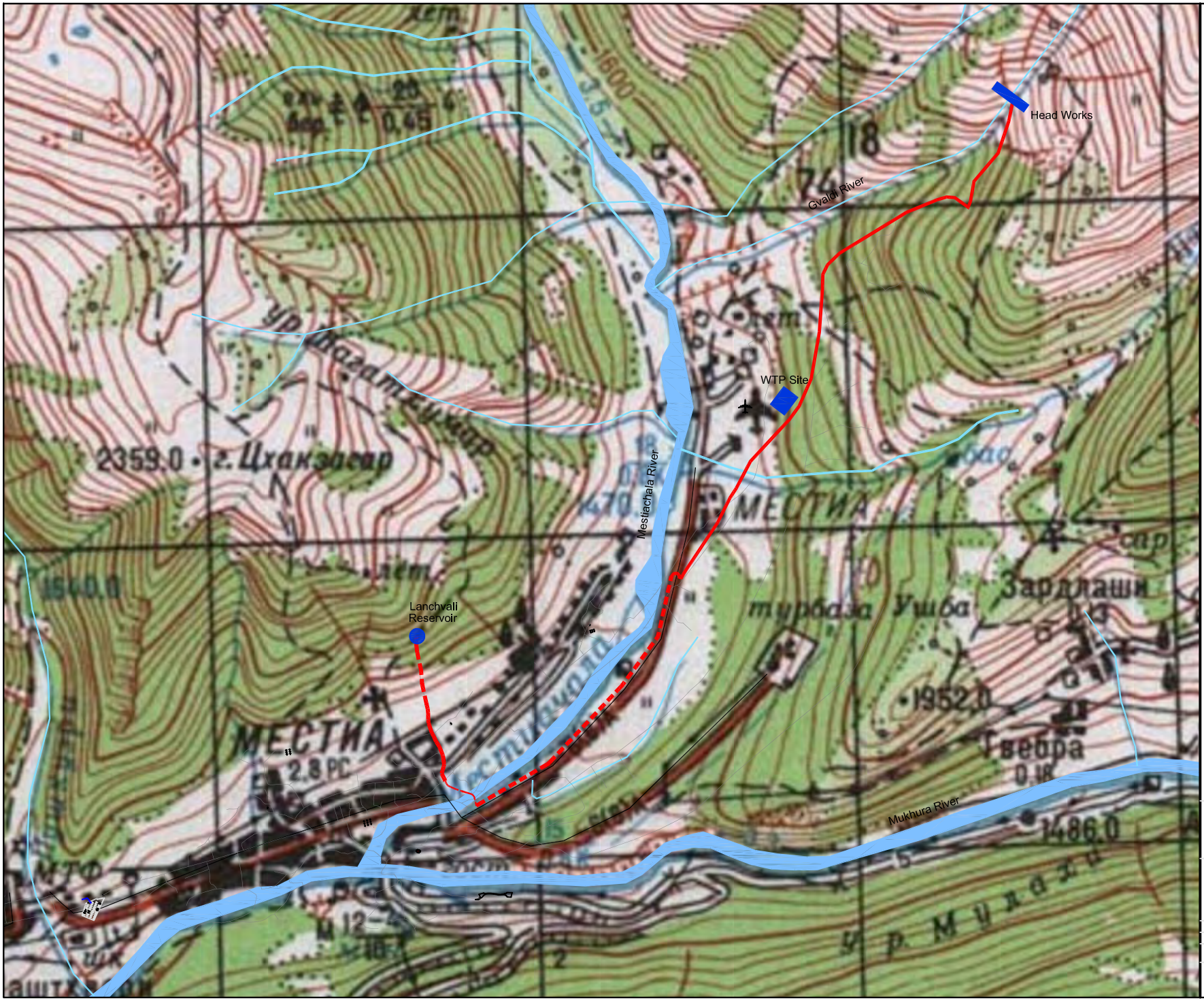
- Road
- Reservoir
- Water Pipe Line - Shkedi
- Water Plpe Llne - Tsrnlashl
- Water Served by Shkedl Reservoir
- Water Served by Tsrnlashl
- Residential areas not covered by existing system

Client:
United Water Supply Company of Georgia, Ministry of Regional Development and infrastructure

Consultant
Wilbur Smith Associates

Drawn:	Checked:
Date:	Approved:
Scale:	

Map -2



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Proposed Subprojects Site

- Major Roads
- Minor Roads
- Waterbodies
- Pipeline Rehabilitation
- New Pipeline
- Air Strip
- Proposed WTP Site
- Proposed Headwork Site
- Reservior Rehabilitation Site

Client:
United Water Supply Company of Georgia, Ministry of Regional Development and infrastructure

Consultant
Wilbur Smith Associates

Drawn:	Checked:
Date:	Approved:
Scale:	

Map -3

E. Project Alternatives

22. The project development concept for improvement of Mestia water supply gives priority to water Demand Management (DM) measures, which are resource and cost efficient. Following DM measures are proposed to improve the existing system efficiency:

- repairs/replacement of leaking pipes and reservoirs,
- leak detection & rectification,
- improved monitoring through hydraulic zoning and metering

23. Inclusion of above DM measures is likely to reduce the losses from present 80% to 20%. This is estimated to decrease the present gross daily water demand (2010) from 6,355 m3 to 1,589 m3 and ultimate demand (2040) from 25,299 m3 to 6,325 m3, which means a reduction of 75% in total demand. **Table 1** below presents an overview of the current and projected water supply situation in Mestia.

24. With the above measures, the present supply can meet the present demand without any source augmentation. However, it will not be adequate to meet the future demand (mainly tourist demand). Ultimate gap (2040) in demand and supply is estimated to be 3,725 m3. Discouraging high volumes of water usage by consumers is also an option. However, recognizing that the per capita use of 200 LPCD is a minimum requirement in Georgia and therefore this was ignored. Therefore to meet the supply and demand gap augmentation of supply is necessary.

Table 1: Daily Water Demand-Supply Analysis

Year	Population			Net Consumer Demand (m^3)	Existing Supply (m^3)	With existing losses (80%) (m^3)		Reduce losses (80% to 20%) (m^3)	
	Town	Tourist	Total			Gross Demand	Gap	Gross Demand	Gap
2010	2,855	3,500	6,355	1,271	2,600	6,355	(3,755)	1,589	1,011
2015	3,076	4,750	7,826	1,565	2,600	7,826	(5,226)	1,957	644
2020	3,480	6,375	9,855	1,971	2,600	9,855	(7,255)	2,464	136
2025	3,937	8,731	12,668	2,534	2,600	12,668	(10,068)	3,167	(567)
2030	4,347	11,847	16,194	3,239	2,600	16,194	(13,594)	4,049	(1,449)
2035	4,799	16,270	21,069	4,214	2,600	21,069	(18,469)	5,267	(2,667)
2040	5,299	20,000	25,299	5,060	2,600	25,299	(22,699)	6,325	(3,725)

Notes:

(i) Net demand (at consumer end) – 200 liters per capita per day
(ii) Gross demand (supply required from source): net demand + losses
(iii) Gap: supply – demand; negative figures (in bracket) indicate supply inadequacy, and positive figures indicate surplus

25. Following **Table 2** presents the analysis of various alternatives considered to meet the estimated gap in service delivery. Developing a new source with requisite treatment and storage facilities (Option 2) is evaluated as appropriate alternative which can achieve the desired objectives of the project. The Option-1 (augmentation of existing sources), which is found unfeasible due to limited yield, and Option-3 (no project), which cannot achieve the objectives, were rejected.

Table 2: Project Design Alternatives

Option – 1	**Option – 2**	**Option – 3**
Augmentation of Supply from Existing Sources	**New Source Development**	**No project**
This option involves augmentation of supply from the existing spring sources. The existing supply of 2,600 m^3 is based on the lean period yield of sources. Although water is available during other periods, considering the worst scenario in lean period, these sources cannot supply more water.	There are numerous springs and streams/river in and around Mestia's hilly region. Mestiachala River, flowing through the town, is a large river carrying high volumes of water throughout the year. Due to following reasons this source is ignored: (i) River flows through valley portion, while the inhabited areas are along both the banks on higher elevation. Supply from river requires huge pumping (ii) Owning to catchment and turbulent flow characteristics, river carries high volumes of silt; water is turbid. Gvaldi River, a tributary of Mestiachala, is identified as a new source considering the following: (i) Adequate flow to meet the ultimate water demand of entire town including the tourist demand (ii) Being located in hilly area and originating from a glacier, water quality is good (iii) There are no present or future sources of pollution in the catchment (iv) Site is accessible by field roads along which the transmission pipeline can be laid	The existing system, without any improvement or augmentation, will not be able to meet even present town demand. With Mestia being developed as a major all-weather tourism centre in the northern Georgia (many tourism development works are in progress), lack of basic infrastructure like water supply will be a set-back for these efforts.
Creation of artificial storage to meet the lean season demand is not considered to be a feasible option both from technical as well as environmental views.	*Environmental value of the stream*: Water abstraction from river may have impacts on existing uses including the ecological requirements. During construction in river bed, the quality of water may also be degraded. Therefore it is necessary that a minimum environmental flow (both in terms of quantity and quality) is ensured downstream to sustain aquatic ecosystems and the ecological components, processes and function on which people depend. This project is likely to have no impacts on water quality, except during construction, which can be mitigated by measures.	

Option – 1	Option – 2	Option – 3
Augmentation of Supply from Existing Sources	**New Source Development**	**No project**
	The impacts of water abstraction/reduction in downstream flow depend on the ecological value and commercial use of water. Commercial use of Gvaldi River is very limited; in summer (June-September) water is tapped for irrigation of nearby pasture lands through earthen channel from upstream side of proposed site. . Aquatic life is limited to Trout fish supported by river bed benthos. There is no commercial fishing activity. River also as a serves as source of water for wild animals. Cattle grazing in the nearby pastures also use river water. River supports plants undergrowth along its course, which has a variety of flowering plants/bushes/shrubs. The river course just upstream of its confluence with Mestiachala is said to be a breeding ground of Trout fish in September-October months. This site is situated 3 km downstream of proposed headworks site. The flow of water in river is very high during the summer months. In September 2010 the flow was 0.5 m3/sec, which is likely to be higher during peak summer (July-August) and lower during peak winter. With the project envisaging abstraction of 0.073 m3/sec (15% of flow), and with most of the uses limiting to summer months during which flow is likely to be very high, no significant impacts envisaged. Besides commercial uses, river requires to have a minimum flow to sustain aquatic and ecological values. To check this, a minimum flow (1/3rd of total) downstream (particularly in low flow period of winter months) will be ensured.	

26. Having selected the Option-2 for implementation, other alternatives within this are considered for selection of appropriate locations. Following alternatives have been considered for location of headworks and transmission main from headworks to new water treatment plant site (**Table 3**).

Table 3: Location and Design Alternatives within the Selected Option

Components	**Location Justification**
New headworks on Glavdi River to abstract water	Gvaldi originates from a glacier on the upper reaches, and joins River Mestiachala on the upstream of Mestia Town. From its origin to until it joins Mestiachala, Gvaldi flows through valley/gorges surrounded by hills covered with alpine forests and pasture lands. An appropriate location considering the following has been identified on the upper reaches: • Relatively plain landscape to develop headworks • Involve no clearing of trees • Most accessible location • Elevation of headworks to allow for gravity flow of water to the proposed WTP site; this will also help in laying of pipeline through field roads in pasture lands • Site is relatively safe from land-slides, boulders from hills
Transmission main from Gvaldi headworks to new WTP site; WTP site, and transmission line from WTP site to Lanchavli reservoirs	Main criteria used for locating these facilities: • Government-owned land to avoid private land acquisition • Easily accessible • No clearance of trees/vegetation • No major earth cutting/filling activities • Allows for gravity flow in the system *Transmission main from headworks to WTP site*: Alignment traverses mostly hilly areas. Pipeline will be laid along the field roads (either on ground or below ground, as topography permits). Near the headworks, pipeline traverses privately-owned pasture lands for about 500 m. This is unavoidable as there is no road/suitable government-owned land to lay the pipeline *WTP and Reservoir Site*. Government owned site located on a higher elevation that the town to allow complete gravity flow based water supply. *Transmission line from WTP to Lanchavli Reservoirs*. This will be laid along the existing road passing through the centre of the town.

F. Consultation

27. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Stakeholders of this project include:

- People who live, and work near construction sites of facilities in Mestia
- UWSCG as implementing agency
- Other government regulatory institutions
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in Mestia in general; and
- The ADB, as funding agency

28. Two forms of public consultation have been used during preparation of the IEE, to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

- A public meeting was held in Mestia Town in November 2010, to which stakeholders were invited. Participants were informed about the aim of the subprojects and the benefits together with their likely impacts and the ways in which they would be mitigated. Participants were invited to discuss their views and concerns, which were then incorporated into the IEE. **Appendix 2** contains a summary of the meeting;

- Ad hoc discussions were also held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

29. This IEE Report in Georgian language will be distributed to the interested public. Report will be available for review in Tbilisi (at UWSCG Head Office), and Mestia (at UWSCG Service Centre and the Town Hall). It will also be disclosed to public by making it available on websites of UWSCG, MoRDI and ADB, together with the IEEs prepared for the other subprojects.

G. Licenses & Approvals Required

30. Environmental assessment of various activities and development projects in Georgia is governed by the Law on Environmental Impact Permits (EIP), which has entered into force in January 2008. This Law notifies the list of the activities and projects, which will be subjected to ecological expertise and require Environmental Impact Permit. The Law also makes the public participation mandatory in the process of environmental assessment, ecological expertise and decision making on issuance of an environmental impact permit. Under this Law, various projects/activities have been divided into four categories based on their size, importance and potential environmental impact, and sets out permitting process for each category.

31. None of the components of the proposed water supply improvement subproject in Mestia are notified in the Law on EIP and therefore environmental impact permit is no required. According to current legislations in force, water abstraction from a surface water source does not require any permission/approval from Government of Georgia.

32. *ADB Review and Approval*. For Category B projects the Draft IEE report are reviewed by ADB's Operational Department (in this case Central & West Asia Department) and after addressing their comments, if any, the EA then officially submits the IEE reports to ADB. Completed reports are made available on the ADB website.

III. PROJECT DESCRIPTION

33. A feasibility study was conducted to improve the water supply system in Mestia to meet the design year demand (2040) and the project is formulated for implementation under the proposed ADB funded Investment Program. Works are proposed to be implemented through multi tranche funding. **Table 4** shows the subproject and components selected for implementation under tranche-1, for which, according to ADB requirement, this IEE is conducted. Photographs of project sites are appended in **Appendix 1**.

A. Sub Project Components

34. This subproject focuses on creation of a new source based water supply system, and is limited to bulk water supply facilities – source development, treatment facility, transmission mains and storage. The descriptions shown in **Table 4** are based on the present proposals. Since the project is at feasibility stage, although the proposed capacities are expected to be substantially correct, certain details such as type of intake construction may change during the design.

Table 4: Proposed Subproject & Components

Infrastructure	Function	Description	Location
Water intake structure at Gvaldi stream	To collect 6,325 m3 per day from the stream	1 m x1 m underground gallery to place the intake pipe	Gvaldi, about 5 km northeast of town, in a hilly area. Intake structure will be constructed in the river
Bulk flow meters	Monitor water flow at the source	Bulk meter; 300 mm diameter; 1 unit	As above
Transmission main from Gvaldi intake (headworks) to new WTP site	Convey water from head works to WTP for treatment	300 mm Diameter MS pipe over a length of 2.8 km	Alignment traverses mostly hilly areas. Pipeline will be laid along the field roads (either on ground or below ground, as topography permits). Near the headworks, pipeline traverses privately-owned pasture lands for about 500 m.
Construction of treatment plant with chlorination facility	Remove turbidity and disinfect water; capacity 6,325 m3 per day	Chlorinator	On a government-owned site, situated in the northern outskirts of the town. This is located along the road that connects Gvaldi head works site and the town
Construction of new reservoir	To provide for water storage	RCC surface reservoir Capacity: 155 m3 size:10mx10m x2 m	Same as above
Water testing lab	Regular monitoring of water quality	Construction of laboratory facility (50 m^2 building) and provision of equipment	Same as above
Transmission main from WTP to Lanchavli Reservoirs	Convey water from head works to WTP for treatment	200 mm Diameter MS pipe over a length of 3.5 km	Will be laid along the existing road in the centre of the town to Lanchavli

B. Construction Activities

35. There are four main elements in the subproject: construction of intake structure; laying of transmission lines; construction of water treatment plant/disinfection facility, and construction of reservoir. Construction practices of these works are briefed below:

36. *Construction of Intake*. This will involve construction of an underground gallery to collect the water from stream (exact construction details are however not available at this stage). A gallery of size 1m wide and 1 m deep will be constructed just below the bed of the stream, length of which will be equal to about 5 m (little more the width of Gvaldi at this stretch). A trench of 1m x 1m will excavated manually, and placed on the bank temporarily. A fully perforated pipe (with one end closed) will be placed in the trench and filter material (locally available gravel and aggregate) will be filled in the space between trench and pipe and on the top of the pipe. At the surface, an iron mesh will be provided over the top of the refilled trench to protect the loosely grained filter material. Transmission pipe will be connected to open end of the pipe. The excavated soil (about 3 m3) will be used for strengthening banks. Construction in the river bed will be taken up in two stages; trench excavation, fixing perforated pipe, filling filter media and placing the mesh of the top will conducted in the half the width of the stream, during which flow will continue from the remaining portion. Work in the remaining portion will be taken up subsequently. Work will be taken up during the low flow period. Construction will be done manually; except perforated pipe, all material (gravel, sand and aggregate) will be sourced locally. Pipes will be brought to the site manually from the nearest access point (1 km from source).

37. *Construction of Water Treatment Plant.* Water treatment plant will involve construction of filter unit and chlorination facility, both of which will be located in a building. Filter unit will consists of large rectangular tanks of adequate size filled with filter media (graded sand), pipes (inlet, outlet and backwash pipes) and fixtures. The chlorination facility will be a small unit to administer the chlorine into filtered water. Construction of the water treatment plant will be similar to building construction – excavation for foundation (2-3 m), fixing of reinforcement and pouring of concrete mixed into voids to form foundation and columns, over which RCC roof will be laid in the similar manner. Walls will be constructed with locally available building stones/cement blocks. Rectangular RCC tanks for filter beds will be constructed similar to any tank/reservoir. Excavation for foundation will be done manually. Concrete will be mixed in mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity of earthwork or surplus soil generated from this work will be available only after design of the units; however, this quantity will be insignificant and can be used within the site to level the ground surface.

38. *Construction of Reservoir.* A new on-ground reservoir will be constructed in the premises of Water Treatment Plant. This work will involve excavation for foundations (2-3m deep), placing of reinforcement rods in wooden shutters and pouring of concrete in voids to form foundations, floor, walls and roof. Cement mortar plaster will be applied to walls (outside and inside), floor and roof for smooth finish. Inlet and outlet pipes and fixers/valves will be installed. Excavation for foundation will be done by backhoe digger or manually, where required. Concrete will be mixed in concrete mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity waste/surplus soil generated from this activity will be insignificant and can be used within the site to level the ground surface.

39. *Laying of Transmission Mains.* A new transmission main (300 mm diameter) will be laid from Gvaldi headworks to WTP site. Pipeline will pass through pasture land for about 500 m starting from headworks, after which will be laid along the field roads. This is a hilly terrain; for a distance of about 200 m, alignment is very steep. Pipeline will be laid mostly

underground, but in sections where it is not feasible due to topography, it will be laid on the ground. Similarly, the transmission main (200 mm diameter) from WTP to Lanchavli reservoirs will be laid along the road through the town. This will be laid underground. Trenches will be dug using a backhoe digger (in the town), supplemented by manual digging.

40. Excavated soil will be placed alongside, and the pipes will be placed in the trench manually. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. A sand layer of 5 cm thick will be laid on top of the pipe, after which the trench will be refilled with excavated and compacted manually. The size of trench will be 1.5 m deep (0.3 m pipe + 1.2 top cover) and 0.6 m wide. The excavation is expected to generate 3,192 m3 soil[2], after construction part of trench will be occupied by pipe and sand layer, and trench is refilled with the excavated material. This activity is expected to generate about 370 m3 of waste soil.

41. *Source of construction materials*. In Mestia, sand is sourced from River Mestiachala and aggregate is sourced from licensed crushers. Construction waste/debris is normally used for leveling low lying areas in the town.

C. Operation of Improvement Water Supply System

42. Utilizing the hilly topography, simple gravity based water supply system is designed for Mestia. Water is collected, treated and distributed by gravity. This system involves – abstraction of water from Gvaldi, transmission to WTP (treatment and disinfection by chlorine) from where water is conveyed to storage reservoirs. From reservoirs, water will be supplied into distribution system. Operation will also involve laboratory analysis of water supplies. This system will supply a maximum of 6,325 m3 of water per day.

43. Treatment will consist of sand filtration, in which water will be passed through a sand bed, and, application of chlorine into the water supplies. Average dose of chlorine will be about 5mg/l; maximum daily usage of chlorine will be 32 kg. A solid powder solution containing chlorine will be used as disinfectant (most commonly used is Sodium Hypochlorite, NaCIO, in white powder form), which contains about 25% of chlorine.

44. Water supply infrastructure will require repair and maintenance activities like detection and repair of leaks. Since good quality pipes are being used breaks are very rare, and leaks will be mainly limited to joints between pipes. Repair work will be conducted in the same way the pipe was laid, by locating the leaking section.

[2] It is assumed that the transmission main from headworks to WTP will be laid partly (50%) laid above ground; main from WTP to Lanchavli laid underground for full length

IV. IMPACTS ON THE PHYSICAL & BIOLOGICAL ENVIRONMENT

A. Introduction

45. Mestia is situated in Samegrelo-Zemo Svaneti Region of Northeast Georgia, about 430 km from Tbilisi. It borders Russia in the north. Geographically located at 42^{o}42'6" and North latitude 43^{o}4'30", Mestia is a hill town, developed near the confluence of Mestiachala and Mukhura Rivers. Altitude ranges from 1,200 m to 3,000 m above the mean sea level (MSL), with town centre at 1,450 m above the MSL.

46. The following sections evaluate the impacts on physical and biological environment due to the proposed project. Each subsection first describes the baseline profile followed by impact identification and assessment during construction and operation. Mitigation measures are also discussed in conjunction with the impacts.

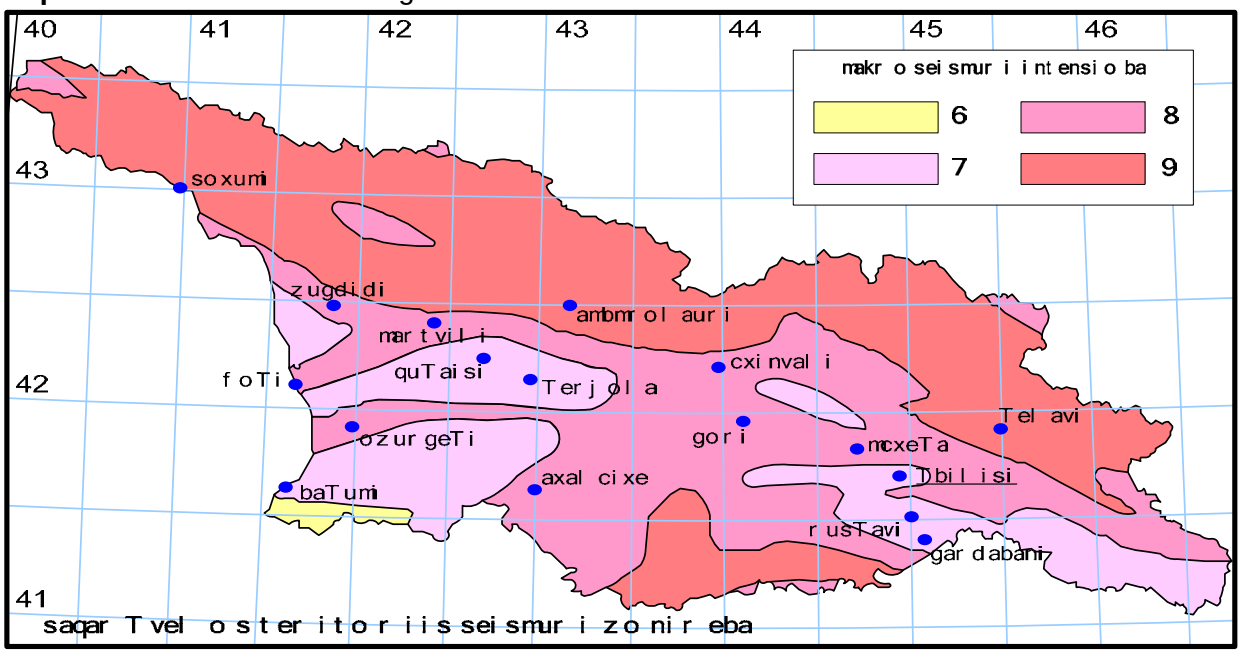
B. Topography, Geology & Soils

1. Baseline Conditions

47. *Topography*. Despite its small area, Georgia presents one of the most varied topographies within its geographical boundaries. Georgia lies mostly in the Caucasus Mountains, and its northern boundary is partly defined by the Greater Caucasus range. The Lesser Caucasus range runs parallel to the Turkish and Armenian borders and the Surami and Imereti ranges connect the Greater Caucasus and the Lesser Caucasus, create natural barriers in the region. Greater Caucasus Range borders Mestia Municipality in the North-East; Svaneti-Abkhazia range in the west and Svaneti Ridge in the South. Elevation of the municipal territory ranges from 1,400 m to 3,600 m above mean sea level, and forms upper part of Enguri River Basin.

48. *Geology*, Project area structurally belongs to central Caucasus unit. This section morphologically represents high-mountainous, locked depression (Zemo Svaneti depression), surrounded by southern slopes of Caucasus's main Ridge and Svaneti Ridge. Zemo Svaneti depression area tectonically belongs to Mestia-Tianeti and Chkhalta-Laili shelled zones of the Caucasus folded system. These tectonic areas are characterized by mid- Jurassic Period slates, and upper Jurassic and lower Cretaceous Period carbonate flysch and mid Jurassic volcanogenic sedimentary rocks. All these rocks are tectonically intensively dislocated and have produced many significant folded structures. According to seismic zoning map, Georgia is classified into Zone 6 to Zone 9 (in increasing order of seismic intensity, **Map 4**) and Mestia falls under Zone 9 (very high seismic intensity zone). There has been no history of major earthquakes in Mestia, however, a powerful earthquake (7.0 magnitude) occurred in 1991 in neighboring Racha province. Much of the damage associated with this earthquake was caused by landslides .

Map 4: Seismic Zones of Georgia



49. *Soil*. The underlying rock strata as presented above under the conditions of relevant relief and with the surface inclination less than 45^0 are covered from with the Quaternary slope, alluvial and glacier deposits. The Pleistocene glacier deposits are quite significantly spread in and around Mestia. Mestiachala River and its tributaries and upper line of the gorges are structured with these deposits. Almost all the settlements in and nearby project area are located on the upper morainal sediments. The same type of glacial sediments are widely maintained on the slopes of the rivers/gorges at 50-500 m relative height from the current riverbed where several stages of Pleistocene freezing stages are observable. The depth of soil in the project area ranges from 1.5-2 m, below which the hard stratum lies. Forest Chernozem soils are present in the hilly zone. Mountain-meadow soils are developed above 1600 m MSL.

2. Impacts during Construction

50. During the construction, impacts on topography and geology are mainly to due to invasive nature of excavation activities.

51. Excavation works for reservoir and water treatment plant will be minor and confined to a site, and therefore not expected to have any impacts on topography, soil and geology. The trench excavation for transmission mains will be 6.3 km long (2.8 km + 3.5 km), which will run along the roads. This may affect the surface water drainage during rains (these impacts are discussed in surface water).

52. Works do not involve deep excavations. Due to hilly region, hard rock is available within a depth of 1.5-2 m and foundations will be laid directly on the hard rock, thus this work do not involve cutting of rocks. In the hilly area through which the alignment runs have rocky outcrops. At these locations, alignment will be shifted or pipeline will be laid on the ground to avoid cutting of rocks.

53. Since the project is located in very high seismic intensity zone, appropriate precautions have to be included in the structural design of facilities:

- Apply design and construction norms of Zone-9 (MSK-64 scale) according to Government of Georgia “Construction in Seismological Regions”
- Select appropriate pipe material and design for transmission lines according to seismic intensity of project area

54. The construction work is not expected to generate significant quantities of waste soil. The surplus soil from foundation work of WTP and reservoir will be utilized at the same site for raising the ground level. The trench excavation work for pipeline is expected to generate 370 m3 of waste soil, which needs to be disposed properly without causing further physical impacts on topography, soil at the point of disposal. This will require:

- Utilizing surplus/waste soil for beneficial purposes such as in construction or to raise the ground-level of low lying sites

55. The excavation and refilling works will disturb the soil characters at the sites. Transmission line near Gvaldi passes through privately owned pasture lands, the excavation of which will lead to disturbance and loss of fertile top soil. Therefore the Contractor should implement the following measures:

- Top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.

56. The excavation work will also tend to loosen the top soil, which may lead to soil erosion due to winds and rains. As project area is situated in a hilly region, the risk of erosion is comparatively high. Removal of vegetation and tree cover will also lead to erosion. Therefore the contractor should:

- No trees shall be removed on the slopes; clearing of shrub, bushes and grass shall be limited to actual construction area only; no clearance is allowed for activities such as material/waste storage, concrete mixing, etc.
- Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer
- In the steep slopes, local grass species shall be planted on the refilled trenches

3. Impacts during Operation

57. Regular operation of water supply system will be within the constructed facilities and therefore no impacts envisaged.

58. The main requirement for maintenance of the water supply infrastructure will be for the detection and repair of leaks. Repairs will be conducted in essentially the same way that the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary. This activity however is not expected to generate any waste soil nor will have any impacts.

C. Surface Water and Groundwater

1. Baseline Conditions

59. *Surface Water*. Georgia is rich in water resources; there are in all 26,060 rivers with a total length of ~ 59,000 km. Besides, there are many thermal and mineral water springs,

lakes and man-made water reservoirs. These however are distributed unequally, with major concentration in the western part of the country. Nearly all rivers of East Georgia flow into the Caspian Sea while and the rivers in the west join the Black Sea. These two basins are separated by Likhi Ridge. The project area, Mestia, is situated in the upper reaches of Enguri River Basin. Mestiachala and Mukhura, two of four main tributaries of Enguri River, flow through Mestia Town.

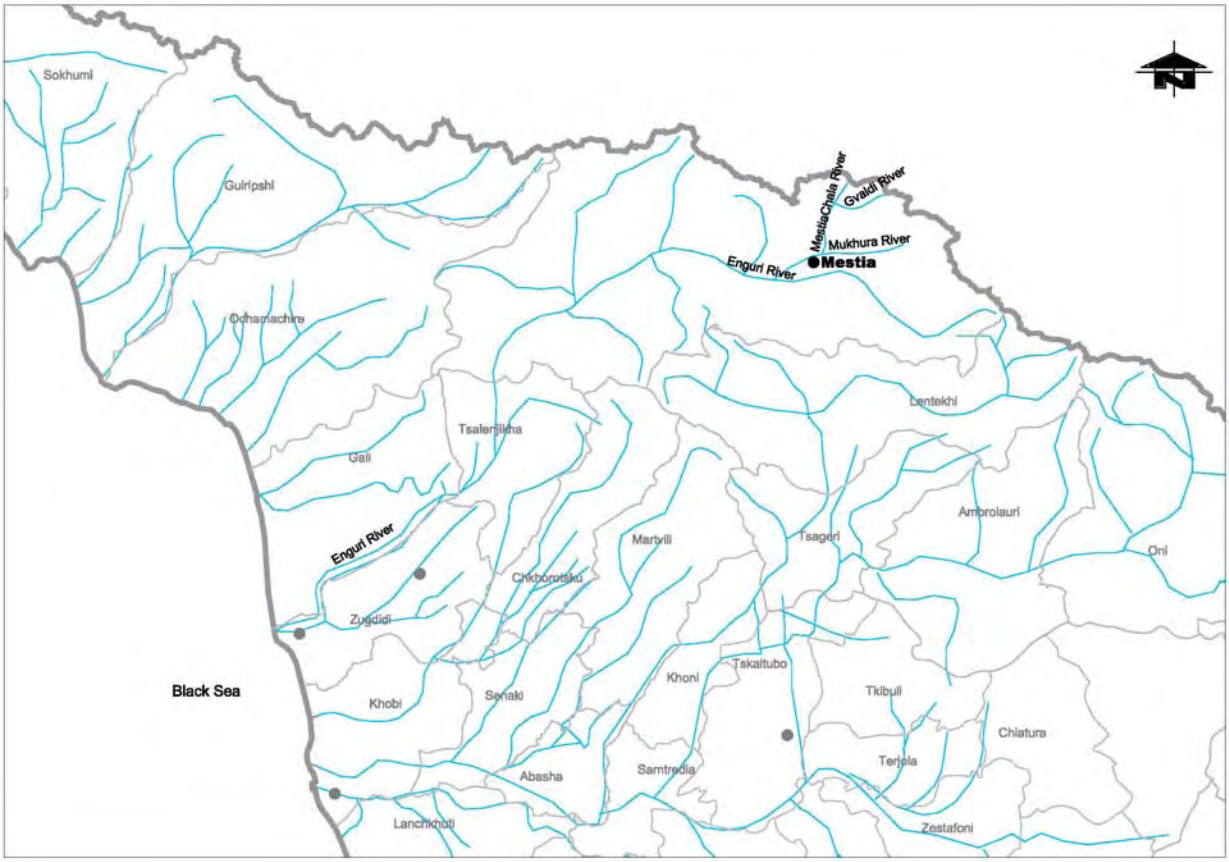
60. Originating in Greater Caucuses Range and flowing into Black Sea in the west, Enguri is one of the biggest rivers in Georgia (**Map 5**). It traverses a distance of 201 km, during which it is joined by 232 small and large streams/rivers. River flows mostly through hilly region, except last leg of for about 80 km. Due to steep slopes, river is deep, flow is turbulent and carries heavy loads of silt, which accumulates in Enguri Dam on the foothills near Dzvari Town. Water flow after the dam is low.

61. Mestia Town is developed in the upper reaches of Enguri River Basin, near the confluence of Mukhura and Mestiachala, two important tributaries of River Enguri. While the rivers flow through valley/gorge and low lands, town is mostly developed on hill slopes. Both the rivers originate in Glaciers in Causes Ranges, while Mukura originates in eastern upper region of Mestia, Mestiachala originates in the northern side. The combined river, Mukhura, flows down further and meets Enguri at 20 km south-west of the town. There are a number of streams, small and big joins Mukhura and Mestiachala, Gvaldi River, the source of supply for the proposed subproject, is a tributary of River Mestiachala.

62. Mestiachala originates from Chalaadi Glacier and flow is supplemented by snow and rainfall. It experiences floods during the warm seasons and low flow in colder periods. In July-September flow is very high, caused both by snow melting and the rainfall. Water quality is very good, except turbidity due to erosion from upper hilly areas.

63. Gvaldi River originates from Mukrvam Glacier in the Caucuses Range in the northeastern upper reaches of Mestia Town. Gvaldi is a small river, and traverse a distance of about 8 km before it joins Mestiachala just upstream of Mestia Town River is glacier fed, and therefore experiences high flow during the warm seasons and low flow in colder periods. Flow measurement of Gvaldi conducted in mid September, 2010 indicated a flow of 0.5 m3 per sec. Flow likely to be higher in peak summer (a rough flow estimate in July-10 indicated 1 m3 per sec) and low during winter (December/January). River water in summer (June-September) is used for irrigation in the nearby pasture lands. Water is abstracted from upper reaches (above the headworks site) for irrigation of nearby fields by gravity and conveyed by earthen channels. Cattle and wild animals use Gvaldi water for drinking. As per the local information, river has changed its course in the past.

Map 5: River Network in Western Georgia



64. **Table 4** shows the water quality of Gvaldi in comparison with the national surface and drinking water norms. All the parameters of Gvaldi River water are within the permissible limits of surface water norms[3]. In comparison with drinking water norms[4], following parameters exceed the limits: turbidity, total coliform and E-coli. While turbidity is due to nature of river course, presence of bacteriological pollution is likely due to cattle and wildlife in the catchment. There are no pollution sources in the River basin.

Table 5: Water Quality of Gvaldi

S. No	Parameters	Gvaldi Water at Headworks Site	Surface Water Norms for Domestic Use	Drinking Water Norms
1	Colour	10	-	15
2	Odor	0	-	2
3	Turbidity	25	-	3.5
4	Sulphate	51.04	500	250
5	Chlorides	5.04	350.0	250
6	Calcium	20.04	-	140
7	Magnesium	5.30	-	85
8	Sodium	9.80	-	200
9	Zinc	0.019	1.0	3.0
10	Iron, total	0.18	0.3	0.3
11	Total coliform	60	-	Nil
12	E-coli	30	-	Nil
13	pH	7.0	-	6-9

[3] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG

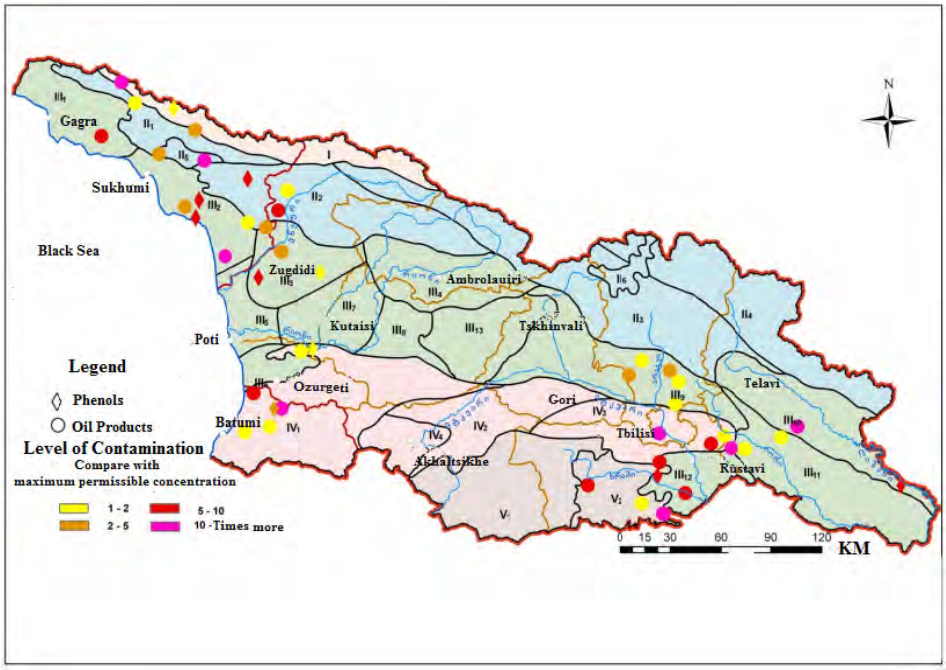
[4] Technical Regulation on Drinking Water, 2007, (Decree №349/N), Ministry of Labor, Health and Social Welfare, GoG

S. No	Parameters	Gvaldi Water at Headworks Site	Surface Water Norms for Domestic Use	Drinking Water Norms
14	Total mineralization	205	-	1000
16	Barium	0.03	0.1	0.7
18	Boron	0.1	0.5	0.5
19	Arsenic	0.0004	0.05	0.01
20	Mercury	ND	0.0005	0.006
21	Cadmium	ND	0.001	0.003
22	Manganese	ND	0.1	0.4
23	Nickel	ND	0.1	0.07
24	Nitrate	ND	45.0	50
25	Nitrite	ND	3.3	0.2
26	Selenium	0.0003	0.001	0.01
27	Copper	0.003	1.0	2.0
28	Aluminum	0.01	0.5	0.1
29	Lead	ND	0.03	0.01
30	Fluoride	0.1	0.05	0.7
31	Chromium	0.015	0.1	0.05
32	Antimony	ND	-	
33	Cyanide	ND	0.1	0.07
34	Pesticides	ND	-	0.05

Source: Sampling Survey, September 2010

65. *Groundwater*. Based on the groundwater characteristics, Georgia is divided into five hydro-geological zones, which are further defined into sub-zones/districts. Project area, Mestia, is in Zone – II (Zone of pressurized groundwater systems of south slope of the main Caucuses) and in hydro-geological district- III_{12} (Svatanian crack pressurized water systems) (**Map 6**). Water bearing strata is of contemporary alluvial deposits characterized by free groundwater table declined along the general flow of the rivers. The water table depths vary from 2.0 m to 5.0 m. At some locations near the riverbeds and groves, groundwater is very shallow depths (0.3 m). The aquifer is characterized by rich water resources, with groundwater springs yielding between 0.1-3.5 l/s. The aquifer is mainly fed from rivers and precipitation. Despite the aquifer is rich with water, its practical water use is limited. No information on groundwater quality is available.

Map 6: Hydro-geological Zones



2. Impacts during Construction

66. The intake structure for abstraction of water will be constructed on the bed of Gvaldi River, which will directly pollute the river water. Contractor shall implement the following:

- Schedule the construction work during low flow season avoiding rainy and summer seasons; work may preferably be conducted after rains and before onset of summer (May/June) or in November
- Water flow shall not be interrupted completely/diverted; work shall be conducted into one-side of the stream, and water be allowed to flow on the other side
- Enclose the construction area (may be with sand bags) so that water do not enter into work site
- Water collected in the trench shall be disposed safely so that silt water do not get mixed in the river water

67. The above measures have potential to mitigate the impact to a greater extent. Nevertheless, there will still be some portion of silt/soil mixing in the water since the work is conducted in the bed of the river. This marginal increase (for a short period of less than a week) however can be ignored, if this is not conducted in the fish breeding season.

68. Excavation can affect local drainage patterns if surface- and groundwater- collects in voids as they are being dug.

69. A small pond is situated along the transmission alignment in pasture land near Gvaldi. Transmission main from WTP to Lanchivli runs along Mestiachala River for over 1-km length and crosses over a bridge to other side.

70. During the rains, surface runoff can be collected in the trenches. Also, the silt-laden run-off from the construction areas may pollute the surface water by increasing the turbidity. Therefore the Contractor:

- Avoid scheduling of excavation work during the rainy season
- Complete pipe laying work in excavated stretches and refill before onset of monsoon
- Complete the excavation and foundation during dry season
- In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil,
- Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site
- Ensure that drains are not blocked with excavated soil

71. Ground water table is deeper than the excavation depths and therefore there is no possibility of groundwater collecting in voids.

3. Impacts during Operation

72. During the operation stage no effects on groundwater envisaged. However as this is a surface water based water supply system, the effects due to water abstraction from Gvaldi needs to be assessed. Also, the likely pollution of source water is needs to be reviewed.

73. Generally the main risk to the physical environment of operating an improved water supply system is that increased abstraction, which may deplete the water resource. Unsustainable reduction may affect downstream uses and may have ecological impacts

(such as on flora, fauna and inadequate groundwater recharge). On the other hand, unsustainable source may also lead to closure of the system and wastage of investment.

74. Due to the following reasons, these impacts are negligible in the present project:

- Gvaldi is a perennial river; flow is mainly from glacier, supplemented by rain and snow
- Proposed extraction (0.073 m3/sec) is about 15% of total flow (0.50 m3/sec); in terms of total daily volume, of the available 43,000 m3, abstraction will be 6,325 m3
- There are no water uses in the downstream; the upstream use for irrigation is limited to summer, during which river carries heavy flow

75. However, lack of flow data, especially during winter months, is a major concern. Although local people and staff of UWSCG indicate that there is adequate flow in the river even during winter months, it is necessary that this is established with flow measurement data. Adequate flow is required for both water supply and as well as for minimum environmental discharge downstream. The following measures shall be integrated into the project design:

- Conduct comprehensive flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability
- A minimum ecological flow (1/3rd of total flow) shall be released downstream all times; this means that the flow in the river shall not be less than 0.11 m3/sec at any point of time
- In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow, and remaining demand shall be met by another source

76. Degradation of source water quality is another risk in operation of water supply system that may have impacts on public health. In the present case, the quality of water is good. Headworks site is located in hills, with no pollution sources or anthropogenic activities upstream, the source can be considered safe from pollution risk. Following source protection is however required to avoid contamination from cattle/wildlife movement just upstream of the headworks source:

- Fence the river banks up to a few meters (10 m above and 10 m below headworks site) to avoid any entry of animals (wild or cattle)

77. An important aspect of increased water supply is that of increased sewage generation, which needs to be treated and disposed properly without causing any impacts. In case of inadequate facilities, disposal of untreated sewage into rivers/streams is common and therefore it offers a potential impact to surface and groundwater.

78. At present, there is no proper sewerage system in Mestia. Although there is a system covering about 25% town population, there is no treatment facility and untreated sewage is disposed into Mukhura on the downstream side of the town. Households not serviced by sewerage network either depend on septic tanks/pit latrines or dispose directly into Mestiachala or Mukhura Rivers,

79. With the current project, water supply will be increased further. The increase in water supply will increase the sewage generation from 390 to 2,720 m3/day, as shown in the following **Table 6**.

Table 6: Increase in Sewage Generation due to the Subproject

Parameter	Unit	Value
Current Situation		
Gross water supply (at source)	m3/day	2,600
Water losses	%	80%
Net water supply (at consumer end)	m3/day	520
Sewage generation	m3/day	390
Sewage collected but disposed without treated	m3/day	98
Sewage uncollected	m3/day	292
With the Sub- project		
Gross water supply (at source)	m3/day	6,325
Water losses	%	57%[5]
Net water supply (at consumer end)	m3/day	2,720
Sewage generation	m3/day	2,040
Sewage collected but disposed without treated	m3/day	510
Sewage uncollected	m3/day	1,530

80. Without any proper sewage collection, treatment and disposal system, the increased sewage will have negative impacts on receiving water bodies It is therefore necessary that:

- Existing sewerage system is improved with treatment facilities, which can treat the sewage to Georgian standards and dispose safely
- Sewerage system is extended to cover 100% population
- The above measures shall be implemented along with the water supply system improvement

D. Climate & Air Quality

1. Baseline Profile

81. *Air Quality*. Ambient air quality monitoring is conducted at only seven locations in Georgia. As there are no major air polluting sources like industries, none of these are located in Mestia, Although traffic is less, roads in town are in very bad condition, and vehicle movement tends to produce a lot of dust.

82. *Climate*. Situated in the Caucuses Range in the Zemo-Svaneti depression, climate of Mestia is humid and surrounded by mountains, it is influenced mostly by air masses coming from the Black Sea throughout the year. Long winters and short summers are characteristic of this region. Normally winter starts in the beginning of October and lasts till June. Summer is from June to September.

83. Average annual temperature in Mestia is +5.8^{o} C. Temperature of the coldest months (January, February, March and December) fluctuates from -1.4 ^{o}C to 2.7 ^{o}C (December) to -4.9 ^{o}C to 5 ^{o}C (January and February). The temperature during the warmest months (July, August and September) is in the range of 10.3 ^{o}C to 13.1 ^{o}C. Absolute minimum temperature is -35 ^{o}C, absolute maximum 35 ^{o}C, while average minimum temperature is -0.3 ^{o}C, and average maximum is +12.9 ^{o}C.

[5] It is designed to reduce the total water losses in the system from present 80% to 20% through improvements in transmission & distribution system. The present subproject in Tranche-1 however improves only transmission system. Considering the ground situation of losses, on the assumption that 35% of total system losses occur in transmission and 65% in distribution, it is estimated that, with this subproject, the total losses in the system will be reduced to 55% from current 60%.

84. Relative humidity is generally low in colder months (lowest 23%), and for the hottest months 45%. Annual average rainfall is 970 mm. The rainfall increases with the elevation as one move upwards on hills. Average annual precipitation days are 168, while snowy days are 160. Average annual wind speed is 0.9 m/s; in winters it ranges from 0.2 m/s to 1.4 m/s while in summer it ranges from 0.8 m/s to 2.0 m/s.

2. Impacts during Construction

85. The activities that could cause impact on ambient air quality are (i) dust generation from construction activity and (ii) air emission from construction equipment (like excavators, crane) and material and waste transport vehicles.

86. Since the work will almost certainly be conducted in the dry season, there is a lot of potential for the creation of dust, from the excavation of dry soil and its storage, and leveling on the ground. As stated earlier, the construction activity does not involve significant quantities of earth work. However, some of the works will be conducted in the town (clear water transmission main will run through middle of the town for about 2 km length). Also Mestia is a tourist place and there are trekking routes near the project sites. Action will therefore be needed to reduce impacts on air quality at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

- Cover or damp down by water spray on the excavated mounds of soil to control dust generation;
- Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process;
- Bring the material (aggregate and sand) as and when required;
- Ensure speedy completion of work and proper site clearance after completion
- Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site
- Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing

87. Various types of equipment and vehicles would be required for the construction activity. The exhaust emissions from these may degrade the ambient air quality. Considering the scale of work and use of equipment, impact will be insignificant, and will be beyond the scope of this project. However, to enhance the subproject benefits, the Contractor should implement the following:

- Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained
- Ensure that all equipment & vehicles confirms to emission and noise norms

3. Impacts during Operation

88. Since the water supply system is gravity based and there is no use of any major equipment or power supply, no impacts on ambient air quality envisaged.

E. Biological Environment

1. Baseline Profile

89. About 40 percent of total geographical area of the country accounts for forests. Average density of forests is 163 m^2 per ha. 97 percent of forests situated on mountain, the rest 3% are low-lying and flood plain forests in Kolhida Region and in the Western Georgia.

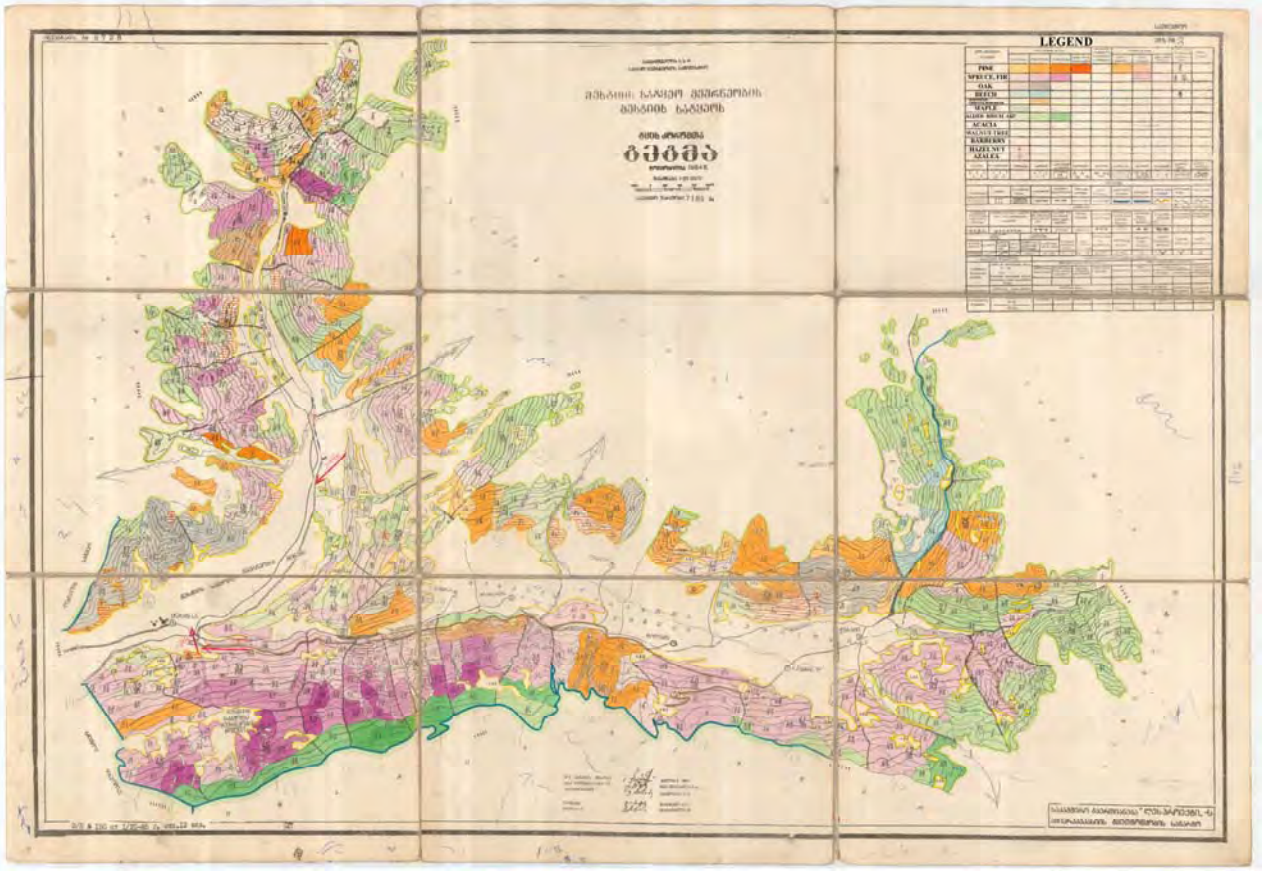
90. *Flora*. No information/data available on the extent of forest areas in Mestia. However except habilitation and agricultural lands on foot hills and flat land parcels on hills (which are converted long back as pastures), entire area is covered with various type of forests. The region which lies below 1,800 m MSL is covered by mixed and coniferous forests. The forest zone is made up of tree species such as spruce, fir, beech, oak, and hornbeam. Other species that are less common but may still be found in some areas include chestnut, birch, maple, pine and box. The zone which extends from 1,800 meters to about 3,000 m consists of alpine meadows and grasslands. Eternal snows and glaciers take over in areas that are over 3,000 meters above sea level. Overall, the region is covered with coniferous forest lower ranges, above which lies alpine belt in mid range above which lies the zone of eternal snow and glaciers.

91. *Fauna*. Svaneti wild life is very diverse. Rodents are abundant. Caucasian endemic – Prometheomys satunin occurs in the alpine and sub-alpine meadows; snow vole is found in rocky areas of sub-alpine meadow (also in lower zones). Many voles are distributed within Okrugo sub-alpine and alpine meadow. Svaneti forest-meadows are rich with predators, of which brown bear is frequent. Caucasian wolf, Jackal, Trans-Caucasian fox, Caucasian boar, Lynx, Western Caucasian tur and Caucasian white throated marten are also present. Avifauna in the area include: Caucasian grouse, Caucasian snowcock, kite, goshawk, greater spotted eagle, cinereous vulture, griffon vulture, golden eagle and Eurasian griffon vulture from 1500 m till 3500 m above the sea level.

92. *Protected Areas*. There are 14 Strict Nature Reserves, 8 National Parks, 12 Managed Nature Reserves, 14 Natural Monuments and 2 Protected Landscapes in Georgia. These protected areas cover about 7 % of the country's territory. About 75 % of Protected Areas are covered by forests. Primary function of the Protected Areas is protection of natural heritage of the country. None of these protected areas are located in the region.

93. Gvaldi River, originating from Mukrvam Glacier in the mountain peaks, flows through a gorge surrounded by hills covered mostly with coniferous forests, and joins River Mestiachala just upstream of Mestia Town. Aquatic life of Gvaldi is very limited; supported by river bed benthic organism the river has Trout fishes in the lower reaches near its confluence with Mestiachala. It is learn that Gvaldi River course for a length of 100 m near the confluence also acts as breeding ground (season is from mid- September to mid-October) for Trout fishes. During the breeding season, fish tend to move upstream for breeding. There is no commercial fishing activity in any of the rivers in Mestia. Initial stretch of transmission main alignment (from headworks to WTP site), after off-taking from the source, traverse through private pasture lands (predominantly plain/rolling terrain) for about 500 m. After that the alignment is along the field paths surrounded by pasture lands and as well as oak forests. These field paths are used as access roads to the pastures lands and for trekking. Main tree species in the area are spruce, fir, beech, oak, and hornbeam. There are a variety of flowering plant species in and around the headworks site. Species include *Campanula latifolia* (Bell flower family), *Helleborus caucasicus* (Caucasian Hellebore), and *Ulmbelliferae* (Apiaceae) – Parsley Family. Common wild animals in the forests around Mestia include hare, wolf, fox, and bear.

Map 7: Forests in Mestia



2. Impacts during Construction

94. Although headwork site is located in a pristine natural environment surrounded by hills and forest areas, there is no impact envisaged as this will not involve any clearance of trees or vegetation. Work will be conducted manually using locally available material and therefore there is no major disturbance anticipated during construction. The construction in river bed however likely to increase the silt level of water body; with the various measures suggested earlier, the silting of river will be reduced considerably, however, cannot completely avoided. The marginal increase may have negative impacts on fish breeding, the following measures shall therefore be implemented:

- Construction works in the river bed shall not be conducted between mid-September and mid-October.

95. Similarly transmission main construction will be carried out manually in areas accessible only by foot. No new access roads will be developed. Few trees may be removed, where it is required to avoid sharp turns. Construction work may have negative impacts on movement of wildlife. Following measures needs to be implemented to avoid any impacts on flora and fauna:

- Avoid tree cutting by local and small change of layout plan/alignment
- In unavoidable cases, plant two trees of same specie for each tree that is cut for construction

- Bushes and grasses shall be cleared only in actual construction area; all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation.
- Use excavated soil for refilling the pipeline trench; avoid sand layer on the top of the pipe in inaccessible areas to avoid importing material and related disturbances
- Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours. This will avoid any safety risk to wild animals.

1. Impacts during Operation

96. The operation and maintenance activities would be conducted within the facilities, and therefore no impacts envisaged on biological environment. Certain measures suggested in previous sections to ensure minimum downstream flow, will avoid any impacts on downstream.

V. IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

A. Economic Resources

1. Baseline Profile

97. *Land use.* Predominant land use in Mestia is under agriculture/pasture followed by inhabited areas. Hills slopes are covered with forests. Agriculture and agricultural related activates (animal husbandry for meat and milk products) is the main economy of the region. Potato and corn are the important crops in the area. Owning to extreme weather conditions, cultivation is limited to summers months. There are no industries.

98. *Mining*. The region is known for mineral resources like gold, silver, lead, zinc, copper, cobalt, molybdenum, barite, arsenic, wolfram and marble, which are almost untapped. The region has mineral and thermal water springs. The region also has a large potential for building stone material (decorative facing stones, marble, lime stone, barite etc). However, most of these minerals at present are untapped, the present activity is limited to mining for construction materials (sand, gravel and aggregate).

99. *Roads & transport*. Nestled in the main Caucuses mountain region, Mestia is connected by road with the rest of Georgia. This road passes, mainly along the banks of Enguri River, through highlands, mountains and has steep slopes. Landslides during rains are not uncommon and often lead to road closure. This road is presently under improvement. Internal roads in Mestia are not well developed. Except the main roads, all other roads are narrow and un-surfaced. Public transport facilities are available and connect to all areas.

100. *Urban Services*. UWSCG provides water supply and sewerage services in the town. Springs and streams are the main source of water supply. Sewerage system is not well developed, and is provided only to a part of Mestia Town population. There is no wastewater treatment facility; the collected wastewater is disposed into River Mukhura without any treatment. Storm water drainage is available in part of the town. Solid waste management system is not well developed; waste is collected and disposed in low-lying areas.

101. *Power Supply*. After the independence, Government of Georgia has made efforts to improve the power supply through new generating sources. Hydropower is the predominant source (88%), while rest is from gas based thermal power stations. Mestia gets uninterrupted good quality electricity supply from Enguri Hydropower Station.

2. Impacts during Construction

102. All the water supply improvement works will be conducted on government owned land, except a stretch of 500 m of transmission main which is passing through private pasture land. This might affect the income of land owners..

103. The clear water main from WTP to Lanchavli will be laid along a road passing through the centre of town. Although work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material and workers discourage customers from visiting shops and other businesses, which lose income as a result. These losses however will be short in duration. Implementation of the following best construction measures will reduce the inconvenience and disturbance:

- Informing all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary;
- Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing workforce to complete the work in minimum time in these stretches

104. The another aspect of the work that has economic implications is the transportation of material to the site and waste from the site to locations where it can be put to beneficial use as recommended. The volume of surplus soil generated from the construction work is limited (370 m3), which will generate just about 74 truck trips (assuming a smaller truck, 5 m3 capacity, due to narrow roads per trip during 1 year construction phase) – spread unevenly with more trips during initial stages. In addition there will be truck movements carrying material. Although this is not significant, considering the narrow roads, it could disrupt traffic in the Town. Dust generated during the transport may also impede the commercial and trade activities, which are predominantly located along the main roads. The transportation of material/waste shall be implemented by the Civil Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

- Plan transportation routes in consultation with Municipality and Police
- Schedule transportation activities by avoiding peak traffic periods.
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

3. Impacts during Operation

105. As the operation and maintenance activities would be conducted within the existing facilities in no impact envisaged on economic resources. Repairs and leaks of the transmission main pipeline will be minor and localized. In fact, the improvements to the water supply system will bring various benefits. Availability of good infrastructure facilities will add to the quality of life, and there will be more people interested to live and visit, which will bring new investments and boost economic development.

B. Socio-Cultural Resources

1. Baseline Profile

106. *Demography*. The present population of Mestia is 2,855, and floating population (tourists) is about 3,500. Contrary to overall growth rate of Georgia, which had declined during the last two decades, population of Mestia has increased though marginally. This is mainly attributed to decline in out-migration due to revival of tourism related economy. With the government focusing on development of Mestia as a all-weather tourist destination with tourism related facilities and infrastructure, the tourist population is likely to increase to 20,000 by 2040 (*Source: Government Estimates*).

Table 7: Population of Project Area

Year	Population			CAGR
	Town	Tourist	Total	
2002	2,575	-	2575	-
2010	2,855	3,500	6,355	-

Year	Population			CAGR
	Town	Tourist	Total	
2020	3,480	6,375	9,855	4.72%
2030	4,347	11,847	16,194	5.03%
2040	5,299	20,000	25,299	3.73%

107. *Population Composition*. Almost entire population in Mestia is ethnic Georgians. Georgian is the main language, while most can speak Russian few can also speak English. There is no population which can be categorized as indigenous in the project area. About 98% of Mestia population is literate.

108. *Education & health facilities*. There are three schools (primary and secondary) and two kindergartens in Mestia. For higher education, people mainly depend larger urban centers of Kutaisi and Tbilisi. Basic health facilities are available; there are two hospitals and a polyclinic in the town to serve the population.

109. *History & Culture*. Historically and ethnographically, Mestia has always been regarded a chief community of Zemo, or Upper Svaneti province. Despite its small size, the town has been an important centre of Georgian culture for centuries and contains a number of medieval monuments. The town is dominated by stone defensive towers (Svan towers). Mestia is also a center of mountaineering tourism and alpinism. Early reference to Svans, an ethnic sub-group of Georgians of south-eastern slopes of the main Caucasus ridge, dates back to 3rd century BC. Archeologists/historians found evidence of life in the region belonging Stone Age (Neolith). Svans adopted Christianity in 523 AD. Svans have played significant role in the life of the old and new kingdoms of Georgia. Their contribution during the reign of David the Builder and Queen Tamar in modern Georgia needs a special mention. Swans are known for ages as fierce fighters and protectors of Georgia. Following are the important places of historical importance in Mestia:

(i) *Swan Towers*. There are a number of ancient Swan Towers in Mestia. An ancient dwelling, believed to be established in 14th century, comprising Machubi' (dwelling house with large hall), summer terrace-type structure 'Guband' and adjoining multi-storey tower (Swan-tower) built by large stone quadrants, is located in Lanchavli. Legend has it that these towers are evidence for the volatile situation in the region, which lead to construction of these defensive structures.

(ii) *Svaneti History and Ethnography Museum*. This museum was established in 1936 by ethnographer Egnate Gabliani and houses very important samples of the Christian culture. The cultural and material monuments kept in the museum are characterized with widespread chronology from the archaeological artifacts from 3 BC to modern age.

110. *Tourism*. Besides being an important cultural and historical centre, Mestia is known for its natural beauty, and notable for its glaciers and picturesque summits. Low and medium range hills mostly covered with mixed and coniferous forests. High hills are characterized by alpine meadows and grasslands, above which lie the zone of eternal snows and glaciers. With the Government of Georgia's focus on all-weather tourism development in Mestia, various initiatives such as development of ski lift and ski slopes, which are already underway, is likely to boost tourism inflow from present 3,500 to 20,000. Infrastructure works like improvement of roads (both internal and external) are being implemented in the town.

2. Impacts during Construction

111. There are various social-cultural resources (such as schools, hospitals, churches and tourism spots) in the town. The transmission main from WTP to existing reservoirs will run through Lanchavli area that houses few Swan Towers. The construction impact will include noise and dust, and interrupted access due to movement of heavy vehicles transporting material and waste. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above (under the impacts on air quality), including:

- Limiting dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks
- Providing wooden walkways planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing the workforce in to complete the work quickly

112. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:

- Following standard and safe procedures for all activities – such as provision of shoring in deeper trenches (> 2 m)
- Excluding public from the site – enclosing the construction area and provide warning and sign boards, and security personnel
- Providing adequate lighting to avoid accidents
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc)
- Maintaining accidents records and report regularly

113. Svaneti Region, including Mestia, is an important centre of Georgian history and culture. So there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. Therefore steps should be taken minimize the risk. This should involve:

- Contractor should put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve:

    - Having excavation observed by a person with archaeological field training;
    - Stopping work immediately to allow further investigation if any finds are suspected;
    - Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

114. *Economic Benefits*. There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labor force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to

labor camps. If temporary labor camps are to be provided, Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

- To the extent possible labor force must be drawn from the local community
- In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people. Following measures shall be followed:
  - Establish temporary labor camps in consultation with the local authority
  - Shall be located away from water bodies
  - No clearance of trees vegetation shall be allowed for establishment of camp
  - Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc)
  - Contractor shall provide fire wood and no worker shall be allowed to cut any tree
  - Ensure regular and clean maintenance of the camp

3. Impacts during Operation

115. As the operation and maintenance activities would be conducted within the facilities, no impacts on socio-cultural resources envisaged. Water will be disinfected through application of bleaching powder, and therefore no risk due to handling and application of chlorine gas.

116. Another impact associated with water supply system is supply delivery of unsafe water into distribution system, which may lead to public health issues. This may occur due to (i) degradation or pollution of source water quality, and (ii) pollution of treated water during transmission and distribution due to leakages.

117. As discussed in earlier sections, the present water quality of Gvaldi is good, and as the headworks site is located in hills, with no pollution sources or anthropogenic activities upstream, the source is free from pollution risk. The suggested measure of fencing the stream bank near the headworks will further protect the source from contamination due to entry of wild animals/cattle.

118. Nevertheless, a regular water quality surveillance program shall be implemented to avoid any public health risk as detailed below:

- Conduct regular water quality monitoring at source; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future
- Develop & implement a water quality monitoring program for distribution system according to the Georgian Law[6]
- Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel

119. The improved water supply will bring numerous benefits when it is operated. The main beneficiaries will be the citizens of Mestia, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor and tourists as well. This will improve the quality of life of people as well as raise standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes

[6] Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia

should increase. Improvement in infrastructure will bring more economic opportunities. Availability of good infrastructure will boost the tourism economy.

120. The improved and expanded water supply system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for local people.

C. Noise & Vibration

1. Baseline Profile

121. Ambient noise is not subjected to monitoring in Georgia, so there is no data on ambient noise/vibration available. Main noise generating sources in the town are transport vehicles and local construction activities; there are no major noise generating activities like industries. Following table shows the subproject sites and their background noise levels (based on site observation) and sensitive receptors, if any.

Table 8: Ambient Noise & Vibration and Sensitive Receptors at Project Sites

Subproject Sites	Background Noise/Vibration	Sensitive Receptors
Gvaldi head works	Site is located in the hilly region away from any developmental activity, in a very pristine environment. There is no noise of any kind except that of flowing water.	This is a pristine and untouched environment.
Pipeline Alignment – from headworks to WTP site	Pipeline runs along field paths surrounded by pasture and forest lands. There no sources of noise, except occasional movement of farm vehicles in the lower reaches near the WTP site	There are no sensitive receptors in the vicinity
WTP/Reservoir site	Site is located on hill in the outskirts of the town overlooking an air strip, mostly used for military helicopters/choppers. It is situated at about 1 km from air strip. There is no background ambient noise.	There are no sensitive receptors in the vicinity
Pipeline Alignment – from WTP site to Lanchavli	This alignment mostly runs through the town along the main road. Residential and commercial establishments are located along the road. Background noise is mainly from traffic.	Sensitive receptors are residential areas along the road

2. Impacts during Construction

122. Construction activities are likely to generate noise and vibration from usage of equipment and haulage of construction materials/waste. This project however does not involve high noise/vibration generating activities like pile-driving or rock cutting. Use of equipment is very limited; excavation activities will mostly be conducted manually. Due to inaccessible location, works at headworks will be conducted manually by a small group of workers. Concrete mixers (80 dB) and concrete vibrators (76 dB) will be used in construction of WTP and reservoirs. As the site is located away from the town, no noise impacts envisaged. Appropriate personal protection equipment however needs to be provided for workers at the site. Haulage of materials/waste, and operation of backhoe (if used for transmission main trench excavation in the town), will also generate noise, but will be limited in duration and require no special measures. Sensitivity to noise increases during the night hours in residential neighborhoods; this is applicable to the transmission line work in the town. Following measures therefore shall be implemented:

- Provide prior information to the local people about the work
- No construction of activities shall be conducted in the night
- Provide personal protection equipment like ear plugs to the workers at the noisy working site

123. Another important activity is haulage of construction material and waste to and from site. Roads in the town are narrow and not in good condition. Following measures shall be included to avoid nuisance due to haulage of material and waste.

- Schedule material and waste haulage activities in consultation with local authorities
- No nighttime haulage activity; limit to day time off peak hours
- Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in the town
- Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement

124. As for the construction vibration is considered, none of the activities in the subproject has potential to generate significant vibration, and there are no sensitive structures in the proximity of the site. Therefore there are no likely impacts.

3. Impacts during Operation

125. There are no sources of noise or vibration from the operation activity of the improved water supply system.

D. Cumulative Impacts

126. Project is designed to improve environmental quality and living conditions in Mestia through the improvement of water supply system. The potential negative impacts identified on various environmental parameters, during both construction and operation, in the previous sections of this report, are localized and temporary.

127. By nature, impacts such as on air quality and on people (due to disturbance, nuisance and safety risk of construction activity) can have cumulative impacts, as all the construction activities are conducted simultaneously. However, construction sites are not concentrated in a small area, and the major construction activity (WTP and reservoir) is confined to a single site located outside the town. Further, these are common impacts associated with any construction activity, and as discussed in the earlier sections, there exists proven and easy-to-implement measures to mitigate these impacts.

128. However, at present various development and construction activities (for instance, road works) are under implementation in Mestia. The proposed water supply improvement works shall therefore be scheduled in consultation with the other implementing agencies so that roads and inhabitants are not subject to repeated disturbance by trenching/construction work in the same area for different purposes. Road work of the main road, where the transmission line is proposed, shall be conducted after the pipeline work.

129. No cumulative impacts envisaged during the operation stage.

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VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

130. Following agencies will be involved in implementing this Water Supply Subproject in Mestia under this ADB funded Investment Program:

(i) Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. MoRDI will have overall responsibility for compliance with loan covenants.

(ii) United Water Supply Company of Georgia (UWSCG) is the implementing agency (IA), which will be responsible for administration, implementation (design, construction and operation) and all day-to-day activities under the loan. An, Investment Program Management Office (IPMO) will be established within the UWSCG for all Investment Program related functions. The IPMO will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.

(iii) The IPMO will be assisted by (a) Detailed Engineering Design Consultants (DC), who will design the infrastructure and manage tendering process. Civil works contractors build the infrastructure, and (b) Construction Supervision Consultants (SC), who will supervise the construction process and ensure the quality.

(iv) ADB is the donor financing the Investment Program.

131. UWSCG, specifically its Department of Quality Management and Environment Protection (DQMEP), will bear the responsibility of implementing the subproject in compliance with the Georgian Law and ADB Policy throughout design and implementation phase. Specific tasks would include:

- Updating this IEE to reflect any changes in final project design,
- Submission of revised IEE to ADB, for review and approval; incorporating ADB comments, if any
- Implementation of the EMP including grievance redress

132. Currently DQMEP is staffed with an Ecologist/Environmental Specialist, who also heads the Department. The incumbent Ecologist/Environmental Specialist, with a master's degree in ecology and 7 years of professional experience (including 5 years in Licenses and Permits Department of the MoEPNR), is well versed with the Georgian environmental law, EIA and EIP processes, and other government regulations. With the existing staff, the DQMEP can update the IEE internally and can also coordinate with government agencies for necessary approvals. The DQMEP, however, requires support for implementation of EMP.

133. Implementation of EMP of this subproject require an experienced Environmental Management Specialist (EMS) to spend a total of around three months over the average 6 month design and 15 month construction period, conducting routine observations and surveys, and preparing monitoring reports. The EMS will also be responsible for: incorporation of mitigation measures in design and construction; and, baseline and construction-stage environmental quality monitoring. Support of an additional EMS is also

required to oversee the EMP implementation, and collating and submitting bi-annual Environmental Monitoring Reports (EMR) to ADB. Since the specialist support is not required continuously, it will be feasible and convenient to an individual consultant to assisting DQMEP in implementing these tasks.

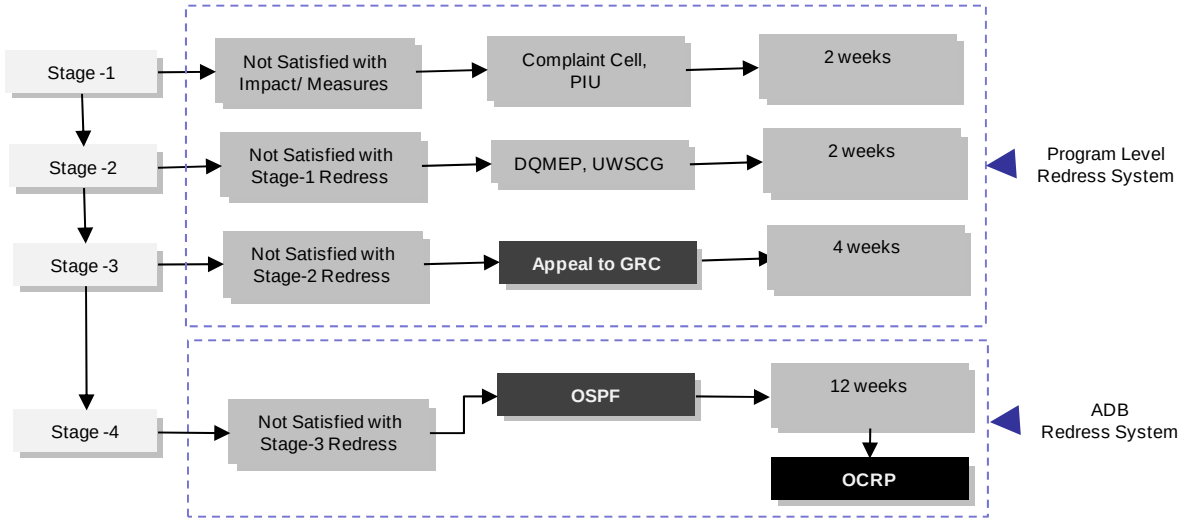
134. DC will be responsible for: incorporation of mitigation measures in design and construction; and, baseline environmental quality monitoring. SC will be responsible for construction-stage environmental quality monitoring and implementation of EMP by the Contractor. DQMEP with the assistance of EMS will review and approve IEE and/or EIA reports and oversee implementation of EMP. The civil works Civil Contractor will implement mitigation measures during construction. Implementation of mitigation and monitoring measures during operation will be the responsibility of DQMEP. Government regulatory agencies such as MoEPNR will also monitor the environmental performance

B. Grievance Redress Mechanism

135. As the work is being done in inhabited areas, most of the impacts are construction-related, and therefore it is anticipated that improper or inadequate implementation of EMP may lead to disturbance and inconvenience to local people during construction. In order to provide a direct channel to the affected persons for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, UWSCG will establish a Grievance Redress Mechanism. A Complaint Cell and a Grievance Redress Committee will be established in Mestia Service Centre to function throughout the construction period.

136. The Complaint Cell at the UWSCG Service Center in Mestia will accept complaints regarding the environment safeguard issues in implementation of the subproject. A four stage grievance redress mechanism is indicated in **Figure 1** below. The grievances received and actions taken will be included into the environmental monitoring reports submitted to ADB.

Figure 1: Grievance Redress Mechanism



(i) Complaints received (written or oral communication) by the Complaint Cell (CC) will be registered in database system, assigning complaint number with date; Complaint Cell will inform the complainant the time frame in which the corrective action will be taken.

(ii) The Complaint Cell and UWSCG Investment Program Management Office (IPMO) will investigate the complaint to determine its validity, and assess whether the source of the problem is indeed subproject activities; if invalid, the Complaint Cell will

intimate the complainant and may also provide advice on the appropriate agency to be approached.

(iii) If the complaint is valid, the Complaint Cell will check the environmental management plan (EMP) of the subproject whether this issue was identified and mitigation was suggested; if yes, the Complaint Cell and UWSCG IPMO will direct the civil works Contractor to take immediate actions as per the EMP.

(iv) If this is an unanticipated issue, the UWSCG IPMO will to identify mitigation measures and advise the civil works Contractor accordingly and a corrective action should be taken and a Corrective Action Plan (CAP) prepared.

(v) The Complaint Cell will review the civil works Contractor's response on corrective action and update the complainant within two weeks.

(vi) If the complainant is not satisfied with the action taken by the Contractor within two weeks from the start of corrective action as directed the Complain Cell, the grievance will be directed to the Department of Quality Management and Environmental Protection (DQMEP) of the UWSCG.

(vii) The DQMEP will review the issue with the IPMO and relevant Service Center and may ask for additional information or conduct site visit, and will advise the IPMO and relevant Service Center on actions to resolve the issue.

(viii) The Service Center will submit the interim report in a week to DQMEP on the status of the complaint investigation and follow-up actions, and final action taken report within two weeks of completing the action. The DQMEP will intimate the complainant of the same.

(ix) If the complainant is still dissatisfied with the action taken or decision, he/she may approach the Grievance Redress Committee (GRC, see below) established in the town

137. A GRC will be established to resolve the unresolved issues at Stage 2 and this will function throughout the construction period, and will have hearings on need-basis. GRC will have following members:

- Chairman, Mestia Municipality or an elected member nominated by the Chairman
- Service Centre Head
- Member of IPMO

138. Considering the anticipated impacts, it is not expected that there is any likely issue which will remain unresolved in the Stage 3 of the process. In the unlikely event of dissatisfaction after Stage 3, the complainant can approach ADB with the complaint. ADB has in place a system under the ADB Accountability Mechanism, where people adversely affected by ADB-assisted projects can voice and find satisfactory solutions to their problems. An affected person can file a complaint (mail, facsimile, electronic mail, or by hand delivery) with:

(i) Office of the Special Project Facilitator (OSPF), ADB, 6 ADB Avenue
Mandaluyong City, 0401 Metro Manila, Philippines
Tel: (63-2) 632-4825; Fax: (63-2) 636-2490; Email: spf@adb.org
Or
(ii) Georgia Resident Mission, which will forward it to OSPF

139. In the event of unsatisfactory redress from OSPF, the complainant can further approach Office of the Compliance Review Panel (OCRP) within ADB headquarters.

C. Environmental Impacts & Mitigation Measures

140. The Following **Table 9** summarizes the environmental impacts and suggested mitigation measures as discussed in previous sections. It also delegates the responsibility of mitigation measures implementation to various project agencies.

Table 9: Environmental Impacts and Mitigation Measures

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
Pre-Construction						
Resettlement impacts due to laying of pipeline through private pasture lands	L	M	• Provide compensation and assistance to the affect persons as suggested by the Resettlement Plan of the subproject	UWSCG	Transmission line from headworks to WTP	RP Cost
Construction						
Risk due to high risk seismic intensity zone	M	M	• Apply design and construction norms of Zone-9 (MSK-64 scale) according to Government of Georgia "Construction in Seismological Regions" • Select appropriate pipe material and design for transmission lines according to seismic intensity of project area	UWSCG	-	Design Cost
Impacts due to excavation and generation of waste soil	L	L	• Utilize surplus/waste soil for beneficial purposes such as in construction or to raise the ground-level of low lying sites	Civil Contractor	All construction sites	Part of construction cost
Loss of top soil	M	L	• Top soil of about 1 ft depth (0.3 m) shall be removed and stored separately during excavation work, and after pipeline construction the same soil shall be replaced on the top.	Civil Contractor	Pipeline work in pasture lands	Part of construction cost
Erosion due to excavation/refilling	M	L	• No trees shall be removed on the slopes; clearing of shrub, bushes and grass shall be limited to actual construction area only; no clearance is allowed for activities such as material/waste storage, concrete mixing, etc. • Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer • In the steep slopes, local grass species shall be planted on the refilled trenches	Civil Contractor	All construction sites	Part of construction cost
Impacts due to construction in the river	M	L	• Schedule the construction work during low flow season avoiding rainy and summer seasons; work may preferably be conducted after rains and before onset of summer (May/June) or in November • Water flow shall not be interrupted completely/diverted; work shall be conducted into one-side of the stream, and water be allowed to flow on the other side • Enclose the construction area (may be with sand bags) so	Civil Contractor	Gvaldi Headworks	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			that water do not enter into work site • Water collected in the trench shall be disposed safely so that silt water do not get mixed in the river water			
Impact on surface water bodies due to construction during rains	L	L	• Avoid scheduling of excavation work during the rainy season • Complete pipe laying work in excavated stretches and refill before onset of monsoon • Complete the excavation and foundation during dry season • In unavoidable circumstances, protect open trenches from entry of rain water by raising earthen bunds with excavated soil • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site • Ensure that drains are not blocked with excavated soil	Civil Contractor	All construction sites	Part of construction cost
Impact on ambient air quality due to dust generation	M	L	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion–; • Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Don't allow access in the work area except workers to limit soil disturbance and prevent access by fencing	Civil Contractor	All construction sites	Part of construction cost
Impact on air quality due to	I	L	• Ensure that all equipment & vehicles used for construction	Civil	-	Part of

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
emissions from construction equipment/ vehicles			activity are in good condition and are well maintained • Ensure that all equipment & vehicles confirms to emission and noise norms	Contractor		construction cost
Impact on aquatic life	L	M	• Construction works in the river bed shall not be conducted in fish breeding season (between mid-September and mid-October).	Civil Contractor	Headworks site	NA
Removal of vegetation/trees for construction and impacts due to presence of open trenches	L	L	• Avoid tree cutting by local and small change of layout plan/alignment • In unavoidable cases, plant two trees of same specie for each tree that is cut for construction • Bushes and grasses shall be cleared only in actual construction area all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation • Use excavated soil for refilling the pipeline trench; avoid sand layer on the top of the pipe in inaccessible areas to avoid importing material and related disturbances • Trench construction shall be taken up in small segments, so that work (excavation, pipe laying and refilling) in each segment is completed in a day. No trenches shall be kept open in the night/after work hours. This will avoid any safety risk to wild animals.	Civil Contractor	Transmission line from headworks to WTP	Part of construction cost
Disturbance to business, people, activities and socio-cultural resources due to construction work	L	M	• Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations if necessary; • Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks • Provide wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required • Increasing workforce to complete the work in minimum time in the town	Contractor	Transmission line from WTP to Lanchavli	Part of construction cost
Disturbance/nuisance/noise due to construction activity	L	L	• Plan transportation routes in consultation with Municipality	Civil Contractor	All construction sites	Part of construction

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
including haulage of material/waste			and Police • Schedule transportation activities by avoiding peak traffic periods • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material at the site by sprinkling water • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in the town • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement • Provide prior information to local people about work; • No nighttime construction activities including material/waste haulage • Educate drivers: limit speed between 20-25 KMPH and avoid use of horn in the town • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement			cost
Socio-economic benefits from employing local people in construction work	L	M	• To the extent possible labor force must be drawn from the local community • Contractor should at least source 50% of unskilled labor force from local communities	Civil Contractor	All construction sites	Part of construction cost
Impacts due to import of labor and establishment of temporary labor camps	L	L	• In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people: o Establish temporary labor camps in consultation with the local authority o Shall be located away from water bodies o No clearance of trees vegetation shall be allowed for establishment of camp	Civil Contractor	Temporary labor camps	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			o Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc) o Contractor shall provide fire wood and no worker shall be allowed to cut any tree o Ensure regular and clean maintenance of the camp			
Safety risk – public and worker	L	M	• Follow standard and safe procedures for all activities – such as provision of shoring in deep trenches (>2 m) • Exclude public from the site – enclose construction area, provide warning and sign boards, security personnel • Provide adequate lighting to avoid accidents • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc); • Maintain accidents records and report regularly	Civil Contractor	All construction sites	Part of construction cost
Historical, archeological chance finds during excavation	L	M	• Contractor shall put in place a protocol for conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. This should involve: o Having excavation observed by a person with archaeological field training; o Stopping work immediately to allow further investigation if any finds are suspected; o Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ..	UWSCG/Design Consultant	All construction sites	Part of construction cost
Cumulative impacts – repeated disturbance to roads and people	L	M	• Schedule the construction activities in harmony with the other ongoing works • Schedule the water transmission line work before road work	UWSCG	Transmission line works in the town	-
Operation						
Impacts due to abstraction of river water	M	M	• Conduct comprehensive flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability • A minimum ecological flow (1/3rd of total flow) shall be	UWSCG	Gvaldi headworks	Part of design costs

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsib-ility	Location	Cost
			released downstream all times; this means that the flow in the river shall not be less than 0.11 m3/sec at any point of time • In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow, and remaining demand shall be met by another source			
Contamination of water source			• Fence the river banks up to a few meters (10 m above and 10 m below headworks site) above headworks site to avoid any entry of animals (wild or cattle)	UWSCG	Gvaldi headworks	US $ 3,000
Impact on surface and groundwater due to disposal of increased volumes of sewage resulting from water supply augmentation	L	M	• Improve the existing sewerage system with treatment facilities, which can treat the sewage to Georgian standards and dispose safely • Extend the sewerage system to cover 100% population • Implement above measures along with the water supply system improvement	UWSCG	-	US$ 12.7 million as per FS Report
Risk of delivery of unsafe water to consumers	L	M	• Conduct regular water quality monitoring; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future • Develop & implement water quality monitoring program for distribution system • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel	UWSCG	-	Part of project design – water quality testing laboratory is part of design

H-high; M- Medium and L-Low

D. Environmental Monitoring Plan

141. A program of monitoring will be required to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by Civil Contractors will be conducted by the SC, and overseen by DQMEP's EMS, on behalf of Implementing Agency. Monitoring during operation stage will be conducted by the Operating Agency.

142. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

143. The following **Table 10** shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies various monitoring activities to be conducted. It describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 10: Environmental Monitoring Plan

Mitigation measures	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Construction Phase					
• All construction related mitigation measures	Implementation on site	All construction sites	Observations on/off site; CC records; interviews with people and workers	Weekly	SC
• All design related mitigation measures	Inclusion in the project design	-	Design review	As needed	DQMEP
• Gvaldi water quality during construction of headworks	Turbidity, Coliform, E-Coli	headworks site - downstream (50m)	Compare with base values Turbidity: 25 NTU Coliform: 100 MPN E-coli: 30 MPN	Before, during and after construction (3x2 samples)	SC
Operation					
Long Term Surveys					
• Conduct Gvaldi water quality monitoring (raw water)	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride Magnesium, Sodium Zinc, Iron, Total coliform, E-coli, BOD	1 sample from head works, 1 sample at WTP before treatment	Comparison with the base values (sep-10) and GoG Surface Water Norms[7]	Quarterly 4x2 samples/year	UWSCG
• Conduct treated water quality monitoring	Same as above	1 sample after treatment	GoG drinking water regulation (footnote 8)	Monthly 1x12 samples/year	UWSCG
• Develop & implement water quality monitoring program for distribution system[8]	Parameters as per footnote 8	Monitoring locations as per footnote 8	GoG drinking water regulation (footnote 8)	Frequency as per footnote 8	UWSCG

[7] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG (Appendix 3)
[8] Schedule N7 of Technical Regulation on Drinking Water, 2007, Ministry of Labor, Health and Social Welfare, GoG (Appendix 4)

E. Costing & Budget

144. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal construction contract, so there are no additional costs to be included in the EMP. Costs of design-related mitigation measures (such as construction of laboratory)o are included in the budgets for the civil works. The fencing of source to protect from entry of animals is included here.

145. Monitoring of implementation of mitigation measures by contractor during construction will be conducted by Environmental Management Specialist of SC. The review of design and contract to check the inclusion of all design-related mitigation measures will be conducted by Environmental Management Specialist (consultant) of DQMEP.

146. Costs of Gvaldi flow monitoring in the lean season as suggested in this IEE, are not included here separately as these will be part of detailed investigation and surveys costs, which are included in the project costs already. The cost of Gvaldi water quality monitoring during construction, which is to be conducted by Design Consultant (DC), is included in the EMP costs.

147. Long-term water quality surveys are proposed in operation phase. Periodic source water quality, raw and treated water quality at WTP is to be conducted through an external laboratory, the cost of which is included in the EMP cost (**Table 11**). Water quality monitoring in distribution system will be conducted in the laboratory of UWSCG, which will be constructed as part of the subproject, and therefore no separate costs are included.

Table 11: Environmental Management Costs

Item	Quantity	Unit Cost	Total Cost
Implementation of EMP (1 year)		*US $*	*US $*
Environmental Management Specialist (SC)	2 months	2,500[9]	5,000
Environmental Management Specialist (DQMEP)	0.25 months	2,500	625
Fencing around the source	30 m	LS	3,000
OPE (travel, per diem, surveys/interviews, reporting, etc)	LS	10,000	10,000
Gvaldi water quality during construction of headworks	6 samples	50	300
Total			*18,925*
Water Quality Monitoring (long-term)			
Source water quality – headworks, costs per year	4 samples	300	1,200
Raw water quality at WTP, costs per year	4 samples	300	1,200
Treated water quality at WTP, costs per year	12 samples	300	3,600
Total			*6,000/year*

[9] Unit cost of domestic consultants include fee, travel, accommodation and subsistence

VII. RECOMMENDATIONS & CONCLUSION

A. Recommendation

148. The environmental impacts of the all infrastructure elements proposed in the water supply improvement subproject in Mestia has been assessed and described in the previous sections of this document. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

149. Mitigation measures were discussed with engineering specialists, and some measures have been already been included in the designs. This means that the number of impacts and their significance has already been reduced by the design. These include:

- Locating the transmission mains within ROW of existing roads to minimize the need to acquire private land and related resettlement issues
- Locating WTP and reservoir on government lands
- Inclusion of water laboratory and disinfection facility to avoid public health risk due to delivery of unsafe water into distribution system

150. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. Appropriate avoidances/mitigation/enhancement measures have been suggested for the likely impacts that are identified.

151. One of the main concerns was to establish the sustainability of source during lean flow season, to meet both the project demand and downstream minimum environmental flow. Monitoring conducted in September, 2010 (which is neither peak nor lean season) indicated there is adequate flow, however to ensure the sustainability of lean season flow the following measures are suggested:

- Conducting flow measurement in December/January during the detailed design stage to confirm the minimum flow at 100% dependability
- Releasing minimum ecological flow (1/3rd of total flow) downstream all times; this means that the flow in the river shall not be less than 0.11 m3/sec
- In case of inadequate flow, the extraction shall be limited to 2/3rd of total flow

152. During the construction phase, impacts mainly arise from construction in the river bed, generation of dust from soil excavation and refilling; and from the disturbance to residents, traffic and important buildings by the construction work. These are common impacts associated with the construction processes, and there are well developed methods for their mitigation. Various measures are suggested including:

- Measures to minimize disturbance in river during construction such as conducting the work during low flow and avoiding fish breeding season etc.
- Utilizing surplus/waste soil for beneficial purposes
- Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc)
- Providing prior public information and planning the work in consultation
- Avoiding nighttime construction activities
- Conducting transmission main (headworks to WTP) work in segments, and completing entire work (excavation, pipe laying and refilling) of a segment in a day

153. Although limited, this environmental assessment process also identified opportunities for environmental enhancement. Certain measures suggested in this regard include:

- Employing the local people in construction work as much as possible to provide them with a short-term economic gain
- Employing local people in operation and maintenance of the improved system

154. Most facilities will operate with routine maintenance, which should not affect the environment. Measures have been suggested to avoid risk of source contamination from wildlife or cattle use and a source water quality surveillance program.

155. The main beneficiaries of the improved system will be the citizens of Mestia, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor (and tourists as well). This will improve the quality of life of people as well as raising standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

156. However, the benefits will be further enhanced if the increased sewage generation resulting from increased water supply is collected and disposed safely. This document identifies that there is no proper sewerage system in the town. To mitigate the likely impact, it is suggested that sewerage system with adequate capacity is developed under the Investment Program (IP) along with water supply. This has already been included in IP.

157. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged.

158. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in the town, after which views expressed were incorporated into the IEE and the planning and development of the project.

159. The recommendation of this IEE process is that all mitigation, enhancement and monitoring activities proposed here and through the parallel process of Resettlement Planning shall be implemented in full. This is essential to ensure that the environmental impacts are successfully mitigated; this is the responsibility of UWSCG.

B. Conclusion

160. The environmental impacts of the proposed water supply subproject in Mestia have been assessed by the Initial Environmental Examination reported in this document.

161. The overall conclusion of the IEE is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

162. There are no uncertainties in the analysis; thus there is no need for further study such as EIA.

Appendices

Appendix 1: Photographs of Project Sites

Photo 1: Headworks Site - Gvaldi River

Photo 4: Pipeline Alignment from Headworks

Photo 2: View of Gvaldi River Course – Hilly Terrain

Photo 5: Small Pond near Alignment

Photo 3: Alpine Forests in Mestia

Photo 6: Pipeline Alignment along the Path

Photo 7: Pasture Lands in the Alignment

Photo 10: Pipeline Alignment through Town

Photo 8: WTP & Reservoir Site

Photo 11: Pipeline Alignment through Town

Photo 9: River Mestiachala

Photo 12: Pipeline Alignment inn Lanchivli

Photo 13: Existing Underground Reservoirs Lanchivli

Photo 16: Ongoing Development Works

Photo 14: View of Existing Reservoir at Lanchivli

Photo 17: View of Mestia with Swan Towers

Photo 15: View of Existing Reservoir Site at Lanchivli

Photo 18: View of Hills around Mestia

Appendix 2

Proceedings of the Safeguards Public Consultation Meeting at Mestia

A public consultation meeting was organized by Government of Mestia Municipality (GMM) on the request of UWSCG on November 13, 2010. The meeting was organized at the Municipality Office in Mestia. GMM has invited the elected representatives, non-governmental organizations (NGOs), and general public. Eighteen participants were present in the meeting (List attached in **Table 1**). The purpose of the meeting was to present to the stakeholders the proposed water supply improvement project to be implemented under the ADB funded GUSIIP, its likely environmental impacts and planned mitigation measures and to receive suggestions and feedback on the same.

A presentation on the proposed project and Initial Environmental Examination study was made by ADB TA consultants. Officials from the Mestia Service Centre represented the implementing agency (UWSCG). Following were presented and discussed:

- Proposed project activities of Mestia Water Supply Improvement Subproject
- Policy, legal and administrative structure
- The possible negative impacts on the environment
- Mitigation measures, environmental management and monitoring
- Analysis of Alternatives
- Grievance Redress Mechanism

Stakeholders were most supportive of the project stressing the need to improve water supply in Mestia and were of the view that the proposed project will improve the environmental quality of the town. Following are the queries/comments of the participants and replies by UWSCG and Consultants.

Question /Comment of the content	**Comments**
1. Will the compensation be given to those of the population who has private property but has not had time to register it?	As the project is conducted by the Asia Development Bank, each proprietor whose property is traversed by the pipeline and who temporarily or permanently could not benefit from the land in the ownership, shall be given appropriate compensation, despite the fact, whether the land is officially registered or not. Other group hired by ADB is also working on the issue.
2. How deep shall the pipeline be laid and at what depth does the ground freeze?	The land is frozen at 40-50 cm within the project area, while the pipeline is buried at 1 m depth.
3. How shall the removed humus layer of the soil be temporarily stored?	The humus layer should be stored in compliance with the below requirements: • The height of the stored layer should not exceed 2 m; • The inclination angle should not exceed 45 %; • Humus layer should not be mixed with unfertile layer;

	• The rain should not wash the stored soil.
4. Shall the local people be employed?	Minimum 50 % of the people employed during the construction shall be local population.
5.Shall the sufficient amount of water be supplied to Mestia after the completion of the project?	The project counts for the development of Mestia as tourist town, which requires the existence of the corresponding infrastructure. The project is proposed with due regard to long-term perspective, which implies the servicing of 20 000 tourists in Mestia daily by 2040.

Table 1: List of Participants

Name of the Participant	Organization	Contact Number
Guladi Gabliani	Police of Mestia	896 11 40 85
Fatima Kvarchiani	Mestia Municipality, Infrastructure architecture and construction services,	899 34 96 84
Soso Khvigliani	Local Representative	890 90 01 05
Lasha Japaridze	Mestia Municipality	893 78 20 05
Mziuri Jafaridze	Mestia Municipality	890 85 85 20
Gvarliani Gocha	Mestia “Sakrebulo”	877 95 52 87
Gia Tevzadze	Non-governmental organization"Human Rights Center’’	893 94 98 43
Mamuka Tivishvili	Head Specialist. Mestia Municipality, infrastructure architecture and construction services.	877 14 84 20
Zurab Revazishvili	Non-governmental organization ’’Information Centre of Social Reforms’’	8 55 26 81 08
Tinatin Jijiashvili	United Water Company of Georgia	-
Evan Zarandia	United Water Company of Georgia .	
Maizer Gafaridze	United Water Company of Georgia. Mesta Service centre	-
Paata Chankotadze	TA Consultant, Asian Development Bank	-
Irakli Kaviladze	TA Consultant, Asian Development Bank	-

Photographs of Consultation Meeting

Appendix 3

General Requirements: Regulation of Water Composition and Features in Reservoirs According to Water Use Categories (Appendix 1 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

	Water Use Category			
			Fishery Purposes	
Indexes	**For potable-economic purposes of the population**	**For economic-household purposes of the population**	**The highest and first categories**	**The Second Category**
1	**2**	**3**	**4**	**5**
	The increase of the composition of the suspended particles is allowed for no more than:			
Suspended particles	0,25 mg/l	0,75 mg/l	0,25 mg/l	0,75 mg/l
	For the rivers containing 30 mg/l natural suspended particles during the lowest water level the increase of the composition of these particles is allowed within 5 %.			
	If the sewage waters contain suspended particles with sedimentation velocity not exceeding 0,2 mm/sec, their disposal into reservoirs (lakes) is banned and if the velocity exceeds 0.4 mm/sec – in rivers (channels)			
Floating mixtures (substances)	Layers of oil products, oils and fats and other mixtures should not be visible on the water surface			
Color	Should not be visible in water column:		Water should not gain strange color	
	20 cm	10 cm		
Odor, taste	Water should not gain odor and taste exceeding 1 score in intensity, which could be observed:		Water should not render fish products strange odor and taste	
	directly, after further chlorinating or other treatment	directly		
Temperature	The summer temperature of water should not increase for more than 30 C as a result of sewage water discharge in comparison with the average monthly temperature of the hottest month for the recent 10 years		The water temperature should not increase for more than 50 C in comparison with the natural temperature of the reservoir. In addition, in water objects where cold water fishes (salmon and whitefish) are present: 200 C in summer and 50 C in winter and for other water objects 280 C in summer and 80 C in winter	
Reaction (pH)	Should not exceed 6,5 - 8,5			
Water Mineralization	Not exceeding 1000 mg/l, of which: chlorides -350 mg/l, sulphates -500 mg/l	Standards are applied according to the above “taste” indexes	Standards are applied according to the taxation of the fishery water objects	

Oxygen in water	Should not be less in any water period:			
	4 mg/l	4 mg/l	6 mg/l	6 mg/l
BOD At $20^{o}C$ should not exceed:	3 mg/l	6 mg/l	3 mg/l	6mg/l
COD Should not exceed	15 mg/l	30 mg/l		
Disease causing	Water should not contain disease causing elements – viable helminth eggs, oncospheres of tenidia and viable protozoa cysts of pathogenic intestines			
Lactose positive intestine bacillus	1 in 10000	1 in 5000		
Coliphages not exceeding	1 in 100 l	1 in 100		
Water toxicity			Should not have severe toxic impact on test-objects at the points of discharge of the sewage waters into the water objects. The water from the water object at the control cross section should not have chronic toxic impact on test-objects	

Maximum Permissible Concentrations of the Contaminant Substances in Reservoirs According to Water Use Categories (Appendix 2 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

S. No	Ingredient name	Hazard class	For potable-economic-household water use reservoirs		For fishery water use reservoirs	
			Limited indexes of harmfulness	Maximum Permissible Concentration mg/l	Limited indexes of harmfulness	Maximum Permissible Concentration mg/l
1	2	3	4	5	6	7
1.	amine nitrogen	3	sanitary-toxicological	0,39	toxicological	0,39
2.	aluminum	2	sanitary-toxicological	0,5	sanitary-toxicological	0,5
3.	barium	2	sanitary-toxicological	0,1	organoleptic	2,0
4.	beryl	1	sanitary-toxicological	0,0002	sanitary-toxicological	0,0002
5.	boron	2	sanitary-toxicological	0,5	toxicological	10,0
6.	arsenic	2	sanitary-toxicological	0,05	toxicological	0,05
7.	vanadium	3	sanitary-toxicological	0,1	toxicological	0,001
8.	quicksilver	1	sanitary-toxicological	0,0005	toxicological	0,00001(should not
9.	tungsten	2	sanitary-toxicological	0,005	toxicological	be)
10.	zinc	3	general sanitary	1,0	toxicological	0,0008
11.	cadmium	2	sanitary-toxicological	0,001	toxicological	0,01
12.	cobalt	2	sanitary-toxicological	0,1	toxicological	0,005
13.	caprolactam	4	general sanitary	1,0	general sanitary	0,01
14.	magnesium	3	organoleptic	0,1	toxicological	1,0
15.	molybdenum	2	sanitary-toxicological	0,25	toxicological	0,01
16.	nitrates	3	sanitary-toxicological	45,0	sanitary-toxicological	0,012
17.	nitrites	2	sanitary-toxicological	3,3	toxicological	40,0
18.	nickel	3	sanitary-toxicological	0,1	toxicological	0,08
19.	iron	3	organoleptic	0,3	toxicological	0,01
20.	selenium	2	sanitary-toxicological	0,001	toxicological	0,005
21.	copper	3	organoleptic	1,0	toxicological	0,0016
22.	sulphates	4	organoleptic	500	sanitary-toxicological	0,001 100,0

(Legislative Herald of Georgia 18.12.2007. art. N 179 1973)

Registered in The Ministry
of Justice of Georgia
Registration number
470.230.000.22.035.011. 242

Decree N 349/N of The Ministry of Labor, Health and Social Affairs of Georgia

December 17, 2007

About Approval of Technical Regulation of Drinking Water

According to "The Public Health Law", "V" sub-paragraph of the article #3 and the first paragraph of the article #23, I give order:

1. To approve the enclosed 'Technical Regulation of Drinking Water".
2. The decree comes into force from the date of publication.

D. Tkeshelashvili

Technical Regulation of Drinking Water

Article **1. General provisions**

1. The Technical Regulation is made on the basis of the Law of Georgia about "Public Health", recommendations of the World Health Organization, European directions, regional characteristics of the country and climate-geographical conditions and sets the safe sanitary norms of human being for drinking water.

2. Liabilities by this Technical regulation should cover the following:

a) Natural or treated water, which is used for drinking, in food and other domestic purposes, in spite of origin and the supply method (distribution network, tank or cistern, bottle or container);

b) Water, which is used in food-stuffs or food-stuff products.

3. Liabilities by this Technical regulation should not cover the following:

a) Curing-mineral waters;

b) Medical water and water with other special targets;

c) Drinking water supplied by some individual source, the capacity of which 10m3/per day serves less than 50 persons not included in commercial or public network.

d) Natural mineral waters, where the mineralization exceeds 1500 mg/L.

4. The following characteristics and their normative size are defined by the Technical Regulation of drinking water:

a) Organoleptic characteristics;

b) Microbiological, inframicrobiological and parasitological characteristics;

c) Chemical characteristics (general characteristics, inorganic and organic substance);

d) Characteristics of radiative safety;

e) Standards of harmful chemical substance, as a result of water treatment;

5. The compliance tests defined by the Technical Regulation, must be carried out as follows:

a) In cases of water distribution systems inside buildings and storehouses, directly from the tap that supplies water to the consumers;

b) In cases of tanks and cisterns from the delivery point;

c) In cases of canning in the bottling point of water and in the selling point;

d) At the point of usage in those enterprises involved with food-stuffs and food products;

6. Any organization implementing the supply service of drinking water, despite the organizational-legal structure and departmental subordination, is liable to carry out the control and monitoring of compliance of drinking water with the defined characteristics under the Technical Regulation; providing accessibility of information and collected data.

7. In cases where the required standards are not met under the Technical Regulation, the supplier of drinking water is liable to carry out appropriate measures, including report to relevant organs, urgent analysis of pollution reasons, restriction of water usage and other measures for the safety of population.

Article 2. Sanitary Requirements on Drinking Water

1. Drinking water must be safe from the epidemical and radiative point of view and by chemical composition; Drinking water must have benevolent organoleptic characteristics.

2. Quality of drinking water must be in compliance with the sanitary standards under this Technical Regulation.

3. The organoleptic characteristics of drinking water must be in compliance with the requirements in the schedule N 1:

Schedule N1

Index	Measuring unit	Standard not more than:
Smell	Numbers	2
Taste	Numbers	2
Coloration	Degree	15
Turbidity	Turbidity unit (by	3,5

	formazin) or mg/L (by kaolin)	 2

4. The existence of outer membrane and water organisms seen with the naked eye is not allowed in drinking water.

5. The following analysis in the schedule #2 (according to the reason) must be carried out for detection and elimination in case of deterioration of organoleptic characteristics of drinking water:

Schedule N2

Index	Measuring unit	Standard not more than:
Sulphate (SO_4^{2-})	mg/L	250
Chloride (Cl^-)	mg/L	250
Oil products, total	mg/L	0,1
Surfactant substance anionoactive	mg/L	0,5
Rigidity	mg–eq./L	7–10
Calcium (Ca)	mg/L	140
Magnesium (Mg)	mg/L	85
Sodium(na)	mg/L	200
Zinc (Zn^{2+}),	mg/L	3,0
Iron (Fe, total),	mg/L	0,3

6. Epidemical safety of drinking water is defined by microbiological, inframicrobiological and parasitological characteristics in accordance with the given standards in the schedule #3.

Schedule N 3

Index	Measuring unit	Standard
Mezophilic aerobes and facultative anaerobes	Colony forming unit/ML 37^0 C 22^0 C	Not more than: 20 100
Total coliformic bacterias	Amount of bacteria in 300 ML	not allowed
E. coli	Amount of bacteria in 300ML	not allowed
Pathogenic microorganisms, including Salmonella	In 100 ML	not allowed
Coliform	Negative colony forming unit in 100ML	not allowed
Pseudomonas aerugiosa (only for pre- aliquoted)	In 250ML	not allowed

Streptococus faecalis	In 250LM	not allowed
Lamblia cysts	Amount of cysts in 50L	not allowed
Dysentery (amoebiasis) cysts	Amount of cysts in 50L	not allowed

7. Amount of mezophilic aerobes and facultative anaerobes must not exceed 100 colony forming unit in 1 ML in case of flood and other natural calamities.

8. Amount of mezophilic aerobes and facultative anaerobes and standards of total coliformic bacteria must not exceed in 95% of tests during 12 months in the water intake points of the water line network.

9. Definition of total coliformic bacterias and E. coli is implemented in the three parallel 100-100 ML tests.

10. Definition of lamblia cysts and Dysentery (amoebiasis) cysts is implemented in the water supply systems of surface sources.

11. Chemical composition of drinking water must satisfy requirements in the schedule #4.

Schedule N 4

Index	Measuring unit	Standard not more than:
Common characteristics		
Hydrogen index	PH	6-9
Permanganate oxidation	mg O_2/L	3,0
Total mineralization (dry remains) mg/L		1000–1500
Nonorganic substance		
Barium (Ba^{2+})	mg/L	0,7
Boron (B,total)	mg/L	0,5
Arsenic (As,total)	mg/L	0,01
Quicksilver (Hg, nonorganic),	mg/L	0,006
Cadmium (Cd, total)	mg/L	0,003
Mangan (Mn, total)	mg/L	0.4
Milobden (Mo, total)	mg/L	0,07
Nickel(Ni, total)	mg/L	0,07
Nitrate(short impact by $NO^-_{3)}$	mg/L	50
Nitrite (long impact by $NO^-_{2)}$	mg/L	0,2
Selenium(Se, total)	mg/L	0,01
Copper(Cu, total)	mg/L	2,0
Lead (Pb, total)	mg/L	0,01
Flourine (F^-)	mg/L	0,7
Chromium (Cr^{6+})	mg/L	0,05
Antimony(Sb)	mg/L	0,02
Cyanide(CN^-)	mg/L	0,07
Organic substance		
Total content of pesticides	mg/L	0,05

12. The control and monitoring must be implemented only on those pesticides, which can be contained in the water supply source. Together with this, the accordance of index must be defined individually for each pesticide and standard of aldrin, dieldrin, hectochlore and heptachlor epoxide content must be 0,030 microgram in Liter.

13. The following pesticides, their metabolites and products of reaction and dissolution are regulated for the provision of safety of drinking water:

a) Organic insecticides;
b) Organic herbicides;
c) Organic fungicides;
d) Organic nematocides;
e) Organic acaricides;
f) Organic alhycides;
g) Organic rodenticides;
h) Organic slymicides;
i) Similar products (including growth regulators).

14. Content of those harmful substances which occur in the water supply sources as a result of economic activity (not listed in the schedule #4), must not exceed quality standards set by the Ministry of Labor, Health and Social Affairs.

15. Radiative safety of drinking water is defined by the accordance of total α and β– radioactive characteristics with the standards in the schedule #5.

Schedule N 5

Index	Measuring unit	Standard not more than:
Total α– radio-activity	bk/L	0,1
Total β –radio-activity	bk/L	1,0

16. Identification of radionuclide in water is implemented in case of exceeding of total radio-activity standards. Estimation of revealed concentrates is implemented according to the radiative safety regulations.

17. Content of harmful chemical substance in the process of water treatment in the water supply system must be in compliance with the requirements given in the schedule #6. Together with this, the index of control is defined according to the concrete treatment technology.

Schedule N 6

Index	Measuring unit	Not more than:

Chlorine remains free	mg/L	0,3 –0,5
Chlorine remains connected	mg/L	0,8–1,2
Chloroform (during chloration)	mg/L	0,3
Ozone remains	mg/L	0,3
Aluminium (Al^{3+})	mg/L	0,1
Formaldehyde (during ozonization)	mg/L	0,05
Acrylamide	mg/L	0,0005
Active silicate acid (with Si)	mg/L ^{3}	10
Polyphosphate (according to PO^{3}_{4-})	mg/L	3,5

18. Duration of the chlorine contact with water during deactivation with free chlorine-no less than 30 minutes, with connecting chlorine-no less than 60 minutes.

19. The total concentration must not exceed 1,2 mg/L during simultaneous content of free and connected chlorine in drinking water.

20. The control of the ozone remains is implemented after mixing box; The contact of ozone with water-no less than 12 minutes.

21. In case of detection of several chemical substances in drinking water, which are regulated by the same limitative index, total correlation of each must not exceed 1 with the utmost admissible concentration.

Article 3. The Internal Control and Monitoring of Drinking Water

1. The internal control and monitoring of drinking water is implemented by the supplier.

2. The definition characteristics of drinking water and amount of research tests must be in compliance with the requirements in the schedule #7.

3. During the analysis of microbiological and organoleptic characteristics, the water samples are taken once in month in the distribution system of water supply, which supplies water to 20 000 residents.

4. With coordination of the competent state organs, the enhanced control regime must be implemented in case of flood and other natural calamities.

Schedul

e N7

	Number of samples per year/no less than				
Index	Number of consumers connected to the water supply system (thousand consumers)				
	Ground source			Surface source	
	Up to 20	20–100	More than 100	More than 100	More than 100
Microbiological	12	24	365	365	365

Parasitology	(is not implementing)			4	4
Organoleptic	12	24	365	365	365
General characteristics	4	6	12	12	24
Nonorganic and organic substances	1	1	1	4	12
Radiological	1	1	1	1	1
Index/ Connected to the technology of water treatment	Chlorine remains, ozone remains (no less than one in an hour), reagent remains (no less than one in shift				

5. The necessary control samples which must be taken after the repair of the distribution network and other maintenance are not included in the amount of samples defined in the second item.

6. In case of detection of total coliformic bacteria and E. coli in the sample of drinking water, it is necessary to define them urgently in the secondary sample. Chloride, nitrites and nitrates must be defined simultaneously for detection of pollution reasons.

7. In case of detection of total coliformic bacteria and E. coli in the secondary sample, the analysis of water is implemented according to the existence of pathogenic bacterium of intestinal group and (or) streptococus faecalis.

8. All the samples from the ground and surface water supply lines require definition of organoleptic characteristics (except samples for the analysis of neutralizing reagents).

9. The laboratory analysis must be implemented according to the following criteria for the routine monitoring:

a) Organoleptic: smell, taste, coloration, turbidity;

b)Microbiological: Mezophilic aerobes and facultative anaerobes, total coliformic bacterias E.coli ;

c) Chemical: PH, nitrogen forms (ammonia, nitrate, nitrite), chlorides, rustiness, chlorine remains.

Article 4. The State Control of Drinking Water

1. The scheme of the state control and monitoring of drinking water, sequence, characteristics for definition and amount of samples are defined according to the law of the relevant state controlling unit.

2. The samples of drinking water must be taken in accredited independent laboratory in compliance with the law.

Government of Georgia
Asian Development Bank

Environmental Assessment Report

Project Number: 43405
November 2010

Proposed Multitranche Financing Facility
Georgia: Urban Services Improvement Investment Program

INITIAL ENVIRONMENTAL EXAMINATION REPORT
Zugdidi Water Supply Improvement Subproject

ABBREVIATIONS

ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
CA	-	Cross section area
COD	-	Chemical Oxygen Demand
CWRD	-	Central and West Asia Region Department
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIP	-	Environmental Impact Permit
EMP	-	Environmental Management Plan
GoG	-	Government of Georgia
GRC	-	Grievance Redresses Mechanism
HDPE	-	High Density Poly Ethylene
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IPMO	-	Investment Program Management Office
DC	-	Design Consultant
MC	-	Management Consultant
Km	-	Kilometer
LPCD	-	Liters per Capita per Day
M	-	Meter
MFF-IP	-	Multitranche Financing Facility Investment Program
mg/l	-	milligram per liter
Mm	-	Millimeter
MoEPNR	-	Ministry of Environment Protection and Natural Resources
MoRDI	-	Ministry of Regional Development & Infrastructure
OSPF	-	Office of the Special Project Facilitator
OCRP	-	Office of the Compliance Review panel
PCB	-	Polychlorinated Biphenyls
RCC	-	Reinforced Cement Concrete
SC	-	Supervision Consultant
SF6	-	Sulfur Hexafluoride
SIEE	-	Summary Initial Environmental Examination
SOP	-	Standard Operating Procedures
UWSCG	-	United Water Supply Company of Georgia
WSS	-	Water Supply & Sanitation

Table of Contents

EXECUTIVE SUMMARY

1. It is proposed to improve the water supply system in Zugdidi under the Asian Development Bank (ADB) funded Urban Services Improvement Investment Program, which is under preparation stage. This Investment Program, implemented in six towns will develop the water and sanitation services, which will improve quality of life and optimize the social and economic development. Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) and United Water Supply Company of Georgia (UWSCG) is the Implementing Agency (IA) of this Program. This subproject will be implemented from mid-2011 and likely to be completed by the end of 2012. Since the subproject is unlikely to have significant adverse impacts, it is classified as environment Category B, and accordingly an Initial Environmental Examination has been conducted. This is a summary of the IEE Report.

2. Zugdidi, situated at 258 km west of Tbilisi, is the administrative centre of the Samegrelo-Zeda Svaneti Region. UWSCG's Zugdidi Service Centre operates the water supply system in Zugdidi City and a number of outlying small towns and villages. Traditionally, water supply to Zugdidi was from Rechko headworks located in Abjkazia. With the 1992-93 Civil War, this source no longer available. At present, water supply is provided to only 7% of thepopulation from local bore holes. This water supply improvement sub-project is therefore designed for a complete revival of the system to meet the present and future demands. Water will be tapped from the Enguri Dam.

3. With the government's focus on the coastal tourism, the coastal areas of the Zugdidi District are expected to generate a huge water demand. Taking the advantage of the dam source, besides Zugdidi, subproject will also cover Anaklia, Ganmukhuri and other en-route villages. The subproject will meet the demand of 2040. This will be achieved by: (i) desilting and providing a outlet to tap water from the Enguri Dam, (ii) construction of a Water Treatment Plant near Bashi, (iii) rehabilitating the existing storage reservoirs at Bashi, and (iv) laying of raw water and clear water transmission mains.

4. The project area extends over a length of 80 km from the Enguri Dam in the foothills of Central Caucasus to Anaklia and Ganmukhuri in the Black Sea Coast. The entire area is in the Enguri River Basin; the topography varies from hilly to flat towards the coast. Owing to its varied physical and geographic conditions, the vegetation in the project area is rich, diverse and consists of three types: (i) Oaks and broad leaved forest near the Dam, (ii) Foothill forests and Kolketi low lands, and, (iii) Kolkheti marshes and swamp forests. Almost all the roads in project area are lined with avenue plantation; the trees include some species listed in the Red Book as "endangered".

5. The subproject activities will be located along the roads and vacant land parcels. The Enguri Dam is connected by Zugdidi-Dzvari-Mestia-Lasdili Road, along which the transmission line from the Dam to the WTP will be laid. Near the dam, the pipeline runs along the river bank. The WTP will be developed on a government-owned site near the Bashi Village. The transmission line from WTP to the Bashi Reservoir will be laid along an un-surfaced road. The transmission line from the Bashi Reservoir to Zugdidi will be laid along narrow roads through sparsely developed areas. This line crosses into private fields for about 200 m. The Zugdidi – Anaklia, Ganmukhuri, Rukhi and Akhal Abastumani pipelines will be laid along the main roads.

6. The Zugdidi water supply improvement subproject involves straightforward construction and low-maintenance operation. Although there are forests and marshy lands, none of the components will cross these areas and all the activities are planned along the roads and on vacant lands. Further, any disturbance will be limited to construction. The likely impacts are short-term, localized and can either be easily avoided or mitigated.

7. The dam desilting work is also not likely to have adverse impacts, because: the volume of material produced by the desilting is likely to be small as the main purpose is to allow free flow from the bottom sluices; silt contains no hazardous substances; it is unlikely to disrupt the water supply to power plant; and, the aquatic life in the reservoirs is very limited due to poor biomass content and there is no fishing activity. However considering the lack of specific information on volumes of material, its properties and dredging method, various measures are suggested including: conducting detailed investigations during the design for sediment bathymetry and volumes, and preparing a Silt Management Plan (with appropriate sediment collection and dewatering methods, dredged material management strategy including its beneficial utilization). Tree cutting along the pipeline alignment will be avoided. The Red Book species will be identified and marked during the alignment fine tuning. These trees will not be cut.

8. The other predicted impacts associated with the construction process, are produced because that process is invasive, involving trenching and other ground disturbance. However the routine nature of the impacts means that they can be easily mitigated. Impacts mainly arise from generation of dust from soil excavation and refilling; and from the disturbance of residents, traffic and activities by the construction work. These are common impacts of construction, and there are well developed methods suggested for their mitigation. These include: (i) Utilizing surplus/waste soil for beneficial purposes; (ii) Measures to reduce/control dust generation; (iii) Providing prior public information; (iv) Planning transport routes/schedules carefully and awareness creation in drivers; (v) Following standard and safe procedures for public and worker safety, and (vi) Avoiding nighttime construction activities.

9. The main risk of operating an improved water supply system is that increased water abstraction will deplete the water resource and will have impacts on the downstream ecosystem. However, for this subproject, water is abstracted from the Enguri dam, and the abstraction is just a fraction of total water storage. It will also not affect current uses (i.e. power generation). Present water quality is suitable for drinking after treatment to reduce turbidity and remove pathogens, and the necessary facilities are included. There are no major water pollution sources in the catchment.

10. The water treatment process will generate waste, such as sludge from sedimentation, chemical coagulation, etc, and from back washing of the filter media. Well developed methods such as the following are suggested for mitigation: providing arrangements for re-circulation of wash water; providing sludge collection, drying system and beneficial use of dried sludge. There is also an identified safety and health risk in operating chlorinators, and necessary measures are developed. Few measures are suggested to enhance the subproject benefits through avoiding transformers and electric equipment containing harmful substances, and employing local people in the construction work. The subproject is likely to have several positive benefits. The citizens will be provided with a constant supply of better quality water, which will improve the quality of life and will also support the tourism development.

11. To ensure that all the mitigation measures as suggested are implemented, a program of environmental monitoring is prepared. Department of Quality Management and Environmental Protection (DQMEP) of UWSCG will oversee and be responsible for implementation of mitigation and monitoring measures. Provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

I. INTRODUCTION

A. Background

1. The proposed Urban Services Improvement Investment Program is intended to optimize social and economic development in select urban areas (provincial capitals and secondary towns) through improved urban water and sanitation (WSS) services. This ADB funded Multitranche Financing Facility Investment Program (MFF-IP) complements the government's emerging vision for the WSS sector, formulated in its sector development strategy and road map, policy framework and reform implementation plan, and a business climate that encourages increased donor investment. This support will also complement ongoing donor efforts to improve and expand Georgia's urban WSS services. ADB identifies support to developing the country's municipal infrastructure a key contributor to enhancing sustainable economic growth, with the cross cutting themes of governance, regional cooperation and environmental protection. ADB's support can contribute to: (i) sector reforms; (ii) strengthening the link between financing local infrastructure projects and decentralization reforms; (iii) stimulating local economic development; and (v) improving the quality of life of urban population.

2. *WSS Services in Georgia*. The service levels of urban water supply and sanitation systems in Georgia at present are not satisfactory. Piped water supply service is available to less than 75 percent of urban population. Most of the serviced population suffers with inefficient service levels – inadequate and intermittent supply with low terminal pressure. Due to old systems, most of the pipelines are profusely leaking, and water lost in the system is as high as 50-70 percent. Similarly, less than 50 percent of the urban population is connected with the underground sewerage system, and the rest depend on individual disposal systems like pit latrines, septic tanks etc. Sewage treatment facilities are almost non-existent and collected waste is disposed untreated into rivers/streams raising environment and public health concerns.

3. This Investment Program focuses on investments to improve basic urban infrastructure (i.e. water supply and sewerage). Besides, it will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. This Program will be implemented in 3 tranches over a period of 8 years beginning in 2011. The Executing Agency (EA) is the Ministry of Regional Development and Infrastructure (MoRDI), Government of Georgia; and the Implementing Agency (IA) is the United Water Supply Company of Georgia, a wholly-owned company of Government of Georgia under MoRDI. The proposed investments under Tranche-1 include improvement of water supply systems in urban areas of Marneuli, Zugdidi and Mestia.

4. The Zugdidi water supply improvement subproject has been classified as environmental assessment category B (some negative impacts but less significant than category A). According to ADB procedures, the impacts of the subproject were assessed by the Initial Environmental Examination, conducted according to ADB Safeguard Policy Statement (2009).

B. Extent of the IEE Study

5. This is the Initial Environmental Examination (IEE) Report for the Zugdidi Water Supply subproject. It discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. It is one of the three IEE documents prepared for Tranche 1 subprojects. These were prepared in July-October 2010 by an International and a Domestic Environmental Specialist via inputs of 2.5 months each.

6. This IEE study is conducted based on the feasibility study proposals. Certain details may therefore change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs, so certain aspects (such as layout plan of WTP etc) are not available at this stage.

7. This IEE study is conducted based on secondary information and data from various sources and field observations. Field surveys were limited to essential baseline factors such as source water and sediment quality.

8. Since there are no significant, irreversible, or complex issues involved, no specialized techniques were required to be employed. All impacts were simple, easy to identify and mitigation measures were readily available.

C. Report Structure

9. This IEE Report is organized into seven sections including this introductory section:

Section 2 establishes the project need, rationale and alternatives
Section 3 describes project components and construction & operation details
Section 4 discusses impacts on physical and biological environment
Section 5 discusses impacts on socio-economic environment
Section 6 provides Environmental Management Plan and Monitoring Plan, and
Section 7 emphasizes on IEE recommendations and concludes the report

II. PROJECT RATIONALE AND NEED

A. Type of the Project

10. This is an urban water supply improvement sub-project. This is involves development of infrastructure facilities for water abstraction from an existing dam, treatment, transmission and storage facilities.

B. Need of the Project

11. As discussed earlier, the service level of urban water supply in Georgia at present are not satisfactory. Services are not available to entire population and the serviced areas suffer with inefficient service levels. Systems are old and inefficient. The situation is at it's worst in Zugdidi. UWSCG's Zugdidi Service Centre operates the water supply system in Zugdidi City and a number of outlying small towns and villages in Zugdidi and Tsalenjika District Areas. Traditionally, water supply to Zugdidi was from Rechko headworks located in Abkhazia. With the 1992-93 Civil War, this source no longer available for Zugdidi which lead to complete collapse of water supply system. At present, UWSCG supplies 2,200 m^3 per day of water from three bore wells, which serves about 7% of total population. The remainder of the population depend on individual sources (like bore wells). Consequently, the existing distribution system has not been in use for the last two decades. UWSCG supplies water to Anaklia, the coastal village where tourism development works are underway, from a separate groundwater source.

12. The present sub-project is therefore designed for a complete revival of the water supply system to meet the present and future demands. The subproject will improve the service standards – a daily supply of potable water in adequate quantities (200 lpcd) and at the requisite pressure.

13. With the increasing focus of the government on tourism as a major economic activity, the coastal areas of the Zugdidi District (Anaklia and Ganmukhuri) are expected to generate a significant increase in water demand in the near future..

C. Location

14. This sub-project is located in Zugdidi, the administrative centre of the strategically important Samegrelo-Zeda Svaneti Region, and is located at 318 km west of Tbilisi. Geographically, it is situated at 41°52'14.75" East latitude and 42°30'29.65" North longitude, 100 m above the MSL. Regional location of Zugdidi is shown in **Map 1**.

15. The subproject involves development of bulk water supply facilities, and most of the sites are located outside the city. There are four main components: (i) desilting and infrastructure to tap water from the Enguri Dam, (ii) A water treatment plant (WTP) near Bashi, (iii) Rehabilitation of existing storage reservoirs at Bashi, and (iv) Raw and treated water transmission mains - from the Dam to WTP; WTP to existing reservoirs at Bashi; and from Bashi Reservoir to Zugdidi, Anaklia, Ganmukhuri, Rukhi and Akhal Abastumani.

16. The Enguri Dam is located at 50 km northeast of Zugdidi City and is accessible by Zugdidi-Jvari-Mestia-Lasdili road. The transmission line from the Dam to WTP will be laid along this road for the majority of its length. A section of the pipeline will run along the River Enguri near the dam. The WTP site is located about 1 km from this road and accessible through a narrow earthen road, along which the transmission main will be laid.

17. The WTP will be developed on a government-owned 4 ha site near Bashi Village. The transmission line from WTP to Bashi Reservoir will be laid along an un-surfaced road.

18. The transmission line from Bashi Reservoir to Zugdidi will be laid along narrow roads through a residential area. This line crosses into private fields for about 200 m near the reservoirs. The Zugdidi – Anaklia, Ganmukhuri, Rukhi and Akhal Abastumani pipelines will be laid along the main roads connecting the respective areas with Zugdidi. Locations of the subproject are sites are shown in **Map 2**. Proposed site for WTP is shown in **Map 3** and the existing Bashi Reservoir site is shown in **Map 4**. Detailed transmission main alignment drawings are presented in **Appendix 2** (Map 2A to 2D).

D. Implementation Schedule

19. Detailed design of the subproject will begin in October 2010 and should be completed by March 2011, after which construction will take about 18 months, so all work should be completed by the middle of 2012.

Georgia Urban Services Improvement Project - Zugdidi

Location of Project Town

Legend

- Country Boundary
- State Boundary
- District Boundary
- Project Town

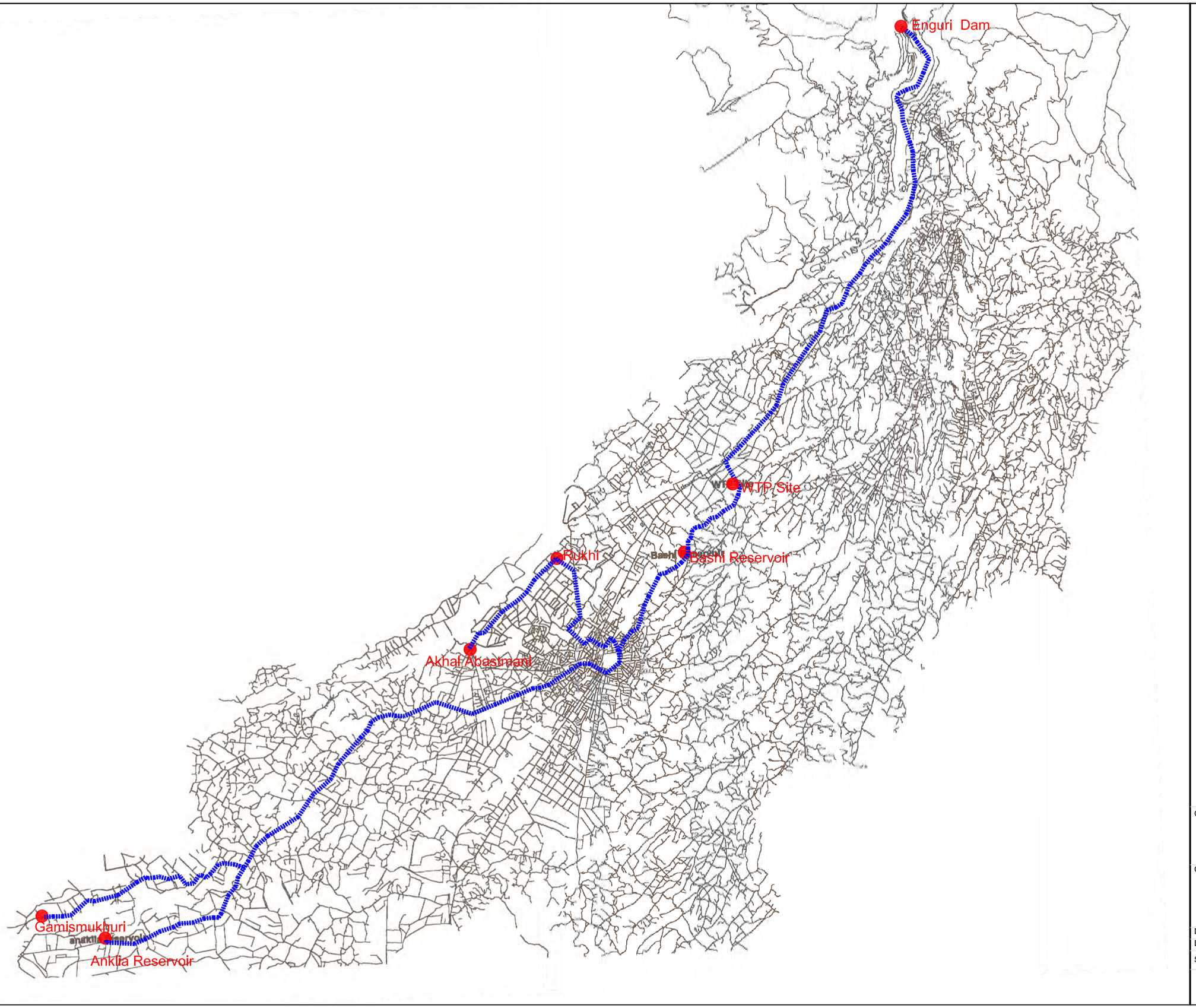
Client:
Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

Map - 1



Georgia Urban Services Improvement Project - Zugdidi

Location Of Project Sites

Project Sites

Proposed water transmission alignment

Client:

Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

Map - 2

Georgia Urban Services Improvement Project - Zugdidi

Proposed WTP Site at Bashi

Client:
Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

Map - 3

Georgia Urban Services Improvement Project - Zugdidi

Existing Reservoirs at Bashi

Client:
MInIstry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

Map - 4

E. Project Alternatives

20. Since there is no operating water supply system in the region, the design of the subproject focused on developing a new source which could provide an adequate supply of good quality water to meet present and future demand. The following two options were considered: (i) groundwater and (ii) surface water from the nearest source – Enguri Dam. Key considerations during the selection of a suitable option were as follows:

- Usage of groundwater will require pumping for extraction and as well as for distribution
- Preferably a combined source which can provide supply both Zugdidi and Anaklia; increasing groundwater extraction to meet the huge tourism demand from coastal aquifer is unlikely to be sustainable and there will be a risk of salt water intrusion
- Enguri Dam is a feasible alternative source, considering:
    - adequate water availability throughout the year
    - good water quality
    - appropriate location on higher elevation, which allows design of a complete gravity flow system for entire service area, and
    - Dam can provide supply to the entire service area; service can be provided to en route villages and towns through gravity with comparatively lesser capital and O&M costs

21. Following **Table 1** shows the water demand of the project area. As stated above, taking the advantage of the dam source, the project has been designed to maximize the coverage. The subproject will serve an estimated 181,020 (2040) population, including an estimated 42,000 tourist population.

Table 1: Water Demand

Year	Zugdidi City	Remaining Service Area Population	Total	Net Water Demand	Gross Water Demand
	No,s	*No,s*	*No,s*	*m3*	*m3*
2010	69,750	56,320	126,070	25,214	30,257
2040	119,880	61,140	181,020	36,204	43,445

Notes:

(i) Net demand (at consumer end) – 200 liters per capita per day

(ii) Gross demand (supply required from source): net demand + 20% losses

22. Having selected the alternative of sourcing water from the Enguri Dam, other alternatives within this system are considered for selection of appropriate locations for project facilities (**Table 2**).

Table 2: Location of Proposed Infrastructure Facilities

Components	**Location Justification**
Site for Water Treatment Plant (WTP)	A government site situated near Bashi has been selected for WTP. Site is vacant and there are no encroachments. With the total area of 4 ha site is adequate for WTP.
Transmission main from the Dam to proposed WTP near Bashi	Total length 25 km; pipeline is aligned in the ROW of the existing roads and river bank to avoid private land acquisition. At the points where the road bends significantly, the pipeline may take a shorter route across small areas of barren land and some cultivated farmland, although this will be very minor. This fine tuning will be done during the detailed design. Near the dam, since the road has sharp bends, the pipeline is aligned along the Enguri River bank for a length of 4 km. The pipeline crosses the river to the other bank at this stretch.
Transmission main from WTP to existing reservoirs at Bashi,	From the WTP to Bashi Reservoir, the clear water transmission line runs along a dirt road
Transmission main from Bashi Reservoir to Zugdidi, and to Anaklia	The existing pipeline from the reservoir to Zugdidi runs through private lands, and therefore a new alignment has been selected along the existing roads to avoid land acquisition. However, for about 200 m near the reservoir, the private land acquisition could not be avoided. From Zugdidi City to Anaklia the pipeline will run along the road connecting Zugdidi and Anaklia
Transmission Main from WTP to Rukhi and Akhal Abastumani,	Pipeline will run along the road connecting Zugdidi and Rukhi-Akhal Abastumani
Transmission Main from Dalcheri to Ganmukhuri	Pipeline will run along the road connecting Zugdidi and Dalcheri - Ganmukhuri

F. Consultation

23. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Stakeholders of this project include:

- People who live, and work near construction sites of facilities in Zugdidi
- UWSCG as implementing agency
- Other government regulatory institutions
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in Zugdidi in general; and
- The ADB, as funding agency

24. Two forms of public consultation have been used during preparation of the IEE, to discuss the project and involve the community in planning the mitigation measures and develop the Environmental Monitoring Plan. These are:

- A public meeting was held in Zugdidi City in November 2010, to which stakeholders were invited. Participants were informed about the aim of the subprojects and the benefits together with their likely impacts and the ways in which they would be

mitigated. Participants were invited to discuss their views and concerns, which were then incorporated into the IEE. **Appendix 3** contains a summary of the meeting;

- Ad hoc discussions were also held on site with people and communities who could be affected by the subprojects, so that views could be expressed in a less formal setting. These were also considered in preparing the IEE.

25. This IEE Report in Georgian language will be distributed to the interested public. Report will be available for review in Tbilisi (at the UWSCG Head Office), and Zugdidi (at the UWSCG Service Centre, the Town Hall and the Public Library). It will also be disclosed to public by making it available on websites of UWSCG, MRDI and ADB, together with the IEEs prepared for the other subprojects..

G. Licenses & Approvals Required

26. Environmental assessment of various activities and development projects in Georgia is governed by the Law on Environmental Impact Permits (EIP), which has entered into force in January 2008. This Law notifies the list of the activities and projects, which will be subjected to ecological expertise and require Environmental Impact Permit. The Law also makes the public participation mandatory in the process of environmental assessment, ecological expertise and decision making on issuance of an environmental impact permit. Under this Law, various projects/activities have been divided into four categories based on their size, importance and potential environmental impact, and sets out permitting process for each category.

27. None of the components of the proposed water supply improvement subproject in Zugdidi are notified in the Law on EIP and therefore environmental impact permit is not required.

28. Abstraction of water from Enguri Dam requires permission of Ministry of Energy of Georgia.

29. *ADB Review and Approval*. For Category B projects the Draft IEE report are reviewed by ADB's Operational Department (in this case Central & West Asia Department) and after addressing their comments, if any, the EA then officially submits the IEE reports to ADB. Completed reports are made available on the ADB website.

III. PROJECT DESCRIPTION

30. A feasibility study was conducted to improve the water supply system in Zugdidi to meet the design year demand (2040) and the project is formulated for implementation under the proposed ADB funded Investment Program. Works are proposed to be implemented through multi tranche funding. The following **Table 3** shows the subproject and components selected for implementation under tranche-1, for which, according to ADB requirement, this IEE is conducted. Photographs of project sites are appended in **Appendix 1**.

A. Sub Project Components

31. This subproject focuses on creation of a new source based water supply system, and is limited to bulk water supply facilities – source development, treatment facility, transmission mains and storage. The descriptions shown in **Table 3** are based on the present proposals. Since the project is at feasibility stage, certain details such as quantity and characteristics of the sediments to be removed from the dam, sizes of WTP units, etc are not available.

Table 3: Proposed Subproject & Components

Infrastructure	Function	Description	Location
Works at dam: • Desilting of dam • Developing water supply outlet	To supply 43,445 m3 per day from Dam	Outlet will be provided from one of the 7 bottom sluice gates, to which the transmission main will be connected; Dam is heavily silted up; silt is accumulated, above the crest of some gates, obstructing the flow. The main objective of desilting is to allow continuous unobstructed flow through bottom sluice gates.	Enguri Dam is located about 50 km from Zugdidi City
Transmission main from the Dam to WTP near Bashi,	Convey water from the Dam to WTP for treatment	700 mm Diameter MS pipe over a length of 25 km	Pipes will be buried in a trench along the road; partly pipeline will be laid on the bank of the River Enguri.
Water Treatment Plant	To treat 43,445 m3 per day of water to drinking water standards	Conventional treatment process and shall include: pre-chlorination, chemical dosing, flash mixing, flocculation, clarification, filtration and post-chlorination	On a government owned site of 4 ha at Bashi
Rehabilitation of Bashi Reservoir	Treated water storage	2 nos. (Capacity 5,000 m^3 each)	Rehabilitation within the existing facility at Bashi
Transmission main from WTP to existing reservoirs at Bashi,	Convey treated water from WTP to storage reservoir	700 mm Diameter MS pipe over a length of 4 km	Pipe will be buried in a trench along a road
Transmission main Bashi Reservoir to Zugdidi, and to	Convey water from storage reservoir to	700 mm Diameter MS pipe over a length of 6.7 km	Buried in a trench along the road; partly through private agricultural

Infrastructure	Function	Description	Location
Anaklia Bore wells,	distribution system	500 mm Diameter MS pipe over a length of 24.3 km	lands Buried in a trench along Zugdidi-Anaklia Road
Transmission Main from WTP to Rukhi and Akhal Abastumani	Convey water to distribution system	100-150 mm Diameter HDPE pipe over a length of 9.4 km	Pipe will be buried in a trench along a main road
Transmission Main from Dalcheri to Ganmukhuri	Convey water to distribution system	300 mm Diameter HDPE pipe over a length of 10 km	Pipe will be buried in the trench along a main road

B. Construction Activities

32. As indicated in **Table 3** above, there are four main elements in the subproject: dam desilting and water outlet; Water Treatment Plant, laying of raw water and clear water transmission mains; and rehabilitation of existing reservoirs. Construction practices of these works are discussed below:

33. *Desilting of Dam*. Owing to its catchment characteristics, silting of Enguri Dam is comparatively high. A study[1] conducted in 2004 indicates that, of the 7 bottom gates, silt has been accumulated above the crest of 3 gates, completely obstructing the flow, and the remaining four gates are comparatively free. With the silting being a continuous process, the silt accumulation may also block the remaining gates. The report recommends periodic opening of bottom gates to flush of the accumulated sediments, when the water level is low. However, due to silting and lack of rehabilitation, most of the gates are non-operational. Works such as clearing of accumulated sediments near the gates and installation of stoplogs are required. At this stage, no detailed data available on the amount of material to be desilted to make the gates operational. About 898,730 m3 of silt is accumulated in the entire reservoir above the level 326.5 m (bottom level of the sluice gate). The purpose of desilting is only to allow free flow of the water from gates, and therefore actual desilting may not be conducted for the entire reservoir and but likely to be limited to a short distance upstream of the gates. Again, no details are available at this stage. As no specifications of the bottom silt is available at this moment (sand-soft silt or clay-compacted silt), which method would be employed is unknown. However, best technologies available (such as hole dredging system for soft/loose material, which will suck the material and pump it out, and trailing system for compacted clay, which will cut and collect by suction), which are efficient with least disturbance, would be employed.

34. *Construction of Water Treatment Plant (WTP).* This will involve the construction of components such as aerator, flash mixer, Flocculator, Clariflocculator, Sludge Well, wash water storage tank, chemical house and filter house. All of these are typical concrete structures with mechanical parts in steel. Construction will involve excavation for foundations, construction of concrete structures and erection of steel structures. Excavation for foundation will be done by using a backhoe. Concrete will be mixed in mixer and needle (pen) vibrator will be used for compaction of concrete around the reinforcement. The quantity of earthwork or surplus soil generated from this work will be available only after design of the units; however, this quantity will be insignificant and can be used within the site to level the ground surface. Precast steel structures of various WTP elements (such as flash mixer, rotating arm etc) will be brought to the site on truck and erected using cranes.

[1] Report on Enguri Dam Bathymetric Survey Upstream the Bottom Gates, EDF (November 2004)

35. *Rehabilitation of Existing Reservoirs.* Rehabilitation works involve replacement of exposed and corroded bars, concreting, cement plastering and replacement of damaged fixtures. Construction material such as sand, aggregate, steel and cement will be brought to site on truck, and placed near by the site. Concrete will be mixed with concrete mixers and the will be placed into void manually. This rehabilitation work is not expected to generate large quantities of debris.

36. *Laying of Transmission Mains.* All transmission mains will be buried along the roads in the vacant space between tarmac and building/property boundary. Of the total of 79.5 km of transmission main (of 150 - 700 mm diameter), 75.3 km will be laid along the roads, while 4 km will be laid along the bank of River Enguri and the 0.2 km will be laid through private agricultural land at Bashi reservoir. Trenches will be dug using a backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed alongside, and the pipes will be placed in the trench manually or using a crane. Pipes will be joined, after which excavated soil will then be replaced on beneath and sides. A sand layer of 5 cm thick will be laid on top of the pipes, after which the trench will be refilled with excavated and compacted manually. The size of trench will be 1.4 - 1.7 m deep and 0.5 - 1.0 m wide. The excavation is expected to generate 112,580 m3 of soil, after construction part of trench will be occupied by pipe and sand layer. 80% of soil will be reused while the remaining, 21,700 m3 will be left as waste/surplus.

37. *Source of construction materials*. In Zugdidi, sand and aggregate is sourced from licensed mines along River Enguri. There is no designated disposal site for construction wastes and are generally disposed in low-lying areas.

C. Operation of Improvement Water Supply System

38. Utilizing the elevation advantage of the Enguri Dam, a simple gravity based water supply system has been designed. This system involves – abstraction of water from Enguri Dam, transmission to the WTP (for treatment and disinfection by chlorine), from where the water is conveyed to storage reservoirs. From reservoirs, water will be supplied into distribution system. This system will supply a maximum of 43,445 m3 of water per day.

39. The main requirement of the proposed system is treatment of water supplied as per the drinking water standards of Georgia. Most of the parameters of Enguri Dam water quality confirms to standards, except turbidity and bacteriological parameters. Operation of Water Treatment Plant (WTP) involves various processes: pre-chlorination, chemical dosing (such as mixing of aluminum sulfate for flocculation), flash mixing, flocculation, clarification, filtration, and post-chlorination. Chemicals such as Alum and chlorine will be used in the treatment processes.

40. A main operation requirement of WTP will be handling and application of chlorine into the water supplies. Average dose of chlorine will be about 6mg/l (for both pre and post chlorination). Initially about 182 kg of chlorine will be consumed daily, which will gradually increase to 261 kg by 2040. Chlorine cylinders (called tonners, with capacity 900 kg) will be procured from nearest manufacturing unit and stored at the site. Tonners sufficient for 30 days will be stored at the WTP; this will be about 9 tonners (6 tonners in storage, and 3 tonners in the chlorine room (2 working + 1 standby)) in initial stage and 12 tonners in 2040.

41. Water treatment processes normally generate waste, comprising of: (i) sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage etc; and waste from rinsing and back washing of filter media containing debris, chemical precipitates and straining of organic debris. These need to be collected and safely disposed.

IV. IMPACTS ON THE PHYSICAL & BIOLOGICAL ENVIRONMENT

A. Introduction

42. The following sections evaluate the impacts on physical and biological environment due to the proposed subproject. Each subsection first describes the baseline profile followed by impact identification and assessment during construction and operation. Mitigation measures are also discussed in conjunction with the impacts.

B. Topography, Geology & Soils

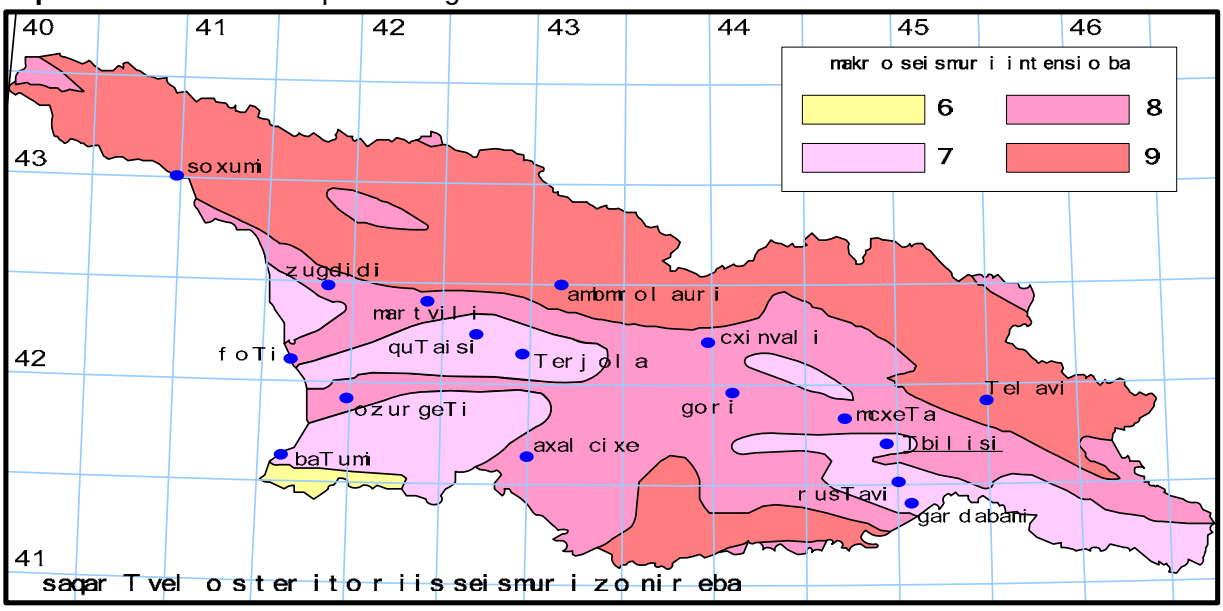
1. Baseline Conditions

43. *Topography*. Despite its small area, Georgia presents one of the most varied topographies within its geographical boundaries. Georgia lies mostly in the Caucasus Mountains, and its northern boundary is partly defined by the Greater Caucasus range. The Lesser Caucasus range runs parallel to the Turkish and Armenian borders and the Surami and Imereti ranges connect the Greater Caucasus and the Lesser Caucasus, and create natural barriers in the region. The project area is characterized by both hills and plains. While Enguri Dam is situated in central Caucasus hilly region, Anaklia and Ganmukhuri are located in the Coast, with almost flat landscape. Elevation ranges from 1-500 m above MSL, over a length of 80 km.

44. *Geology.* The project area is situated in the Central Caucasus and in Kolkheti depression. In terms of tectonic development, the major part belongs to Kolkheti tectonic depression, which is bordered with the Black Sea basin to the west and Fanavi and Samagrelo (Egrisi) ridges to the north. Poti-Askhi and Kurzu-Khikhadziri deep faults are located within this area. Erosive forms of mezo and micro relief riverine accumulative terraces are widely spread. According to seismic zoning map, Georgia is classified into Zone 6 to Zone 9 (in increasing order of seismic intensity, **Map 5**) and Zugdidi falls under Zone 8 (high seismic intensity zone). There has been no history of major earthquakes in Zugdidi.

45. *Soil*. The Samagrelo region is characterized by various types of soil due to diverse climate-relief conditions. Soils in the areas near the coast are part of the lowland marshy and podzol soil zone of the Western Georgian lowland. Peat soils are predominant along the coastal strip of 2-8 km wide. Marshy silt soils are represented along riverbanks. Towards the Enguri Dam, variety of alluvial soils can be found in the altitude between 100-200 m; riverine clays, loams and silt sands are dominant. These soils are poor in humus, and are less fertile. Yellow soils of clayey and thick strata and red soils are found in the foothill zone. The upper part of 200-500 m above MSL, are mostly characterized by Humus rich carbonate soils and forest Chernozem soils. Depth of soil in the project area ranges from 3-5 m.

Map 5: Seismic Zone Map of Georgia



46. **Table 4** presents chemical characteristics of Enguri Dam silt. Heavy metals are in negligible concentration. It shall be noted that due to difficulty in collecting the sample from dam bottom, the silt sample was collected from downstream of the Dam where silt is accumulated from the release of water from bottom sluices. Although this gives an idea of the likely characteristics of the accumulated sediment, a detailed analysis is required to characterize the sediments accurately.

Table 4: Chemical Characteristics of Enguri Dam Sediment/Silt

S. No	Parameter	Unit	Concentration
1	pH	-	6.9
2	Zinc	mg/l	0.0545
3	Iron, total	mg/l	0.1522
4	Barium	mg/l	0.0081
5	Boron	mg/l	0.0178
6	Arsenic	mg/l	0.0058
7	Mercury	mg/l	0.0005
8	Cadmium	mg/l	0.0015
9	Manganese	mg/l	0.0163
10	Nickel	mg/l	0.0068
11	Nitrate	mg/l	40
12	Nitrite	mg/l	0.0793
13	Selenium	mg/l	0.0084
14	Copper	mg/l	0.0153
15	Aluminum	mg/l	0.0201
16	Lead	mg/l	0.0108
17	Fluoride	mg/l	0.0126
18	Chromium	mg/l	0.0110
19	Antimony	mg/l	0.0005
20	Pesticides	mg/l	Traces

Source: Sampling Survey, September 2010

2. Impacts during Construction

47. During the construction, impacts on topography and geology are mainly due to invasive nature of excavation activities.

48. The dam desilting activity, although no quantity data is available at present, will generated considerable silt in dense liquid form. This needs to be collected and disposed without any impacts on the river bed or at the disposal location. Indicative sampling and analysis conducted indicates no hazardous substances are present in the silt however further sampling needs to be conducted during the detailed design stage to confirm this. The following measures need to be included to mitigate the impacts of silt disposal:

- Conduct detailed investigations for sediment bathymetry and volumes for removal
- Characterization shall include analysis for heavy metals, hazardous substances, and soil nutrients
- Prepare a Silt Management Plan, which should include
    - Appropriate sediment collection method with minimum disturbance to bottom soil
    - Appropriate dewatering technologies
    - Identifying temporary dredged material management site
    - Material management strategy, including material processing, handling and beneficial utilization or disposal
- In case of silt characteristics beneficial for agricultural purposes, it may be provided to the nearby farmers to increase the fertility of their lands

49. Excavation works for water treatment plant will be limited and confined to the site, therefore not expected to have any impacts on topography, soil and geology. The trench excavation for transmission mains will be 80 km long, which will run along the roads. This may affect the surface water drainage during rains (these impacts are discussed in surface water).

50. Works do not involve deep excavations. The depth of excavation for transmission pipelines will be about 2 m. Excavation for various element of WTP will be 2-3 m. These works do not involve cutting of rocks. Laying of 80 km of transmission mains is likely to generate around 21,700 m3 of waste soil. Therefore this quantity of waste could not be dumped without causing further physical impacts on topography and soil at the point of disposal. It will be important therefore to reduce the amount of dumping by finding beneficial uses for as much waste soil as possible. This will require:

- Using the surplus soil where possible in construction projects; to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas

51. The excavation work will also tend to loosen the top soil, which may lead to soil erosion during winds and rains. Therefore the contractor should:

- Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer

3. Impacts during Operation

52. Regular operation of water supply system will be within the constructed facilities and therefore no impacts envisaged.

53. The main requirement for maintenance of the water supply infrastructure will be detection and repair of leaks. Repairs will be conducted in essentially the same way the pipes were laid. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary. This activity is not expected to generate any waste soil nor will have any impacts.

C. Surface Water and Groundwater

1. Baseline Conditions

54. *Surface Water*. Georgia is rich in water resources; there are in all 26,060 rivers with a total length of ~ 59,000 km. Besides, there are many thermal and mineral water springs, lakes and man-made water reservoirs. These however are distributed unequally, with major concentration in the western part of the country. Nearly all rivers of East Georgia flow into the Caspian Sea while and the rivers in the west join the Black Sea. The project area is located in lower reaches of the Enguri River Basin.

55. Originating from Namkvani Glacier in Greater Caucuses Range and flowing into Black Sea in the west, the Enguri is one of the biggest rivers in Georgia. It traverses a distance of 213 km, during which it is joined by a number of small and large streams/rivers. River flows through hilly region in the upper parts, before the Enguri Dam at foot hills.

56. Water supply for the proposed project will be sourced from Enguri Dam, on River Enguri, just upstream of Dzvari Town. This is a hydropower dam, and is the world's highest concrete arch dam. The construction of dam was started in 1961, but became fully operational only in 1987. Enguri Hydroelectric power station generates over 40% of the total electricity supply of Georgia. the dam is exclusively used for power generation; water is released to power station located in Abkhazia via a diversion channel. Dam has seven bottom gates through which surplus water is released. Water is also released downstream regularly to maintain minimum environmental flow however there is record of water releases from the dam either for power plant or downstream discharges.

57. The river is fed by glaciers, snow and rainfall, and experiences floods during the warm seasons and lower flow in colder periods. In July-September flow is very high, caused both by snow melting and the rainfall. As show in **Figure 1**, generally water level in Dam is high in July-August (summer) and minimum in March-April (winter). In the last 10 years, water level in the Dam has always been above the requirement for power plant diversion channel, except in April-May 2006, which recorded a lower level of 389.86 m. It shows that the dam holds good volume of water throughout the year.

58. The river is divided into three parts as shown in **Map 6**. Due to steep slopes in the upper portion, the river is deep, flow is turbulent and carries heavy loads of silt, which accumulates in Enguri Dam on the foothills near Dzvari Town. The river is wide and shallow in the lower reaches.

Map 6: Enguri River Basin

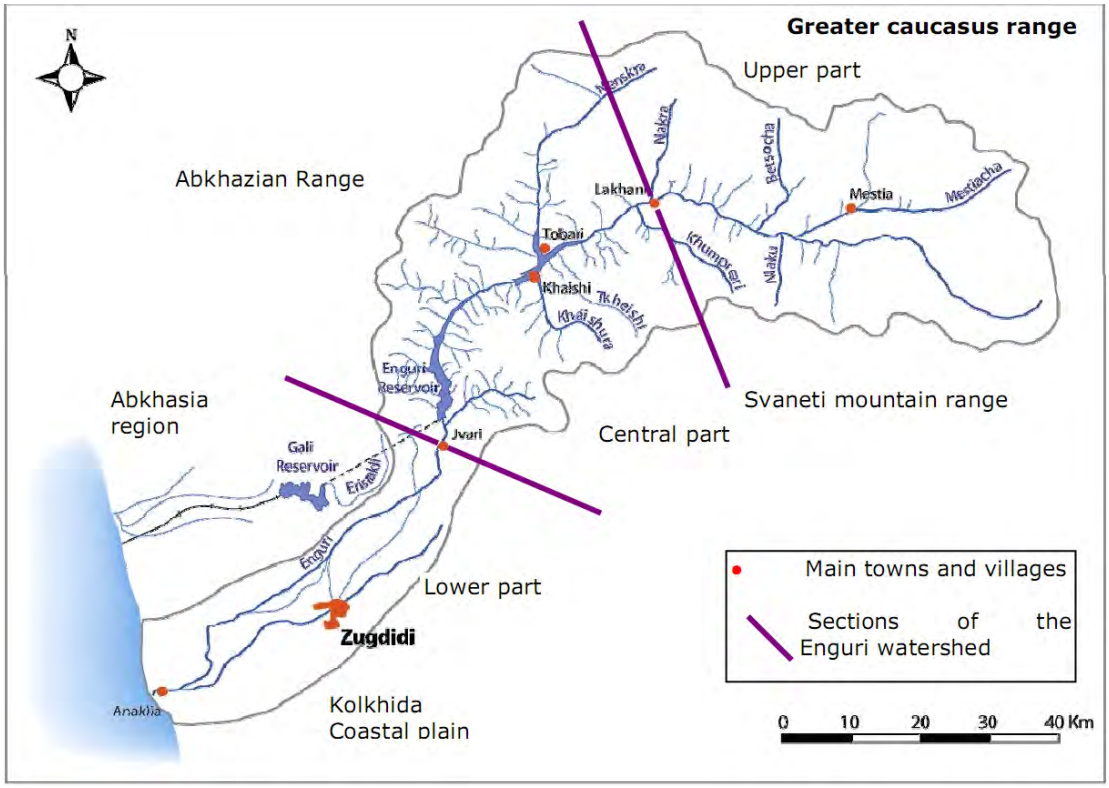
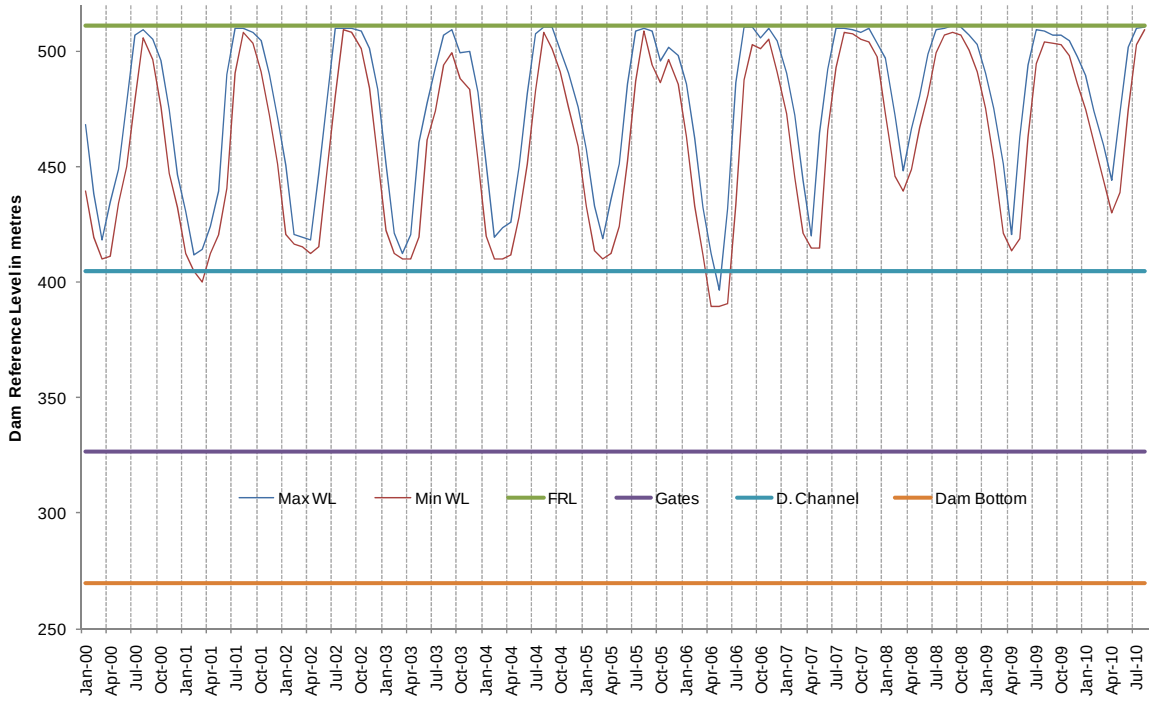


Figure 1: Monthly Maximum & Minimum Water Level of Enguri Dam (2001-2010)



Max & Min WL – Recorded Maximum and Minimum Water Level in the Dam in Corresponding Months; FRL – Full Reservoir Level; Gates – Bottom Level of Sluice Gates; D. Channel – Bottom level of power station diversion channel; Dam Bottom – Original Level

59. **Table 5** shows the Enguri Dam water quality in comparison with the national surface water norms[2] and drinking water norms[3] set by the GoG. Two water samples were collected for analysis: one, from the top of the dam, and two, from the outflow of discharge sluice, where the water supply line is likely to be connected. All the quality parameters confirm to the use of water body for domestic and fishing purposes. In comparison with the drinking water norms, the sample collected from bottom sluice discharge, shows higher turbidity. Both samples show the presence of coliform which are above levels required for drinking water, however all the other parameters analyzed were well within the limits.

Table 5: Water Quality of Enguri Dam

S. No	Parameters	Unit	Enguri Dam Storage	Enguri Dam sluice	Surface water – domestic use	Surface water – fishing purpose	Drinking Water Norms
1	Colour	-	5	15	-	-	15
2	Odor	-	0	1/2	-	-	2
3	Turbidity	NTU	10	40	-	-	3.5
4	Sulphate	mg/l	38.3	42.8	500	100.0	250
5	Chlorides	mg/l	35	30	350	300	250
6	Oil Products	mg/l			0.3	0.05	
7	Calcium	mg/l	18.03	20.04	-	-	140
8	Magnesium	mg/l	26.97	7.8	-	-	85
9	Sodium	mg/l	8.1	8.3	-	-	200
10	Zinc	mg/l	0.0311	0.0386	1.0	0.01	3.0
11	Iron, total	mg/l	0.08	0.1102	0.3	0.005	0.3
12	Total coliform	MPN	110	160	-	-	Nil
13	E-coli	MPN	50	80	-	-	Nil
14	pH		7.8	8.3	-	-	6-9
15	Total mineralization	mg/l	206.6	322.4	-	-	1000
16	Barium	mg/l	0.0025	0.0030	0.1	2.0	0.7
17	Boron	mg/l	0.0136	0.0151	0.5	10.0	0.5
18	Arsenic	mg/l	0.0041	0.0046	0.05	0.05	0.01
19	Mercury	mg/l	0.0003	0.0003	0.0005	0.00001	0.006
20	Cadmium	mg/l	0.0006	0.0009	0.001	0.005	0.003
21	Manganese	mg/l	0.0025	0.0072	0.1	0.01	0.4
22	Nickel	mg/l	0.0034	0.0037	0.1	0.0001	0.07
23	Nitrate	mg/l	10	20	45.0	40.0	50
24	Nitrite	mg/l	-	-	3.3	0.08	0.2
25	Copper	mg/l	0.0058	0.0120	1.0	0.001	2.0
26	Aluminum	mg/l	0.0062	0.0095	0.5	0.5	0.1
27	Lead	mg/l	0.0073	0.0086	0.03	0.1	0.01
28	Fluoride	mg/l	0.0065	0.0088	0.05	0.05	0.7
29	Chromium	mg/l	0.0051	0.0073	0.1	0.001	0.05
30	Antimony	mg/l	-	0.0003	-	-	
31	Cyanide	mg/l	-	-	0.1	0.05	0.07
32	Pesticides	mg/l	-	-	-	-	0.05
33	Alkalinity	mg/l	0.92	1.25			-
34	DO	mg/l	7.27	6.55			-
35	BOD	mg/l	3.63	0.19	3	15	-
36	COD	mg/l	3.2	3.2	6	15	-

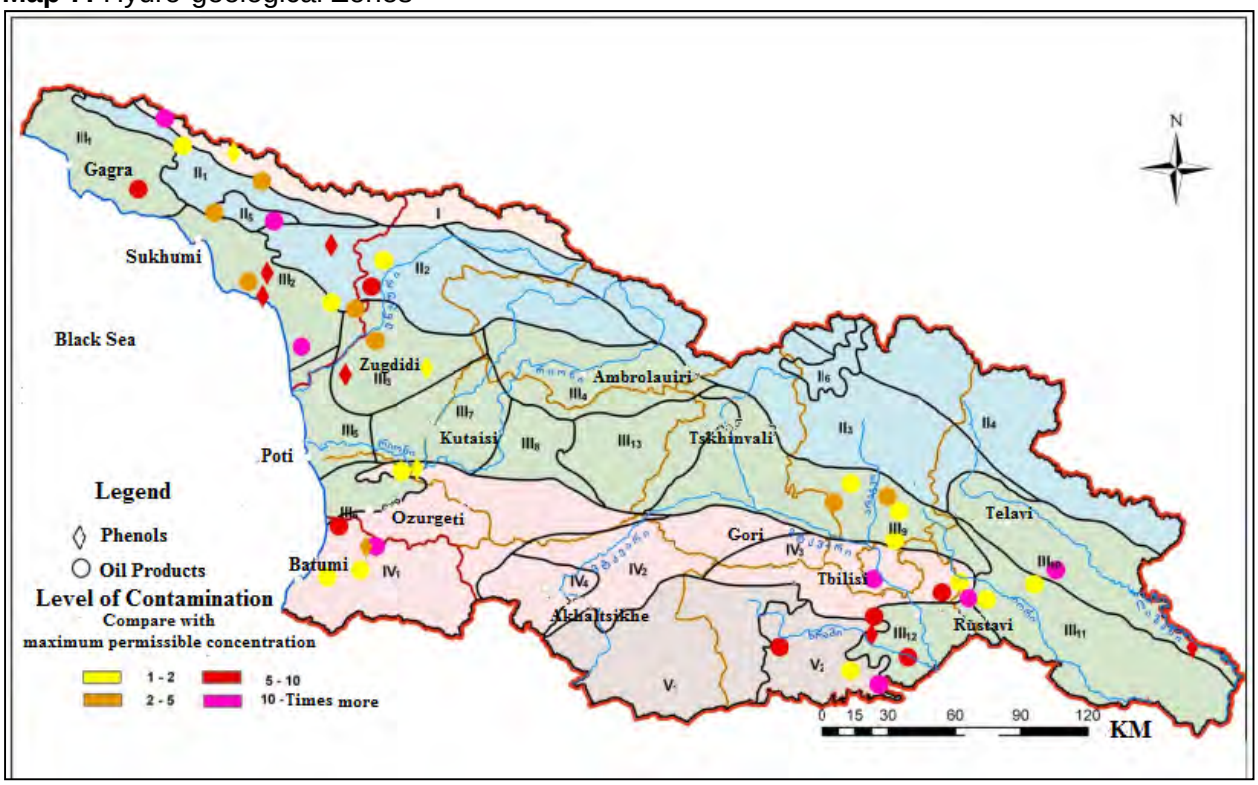
BOD – Biochemical Oxygen Demand; Chemical Oxygen Demand, and DO – Dissolved Oxygen
Source: Sampling Survey, September 2010

[2] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare (Attached at **Appendix 4**)
[3] Technical Regulation on Drinking Water, 2007, (Decree №349/N), Ministry of Labor, Health and Social Welfare (Attached at **Appendix 5**)

60. The project area is situated in the Enguri River basin and many of its tributaries crisscross the project area. Pipelines from Dam to WTP near Bashi, and WTP to Zugdidi and Anaklia will cross a number of streams/rivers, including important tributaries of Magana, Chkhoushi and Jumi. Magana River meets Enguri just downstream of the Enguri Dam, while the Jumi and Chkhoushi join in the plains downstream of Zugdidi City. The pipeline near the dam runs along River Enguri and Magana for about 4 km. The pipeline crosses various rivers/streams at 15 locations.

61. *Groundwater*. Based on the groundwater characteristics, Georgia is divided into five hydro-geological zones, which are further defined into sub-zones/districts. Project area, Zugdidi is in Zone – III (Artezian basin zone of Georgian belt) and in hydro-geological district- III_3 (Fractured and fractured/karstic artesian basin of Samegrelo) (**Map 7**). The water in this artesian zone is abundant, and towards the coast the utilizable groundwater is limited. The depth of groundwater is about 5 m and towards the coast it is between 1-2 m. Groundwater in the densely populated areas shows the presence of Nitrogen compounds - nitrates, nitrites, and ammonia, mainly due to leachates from poor sanitation systems.

Map 7: Hydro-geological Zones



2. Impacts during Construction

62. The desilting activity in the dam is likely to degrade the water quality. The desilting or dredging activity will increase the turbidity, which will directly impact the water uses, aquatic life and low light penetration will also affect the benthic organisms. The oxygen level in the dam will fall. Use of traditional hydrodynamic dredging methods are likely to exert disturbance, therefore shall be avoided. The dredging will be under taken at the depth of 331 m, while the water abstraction for power plant is at 405 m, and with the use of the best dredging technology (as suggested earlier under the impacts on soil), the impact will not be felt at the higher levels. The accumulated silt does not contain any harmful substances (as suggested this shall be confirmed through detailed sampling during the detailed design) and

therefore except increase in turbidity no change in water quality anticipated. The following measures shall be implemented::

- Ensure that there is no disruption of water supply to Enguri Power Plant during the dredging work
- Employ best dredging method, which will remove the silt with least disturbance in the water body

63. At present, there is no data/information available on the volume of material to be removed and the exact characteristics. Although indicative sampling shows presence of no hazardous substances, improper disposal may increase the turbidity of water courses and affect the natural drainage. Therefore as suggested earlier, a Silt Management Plan should be prepared, including measures to avoid impacts on drainage and surface water bodies.

64. About 4 km length of transmission pipeline will be laid (above ground) on the bank of River Enguri, near Dzvari Town. This section of the river is about 2 km downstream of the dam; river is very shallow and wide. The pipeline will be laid on the ground and fixed to concrete anchors, on the bank. Due to shallow and wide river stretch, banks are not well defined; the pipeline will be laid in the slightly elevated strip of land, covered with grass. There are two old pipelines already in place along this stretch, the new pipeline will be laid alongside the existing pipes. At the point where it crosses the river, the pipeline will be fixed on small prefab concrete anchors of about 1 m height. Anchors will be fixed at a distance every 100 m in the river stretch and pipeline will be fixed on the anchors. Although the work does not involve any significant excavation or construction activities, the following measures needs to be implemented to avoid any impacts:

- Work shall not be conducted during flood season (July-September)
- Consult dam authorities to ensure that there is no discharge from the dam during the construction
- After completion of work, the site shall be cleared of any material/debris

65. The project area experience rainfall throughout the year, although comparatively higher in rainy season. The surface runoff can collect in the trenches dug for pipeline. The silt-laden run-off from the construction sites may pollute the surface water by increasing the turbidity. Therefore the Contractor should:

- Protect open trenches from entry of rain water by raising earthen bunds with excavated soil,
- Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site
- Ensure that drains are not blocked with excavated soil/material

66. Ground water table is deeper than the excavation depths and therefore there is no possibility of groundwater collecting in voids.

3. Impacts during Operation

67. During the operation stage no effects on groundwater envisaged. However as this is a surface water based water supply system, the effects due to water abstraction from the source and source water contamination risk needs to be assessed.

68. Generally the main risk to the physical environment of operating an new/improved water supply system is that of increased abstraction, which may deplete the water resource. Unsustainable reduction may affect downstream uses and may have ecological impacts

(such as on flora, fauna and inadequate groundwater recharge). On the other hand, unsustainable source may also lead to closure of the system and wastage of investment.

69. However, in the present project, water is being abstracted from an existing large dam, and the volume of abstraction is just a fraction of total water availability. Therefore this source is sustainable and also abstraction for the project will not affect any current uses (i.e. power generation). Present water quality is suitable for drinking after conventional treatment for turbidity and pathogens and the necessary treatment facilities are part of the project. There are no major water pollution sources in the catchment, so there is no risk of source water contamination. At this stage is not clear on how the water will be tapped from the dam for water supply. In the case of providing water supply from the bottom sluice gates, the risk of raw water containing high concentration of suspended solids needs to be taken into consideration while designing the system. It may be noted that a primary function of the bottom sluice gates is to flush out the accumulated sediments periodically, and therefore connecting the water outlet at this location may not be appropriate.

70. WTP operation involves various processes: pre-chlorination, aeration, chemical dosing, flash mixing, flocculation, clarification, filtration and post-chlorination. Chemicals such as alum (coagulant) and chlorine (disinfectant) will be used in the treatment processes.

117. The water treatment process will generate waste, which will comprise of the following: (i) sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, etc; and (ii) wastewater from rinsing and back washing of filter media containing debris, chemical precipitates, and straining of organic debris. Improper disposal of the waste will pollute receiving water bodies. Following measures shall be incorporated into the design:

- Provide arrangements for re-circulation of wash water, which will optimize the raw water usage, reduce wastewater generation and need for the disposal
- Provide a proper sludge collection and drying system for settling tanks and clarifiers
- Dispose the dried sludge by land filling or can be used as soil conditioner

71. An important aspect of increased water supply is that of increased sewage generation, which needs to be treated and disposed properly without causing any impacts. In case of inadequate facilities, disposal of untreated sewage into rivers/streams is common and therefore it offers a potential impact to surface and groundwater.

72. At present, there is no proper sewerage system in the Project Area. Although there is a system covering about 70% town population, there is no treatment facility and untreated sewage is disposed into a stream that discharge in River Enguri on the downstream side of Zugdidi City. Rest of the people depend on individual facilities like pit latrines or septic tank-soak pit system. There is no sewerage system available in Anaklia.

73. With the increase in water supply, the total sewage generation from the project area will be 39,800 m3 per day, with most of it generating from Zugdidi City and Anaklia – from both resident and tourism areas. Without any proper sewage collection and treatment system, the disposal of the large quantities of sewage will have negative impacts on receiving environment, particularly on Enguri River and coastal waters. It is therefore necessary that:

- Sewerage system with adequate treatment facilities, which can treat the sewage to Georgian standards and dispose safely, shall be provided; the urban and tourism areas (Zugdidi City and Anaklia) shall be provided with sewerage system on priority

- The above measures shall be implemented along with the water supply system improvement

D. Climate & Air Quality

1. Baseline Profile

74. *Air Quality*. Ambient air quality monitoring is conducted at only seven locations in Georgia. None of these are located in Zugdidi, as there are no major air polluting sources like industries. Most of the roads in project area are in good condition with considerable tree cover in and around, and therefore dust pollution due to traffic is also very limited.

75. *Climate*. Zugdidi climate is humid sub-tropical with warm winters and hot summers. The annual average temperature is 13.8^{o} C, average winter temperature (January) is 4.9^{o} C, while the average summer (August) temperature is 22.7^{o} C. Annual average precipitation is 1,616 mm almost equally spread across the months, although comparatively higher during the rainy season. Winds are influenced by the Black Sea in the west and mountains in the northeast. Throughout the day winds are from the lowland to the mountains and in the night, from the mountains to lowlands. Wind velocity ranges from 0.1 m/sec to 1.8 m/sec.

Figure 2: Monthly Average Temperature

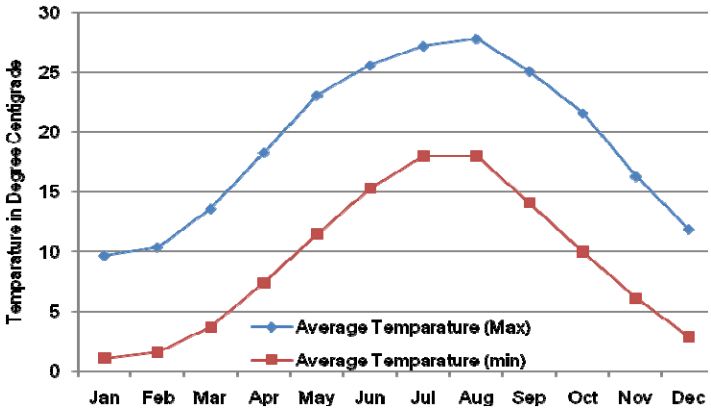


Figure 3: Wind Direction

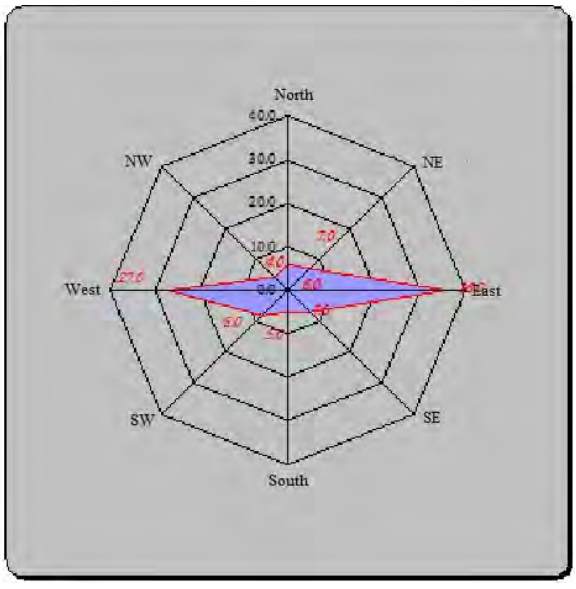
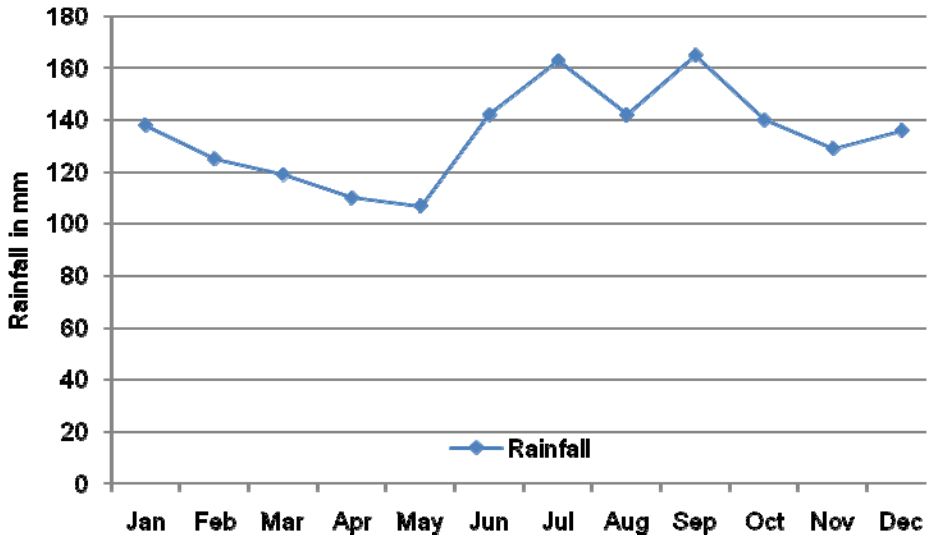


Figure 4: Monthly Average Precipitation



2. Impacts during Construction

76. The activities that could cause impact on ambient air quality are (i) dust generation from construction activity, and (ii) air emissions including dust from operation of construction equipment (like excavators, cranes) and material and waste transport vehicles.

77. The construction work has a lot of potential for the creation of dust, from the excavation of dry soil and its storage, and leveling on the ground. As stated earlier, the construction activity will involve significant quantities of earth work (112,580 m^3), although spread over a large project area. About 21,700 m3 of soil is expected to generate as waste, which needs to be disposed off without any impacts. Most of these works are located along the roads with sparse development however some sections are located in the urban areas like Zugdidi, where the impacts of dust generation will comparatively be higher. Action will therefore be needed to reduce the impacts on air quality at both the construction and disposal sites, by controlling dust. The Contractor should therefore be required to:

- Cover or damp down by water spray on the excavated mounds of soil to control dust generation;
- Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process;
- Bring the material (aggregate and sand) as and when required;
- Ensure speedy completion of work and proper site clearance after completion
- Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

Restrict access to the work area except for workers to limit soil disturbance

78. Various types of equipment and vehicles would be required for the construction activity. The exhaust emissions from these may degrade the ambient air quality. Considering the scale of work and use of equipment, impact will be insignificant, and will be beyond the scope of this project. However, to enhance the subproject benefits, the Contractor should consider the following:

- Ensure that all equipment and vehicles used for construction activity are in good condition and are well maintained
- Ensure that all equipment and vehicles confirms to emission and noise norms

1. Impacts during Operation

79. Since the water supply system is gravity based and there is no use of any major equipment or power supply, there will be no activities which have potential to generate air pollution. Therefore no impacts on ambient air quality are envisaged. The electrical equipment like transformers will be used only at the WTP. Transformers may contain harmful substances - insulating oils / gases (e.g. Polychlorinated Biphenyls [PCB] and sulfur hexafluoride [SF6], and fuels. SF6 may also be used as a gas insulator for electrical switching equipment and in cables, transmission lines, and transformers. SF6 is a greenhouse gas with a significantly higher global warming potential (GWP) than CO2. PCBs were widely used as a dielectric fluid to provide electrical insulation. Similarly, hazardous/harmful material may be present in laboratory apparatus/equipment/chemicals. Although this is not major impact considering the magnitude of equipment use, consideration of these in the project will however enhance the benefits.

80. During regular operation none of these substances will be emitted; likely escape into atmosphere may be during repairs and during disposal after life. During the design and procurement of equipment the following shall be considered:

- Avoid use of transformers and other electrical equipment containing PCBs through alternative (green) models
- Minimize use of SF6 through appropriate selection of equipment
- In unavoidable cases due to non-availability of appropriate equipment the following measures shall be put in place:
    - Conduct awareness programs to workers/lab operators to know about the equipment containing hazardous material
    - The repair and maintenance of such equipment shall be conducted only by trained persons and in appropriate facilities; more appropriately the contract for procurement with supplier/manufacturer shall include taking back the equipment after the useful life

E. Biological Environment

1. Baseline Profile

81. About 40 percent of total geographical area of the country accounts for forests. 97 percent of forests situated on mountain, the rest 3% are low-lying and flood plain forests in Kolhida Region and in the Western Georgia.

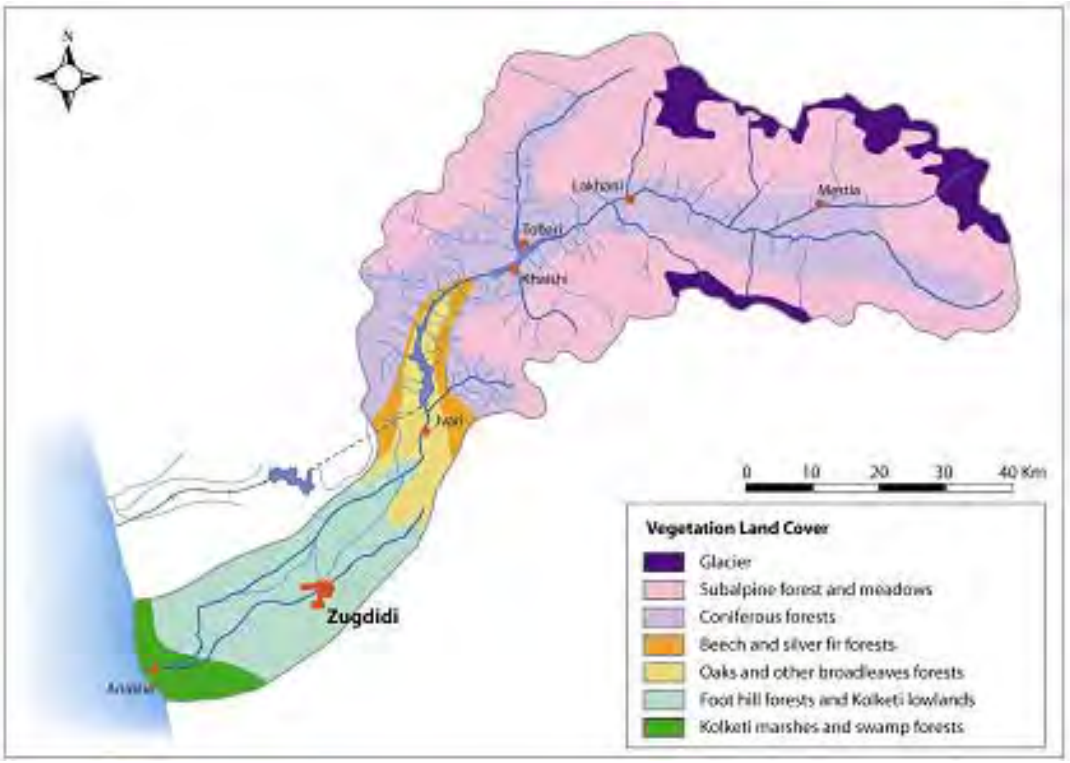
82. *Flora*. Owing to its varied physical and geographic conditions, the vegetation in the project area is rich and diverse. Flora consists of about 1,200 higher plant species, of which 175 are endemics. In floristic terms peat bogs are unique along with Colchic forests with evergreen undergrowth, oak forests, beech and coniferous forests, sub-alpine crook stem forests, sub-alpine and alpine high grass and alpine meadows. All the project components are located along the roads and in government lands. A pipeline for about 200 m passes through agricultural lands. As shown in the following **Map 8**, Project area consists of three types vegetation: (i) Oaks and broad leaved forest near the Dam, (ii) Foothill forests and kolketi low lands for most of the area, and (iii) Kolkheti marshes and swamp forest. Following

species are found in areas around Enguri Dam: oak (*Quercus iberica*), hornbeam (*Carpinus caucasicus*), oriental hornbeam (*Carpinus orientalis*), chestnut (*Castanea sativa*), beech (*Fagus orientalis*), and hazel tree (*Coryllus avellana*). Moist areas are dominated by beech forests (*Fagus orientalis*), chestnut (*Castanea sativa*), box tree (*Boxus colchicus*) and undergrowth is dominated by rhododendron (*Rhododendron ponticum, R. caucasicum*), and bilberry (*Vaccinum myrtillus, V. arctostaphylos*).

83. Almost all the roads in project area including the highways are lined with avenue plantation. Species include: silver fir, spruce, palm tree, Georgian maple, chestnut, eucalyptus, cedar, bay leaf, cypress, hazel nut, floodplain oak , Megrelian birch, Colchic Holly, Rhododendron, Ash, Alder and Great Sycamore. The following species are listed as endangered in the IUCN Red Book (typical photographs are in **Appendix 1**):

- Georgian maple (Acer ibericum)
- Chestnut (*Castanea sativa*)
- Floodplain oak (Quercus pedunculiflora)
- Megrelian Birch (*Betula megrelica*)

Map 8: Vegetation Cover in Enguri Catchment



84. *Fauna*. Samagrelo fauna comprises distinct species. Wolf, jackal, fox are present in the region. Roe deer are found in forest flood plains. Many nesting and migratory species occur in Kolkheti reserve, which is the migration route for the species from the Europe and Russia. Notable avifauna in the area include: white wagtail, blackbird, tit, starling, raven, hooded crow, swallow, etc. Kolkheti lowland is the place of origin of the pheasant (*Phazianus colchikus*). Raptors are also abundant: black kite, falcon, marsh harrier, and imperial eagle are common. Otters can be found on the banks of Paliastomi lake, Tskhenistskhali and Enguri. The area is not rich in reptiles.

85. *Protected Areas*. There are 14 Strict Nature Reserves, 8 National Parks, 12 Managed Nature Reserves, 14 Natural Monuments and 2 Protected Landscapes in Georgia. These protected areas cover about 7 % of the country's territory. About 75 % of Protected Areas are covered by forests. Primary function of the Protected Areas is protection of natural heritage of the country. Kolkheti National Park (KNP) is the nearest protected area, boundary of which is located at about 10 km from the project area. KNP was established in 1998 with the purpose to protect wetland ecosystems. The total area of the Park is 28,571 ha including 15,742 ha of water area, classified into three zones: The Paliastomi Lake in the Park is the ideal environment for many species of fish and invertebrates. Kolkheti wetlands are important for their floristic diversity.

86. *Aquatic Life in River Enguri*. A total of 35 fish species were recorded in the Enguri River System and are divided into four groups according to their eco-biology and distribution along the Enguri River System.

(i) Amphibiotic migratory species: The species of sturgeon (*Acipencer sturio, A. stellatus, A. gueldenstaedti colchicus and Huso Huso*) are anadromous species with a life cycle between the Black Sea and the lower Enguri River. The Enguri Dam is a barrier for migration.

(ii) Euryhaline species: They are found in the lower part of the Enguri River, up to the mouth and comprises of Mullets (*Mugil cephalus*, and *M. auratus*), Pipefish (*Syngnatus nigrolineatus*); Round Gobbies (*Neogobius cephalarges* and *Neogobius melanostomus*) and Three-spined Stickleback (*Gasterosteus aculeatus*). These species are specific to the estuary and the lower reaches of the river.

(iii) Lower river freshwater fishes: these species form the community of the lower part of rivers with large bed and low current. Some of them are present in the Enguri Reservoir too. These include: Carp Bream, White Bream and Russian Bream (*Abramis brama, Blicca bjoerkna* and *Vimba vimba*), Common Carp (*Cyprinus carpio*), Rudd (*Scardinius eurythrphtalmus*) and Chub (*Leucosiscus. boristhenicus*), Common Bleak and Danube bleak (*Alburnus alburnus* and *Chalcalburnus chalcoides*), Bitterling (*Rhodeus sericeus amarus*) and Asp (*Aspius aspius*).

(iv) Upper river fishes: These species are living in mountainous river courses with high currents, gravels and oligotrophic conditions. The common species are truite, Salmo trutta with a form living in reservoirs (*Samo trutta morpho labrax*). Among them are cyprinids including theCrimea Barbel (*Barbus tauricus escherichi*), Colchic nase (*Chondrostoma colchicum*, endemic to colchic rivers), Chub (*Leuciscus cephalus*), Minow (*Phoxinus phoxinus colchicus*) and Gudgeon (*Gobio gobi*).

87. There is no commercial fishing activity, even at a small scale, in the Enguri Reservoir or in the river. The fish and biomass in the reservoir is said to be very poor, and the attempts to restock with commercial fish species failed in the past. Only species like trout are found.

2. Impacts during Construction

88. The major activity is desilting of dam to allow free flow through bottom sluice gates. The dredging activity normally causes degradation of water quality (high silting and related quality problems if the accumulated silt contains hazardous or harmful substances), reduce the light penetration, deplete the oxygen levels and ultimately detrimental to aquatic life, water uses and dependent population. Therefore the significance of impacts depends on the sensitivity of the water body, its aquatic profile and dependent population. Following are the important characteristics that determine that there will no significance of impacts of dredging activity:

(i) The aquatic life in the reservoirs is very limited due to poor biomass content,
(i) Fish species in the river is limited to Trout which can live in comparatively turbid water and in cold conditions
(iii) No commercial fishing activity and there are no dependent population

89. Again, the measures suggested under impacts on soils and surface water, earlier including the following will reduce the degradation of water quality and will therefore minimize the impacts further:

- Employ the best dredging method with appropriate equipment, which will remove the silt with least disturbance in the water body
- Ensuring no disturbance to the river bottom soil
- Preparing a Silt Management Plan, which should include measures for safe and efficient dredging

90. The site for water treatment plant is government-owned and is presently unused. The site is covered with a degraded tea plantation from the Soviet Era which is now abandoned. There are trees and bushes of local species in the periphery of the site. The roads along which the pipelines are proposed are covered with avenue plantation. At the WTP site, tea plantation will be cleared off, however, no impacts envisaged. The pipelines will be laid in the vacant space between the road tarmac and the adjoining property line. In most of the stretches this vacant space is partly occupied by avenue plantation and road side drains, and the pipeline will be laid in the remaining vacant portion and in stretches where no vacant space available, the trees may be removed. Following measures shall be implemented:

- Avoid tree cutting by local and small change of alignment
- Avoid tree cutting by locating the pipeline below the drain or into the road tarmac as far as possible
- Avoid cutting of matured trees
- In unavoidable cases, plant two trees of same specie for each tree that is removed
- Do not cut tree species listed in the Red Book (**Georgian maple**, **Chestnut**, **Floodplain oak and Megrelian)**
- Identify and mark all the Red Book species in the immediate vicinity of the alignment during the design,
- Sensitize the civil contractor and supervising staff before the start of construction
- Trees, bushes and shrubs shall be removed only in actual construction area, all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation.

3. Impacts during Operation

91. The operation and maintenance activities would be conducted within the facilities, and therefore no impacts envisaged on biological environment.

V. IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

A. Economic Resources

1. Baseline Profile

92. *Agriculture*. Agriculture is the main economical activity of the region. Region was once famous for tea plantations. Owning to various reasons, however at present, there are practically no tea plantations. This has given way to commercial crops like Hazelnut, which is presently a major product which is exported from the region. In addition, new fruit species like kiwi and feijoa have been introduced; currently the production satisfies the entire country's demand. Besides, cereal production and live stock breeding for milk and meat is predominant in the region. In some areas grape cultivation is also practiced. The low land areas towards coast are less fertile compared to the agricultural lands in the mid-reaches of Enguri River, between the dam and Zugdidi City.

93. *Industry*. There are no major industries in the project area; there are small scale agro-based units like timber processing, fruit and hazel nut processing units in the region.

94. *Mining*. Major peat deposits are found in Anaklia. At present mining for lime, peat and building materials like brick earth, gravel and building stone is conducted to meet the domestic demand. The region also has mineral resources like: gold, lead, zinc, copper, cobalt and silver, most of which are still unexploited.

95. *Roads & transport*. Zugdidi is an important and strategic city in Georgia and is well connected with the rest of the country with roads and a railway. The Tbilisi-Samtredia-Sochi highway and Tbilisi-Batumi railroad pass through the city. The nearest port is at Poti (60 km), and the nearest airport is at Senaki (40 km). Internal roads in the city are very well developed and are in good condition. Public transport facilities are available and connect to all areas.

96. *Urban Services*. UWSCG provides water supply and sewerage services in the project area. At present, due to lack of source, the water supply system is almost non-functional. With supply from local bore wells, about 7% population is covered, and the remaining depend on own bore wells. In Anaklia, water supply is provided from bore wells and serves only a part of the area. Sewerage system is available only in Zugdidi and covers about 70% of the city population however, there is no treatment facility. Storm water drainage system is well developed in the entire project area. There is a municipal solid waste collection and transportation system in Zugdidi, however there is no proper disposal facility.

97. *Power Supply*. After the independence, Government of Georgia has made efforts to improve the power supply through new generating sources. Hydropower is the predominant source (88%), while the rest is from gas based thermal power stations. Zugdidi gets power supply from Enguri Hydropower Station. Uninterrupted and good quality power supply is available in Zugdidi.

2. Impacts during Construction

98. The water supply improvement works will all be conducted on government owned lands, except a small stretch near the existing Bashi Reservoirs, where the transmission main line pass through private agriculture land. This might affect the income of land owners.

99. All the pipelines are aligned along the roads, where mostly sparse development and agricultural fields can be observed. At Dzvari Town, pipeline will be laid along the river bank to avoid construction in the town.

100. In Zugdidi City, pipeline will be laid along the main roads, most of which are busy with commercial and business activities. Although work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material and workers discourage customers from visiting shops and other businesses, which lose income as a result. These losses however will be short in duration. Implementation of the following best construction measures will reduce the inconvenience and disturbance:

- Informing all residents and businesses about the nature and duration of work well in advance so that they can make necessary preparations
- Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing workforce and using appropriate equipments to complete the work in minimum time in these stretches

101. The another aspect of the work that has economic implications is the transportation of material to the site and waste from the site to locations where it can be put to beneficial use as recommended. The quantum of surplus soil generated from the construction work is significant (21,700 m3), which will generate 2,170 truck trips during the construction phase of 18 months– spread unevenly with more trips during initial stages. In addition there will be truck movements carrying material. Considering the location of sites along the main roads, and mostly in sparsely developed areas, the impact and inconvenience due to movement of vehicles will be insignificant. However, there may be considerable inconvenience in urban areas like Zugdidi City, where roads are already congested with traffic, pedestrians and activities. Dust generated during the transport may also impede the commercial and trade activities. The transportation of material and waste shall be implemented by the Construction Contractor in liaison with the city authorities, and the following additional precautions should be adopted:

- Plan transportation routes in consultation with the Zugdidi Municipality and Police
- Schedule transportation activities by avoiding peak traffic periods
- Use tarpaulins to cover loose material that is transported to and from the site by truck
- Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area
- Clean wheels and undercarriage of haul trucks prior to leaving construction site

102. The work of laying pipelines along the roads may disrupt/damage the existing infrastructure like storm water drains, water and sewer lines and power supply lines. Strom water drains along the roads are likely to be disturbed. It is therefore required to implement following measures to avoid or minimize the impact during construction:

- Design alignment with minimum disturbance to the existing infrastructure
- Identify the services to be affected and notify the respective service agencies about the construction work and if there is any need for shifting
- Coordinate with respective agencies and provide prior information to public about the disruption in services during construction
- In case of damage to storm water drains, temporary arrangements shall be made to let-off the runoff downstream to avoid flooding; rehabilitate the drains as early as possible to original position immediately after the pipeline work

3. Impacts during Operation

103. As the operation and maintenance activities would be conducted within the existing facilities, no impacts envisaged on economic resources. Repairs and leaks of the transmission main pipeline will be minor and localized. In fact, the improvement water supply system will bring various benefits. Availability of good infrastructure facilities will add to the quality of life, and there will be more people interested to live and work, which will bring new investments and boost economic development.

B. Socio-Cultural Resources

1. Baseline Profile

104. *Demography*. The present population of the project area is 126,070, of which 55% are in Zugdidi City. Contrary to the overall population growth in the country which has declined in the last decade, Zugdidi population has increased. This is mainly due to the large influx of Internally Displaced Persons (IDPs). Anaklia and Ganmukhuri, which are being developed by the government as coastal tourism destinations, are likely to experience high population growth.

Table 6: Population of Project Area

Year	Population			CAGR
	Urban	Rural	Total	
2010	69,750	56,320	126,070	-
2015	87,206	56,170	143,376	2.61%
2020	94,670	57,110	151,780	1.15%
2025	101,160	58,070	159,230	0.96%
2030	107,190	59,070	166,260	0.87%
2035	113,760	60,090	173,850	0.90%
2040	119,880	61,140	181,020	0.81%

105. *Population Composition*. Most of the population in Zugdidi are ethnic Georgians. About 28% of the population consists of IDPs, while this figure is 31% in overall district population Georgian is the main language, while most can speak Russian few can speak English. There are no population in the indigenous category. Almost all persons in Zugdidi are literate.

106. *Education & Health Facilities*. Zugdidi is provided with good health and educational facilities. There are 26 hospitals, 19 polyclinics and 6 dispensaries serving the district population. There are 80 state and 3 private secondary schools, 4 professional institutes and 3 higher education institutions including the University of Zugdidi.

107. *History, Culture and Tourism*. According to the history, Zugdidi was the administrative, cultural and political center in the 17th Century. Zugdidi has produced a number of famous Georgian writers. During Dadiani dynasty, Zugdidi was flourished as a literary centre. The city has wide streets and a beautifully developed avenue plantations. The main grove in the uptown was planned by famous Georgian writer R. Eristavi. Important socio and cultural places in Zugdidi include: Zugdidi Drama Theater and State Historical-ethnographic Museum. Besides, there a number of religious places like churches.

2. Impacts during Construction

108. There are various social-cultural resources (such as schools, hospitals, churches and cemeteries in the project area. There are 2 churches, 9 cemeteries and 9 schools located

along the roads where the pipelines are proposed. The construction impact will include noise and dust, and interrupted access due to movement of heavy vehicles transporting material and waste. Mitigation will therefore be needed to protect socio-cultural resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through following measures:

- Limiting dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks
- Providing wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required
- Increasing the workforce to complete the work quickly
- Avoiding construction work in sensitive times like festivals

109. There is invariably a safety risk when substantial construction such as this is conducted, especially in urban areas. Precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to formulate and implement health and safety measures at construction sites, which should include such measures as:

- Following standard and safe procedures for all activities – such as
  - provision of shoring in deeper trenches (> 2 m)
  - When working on height - testing structures for integrity prior to undertaking work and using appropriate safety belts
- Restricting entry into the construction area, providing warning and sign boards, and employing security personnel
- Providing proper signage, warning boards and barricades for trenches dug along the highway
- Providing adequate lighting to avoid accidents
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc);
- Maintaining accidents records and reporting regularly

110. *Economic Benefits*. There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labor force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labor camps. If temporary labor camps are to be provided, Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

- To the extent possible labor force must be drawn from the local community
- In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people. Following measures shall be followed:
  - Establish the temporary labor camps in consultation with the local authority
  - Shall be located away from water bodies
  - No clearance of trees vegetation shall be allowed for establishment of camp
  - Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc)
  - Contractor shall provide fire wood and no worker shall be allowed to cut any tree
  - Ensure regular and clean maintenance of the camp

3. Impacts during Operation

126. As the operation and maintenance activities would be conducted within the facilities, therefore no major impacts on socio-cultural resources envisaged. There is invariably a safety risk when considerable quantities of chlorine is handled - chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies. As detailed earlier, there will be 17 tonners in the facility at any point of time.

127. The chlorination facility will be is located within the proposed water treatment facility at Bashi. The site is surrounded by agricultural fields, and there is no habitation within a distance of 500 m. Therefore there may not be any public risk but workers safety must be considered. Following measures therefore shall be included:

- Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include:
    - Chlorine neutralization pit with a lime slurry feeder
    - Proper ventilation, lighting, entry and exit facilities
    - Facility for isolation in the event of major chlorine leakage
    - Personal protection and safety equipment for the operators in the chlorine plant
    - Visible and audible alarm facilities to alert chlorine gas leak

- Laboratory facility shall not be housed within the chlorination facility
- Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier
- Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Georgian Languages
- During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures

111. Another impact associated with water supply system is delivery of unsafe water into distribution system, which may lead to public health issues. This may occur due to (i) degradation or pollution of source water quality, and (ii) pollution of treated water during transmission and distribution due to leakages.

112. The subproject sources water from Enguri Dam, a very large water retaining structure, with quality of water confirming to domestic usage. There is no risk of pollution of source as there are no problematic discharges in the catchment that could degrade the water quality. Owing to the catchment characteristics, the dam experiences high silting, and the water has high turbidity, that will be removed through treatment before supplying to the consumers. Therefore no potential risk envisaged. Mitigation measures are already suggested in the surface water section to avoid the risk of collecting raw water with high suspended solids and turbidity.

113. A regular water quality surveillance program shall be implemented to avoid any public health risk as detailed below:

- Conduct regular raw water quality monitoring; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future

- Develop & implement a water quality monitoring program for distribution system according to the Georgian Law[4]
- Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel

114. The improved water supply will bring numerous benefits when it is operated. The main beneficiaries will be the citizens of Zugdidi, Anaklia, Ganmukhuri, Rukhi and other en route villages, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including the poor and tourists as well. This will improve the quality of life of people as well as raise standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase. Improvement in infrastructure will bring more economic opportunities. Availability of good infrastructure will boost the tourism economy .

115. The improved and expanded water supply system would require additional workforce – both skilled and unskilled, for operation and maintenance, and therefore creates new employment opportunities for local people.

C. Noise & Vibration

1. Baseline Profile

116. Ambient noise is not subjected to monitoring in Georgia, so there is no data on ambient noise/vibration available. Main noise generating sources in the project area are transport vehicles. Following table shows the subproject sites and their background noise levels (based on the site observations) and sensitive receptors, if any.

Table 7: Ambient Noise & Vibration and Sensitive Receptors at Project Sites

Subproject Sites	Background Noise/Vibration	Sensitive Receptors
Enguri Dam	Dam is located in hilly region away from any developmental activity. There is no noise of any kind except that of water jetting out from the bottom sluices	None
Pipeline Alignment – from Dam to WTP, Bashi, Zugdidi and Anaklia	Pipeline runs along the main roads, carrying considerable traffic. Linear sparse development can be observed along the roads. The main noise source is traffic.	There are residential areas, 9 cemeteries, 2 churches, 9 schools and a kindergarten along the alignment
WTP site	WTP site is located in rural hinter land surrounded by agricultural fields.	None
Bashi Reservoir	This is the existing reservoir site. It is located in rural hinter land surrounded by agricultural fields.	Nearest house is located at about 200 m from the site.

2. Impacts during Construction

117. Construction activities are likely to generate noise and vibration. In the present project, haulage of construction materials, and operation of equipment like backhoe loader (80 dB), handheld pneumatic drill (85 dB), concrete mixers (80 dB) and concrete vibrators

[4] Schedule N7 of Technical Regulation on Drinking Water issued in 2007 by Ministry of Labor, Health and Social Welfare, Government of Georgia

(76 dB) are the primary noise generating activities. This project does not involve high noise/vibration generating activities like pile-driving or rock cutting.

118. Assuming the worst case conditions and simultaneous working of two pieces of equipment (backhoe and pneumatic drill) the following table shows the noise levels in comparison with the Georgian noise standards. Since the construction noise is intermittent and short-term, the maximum admissible noise levels as per the Georgian standards (figures in bracket) are considered for comparison. The predicted day-time noise levels exceed the standard only within a distance of 50 m (single equipment use) and 100 m (combined use of two equipments). There are no sensitive receptors within this distance of work sites, therefore no impacts envisaged. There may be sensitive receptors within 50 m of pipeline works in residential/urban areas. The noise from pipeline works will be temporary (on an average a 50 m length of trench will be excavated in 4 hours), no special precautions will be required. Sensitivity to noise increases during the night hours. Appropriate safety measures shall be put in place for workers, who will be continuously in the noisy work environment. Following measures therefore shall be implemented:

- no construction activities shall be conducted in the night
- Provide personal protection equipment like ear plugs to the workers at the noisy working site

Table 8: Noise Levels at Various Distances from the Site

Distance for equipment	Backhoe	Hand-held pneumatic drill	Mixer	Vibrator	Combined[5]	Noise Standard[6] *Leq dB(A)*	
M	*Leq dB(A)*					*Day*	*Night*
15	80	85	80	76	86	55 (70)	45 (60)
50	70	75	70	66	76		
100	64	69	64	60	70		
200	58	63	58	54	64		
500	50	55	50	46	56		
1,000	44	49	44	40	50		
2,000	38	43	38	34	44		

119. Another important activity is haulage of construction materials and waste to and from the sites. Following measures shall be included to avoid nuisance due to haulage of material and waste.

- Schedule material and waste haulage activities in consultation with local authorities
- No nighttime haulage activity; limit to day time off peak hours
- Educate drivers: limit speed and avoid use of horns
- Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads that may disturb the traffic movement

120. None of the activities in the subproject has potential to generate observable vibration, and therefore no impacts envisaged.

[5] Combined noise of two noise generating equipment (backhoe and pneumatic drill) likely to be used

[6] Tolerable and maximum admissible levels of noise for residential zone as per Decree on Environmental Quality Standards notified in 2001 by the Ministry of Labor, Health and Social Welfare, Government of Georgia; figure shown in bracket are maximum admissible levels.

3. Impacts during Operation

121. There are no sources of noise/vibration from the operation of the water supply system.

D. Cumulative Impacts

122. The project is designed to improve environmental quality and living conditions in Zugdidi, Anaklia and en-route villages through the improved water supply system. The potential negative impacts identified on various environmental parameters, during both construction and operation, in the previous sections of this report, are localized and temporary.

123. By nature, impacts such as on air quality and on people (due to disturbance, nuisance, safety risk of construction activity) can have cumulative impacts, as all the construction activities are conducted simultaneously. However, as the construction sites are spread over a large area, cumulative impacts are unlikely. Further, these are common impacts associated with any construction activity, and as discussed in the earlier sections, there exists proven and easy-to-implement measures to mitigate these impacts.

124. No cumulative impacts envisaged either during the operation stage.

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VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements

125. Following agencies will be involved in implementing the Investment Program:

(i) Ministry of Regional Development and Infrastructure (MoRDI) is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. MoRDI will have overall responsibility for compliance with loan covenants.

(ii) United Water Supply Company of Georgia (UWSCG) is the implementing agency (IA), which will be responsible for administration, implementation (design, construction and operation) and all day-to-day activities under the loan. An, Investment Program Management Office (IPMO) will be established within the UWSCG for all Investment Program related functions. The IPMO will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.

(iii) The IPMO will be assisted by (a) Detailed Engineering Design Consultants (DC), who will design the infrastructure and manage tendering process. Civil works contractors build the infrastructure, and (b) Construction Supervision Consultants (SC), who will supervise the construction process and ensure the quality.

(iv) ADB is the donor financing the Investment Program.

126. UWSCG, specifically its Department of Quality Management and Environment Protection (DQMEP), will bear the responsibility of implementing the subproject in compliance with the Georgian Law and ADB Policy throughout design and implementation phase. Specific tasks would include:

- Updating this IEE to reflect any changes in final project design,
- Submission of revised IEE to ADB, for review and approval; incorporating ADB comments, if any
- Obtaining the approval from the Ministry of Energy of Georgia for water abstraction from the Enguri Dam, and
- Implementation of the EMP including grievance redress

127. Currently DQMEP is staffed with an Ecologist/Environmental Specialist, who also heads the Department. The incumbent Ecologist/Environmental Specialist, with a master's degree in ecology and 7 years of professional experience (including 5 years in Licenses and Permits Department of the MoEPNR), is well versed with the Georgian environmental law, EIA and EIP processes, and other government regulations. With the existing staff, the DQMEP can update the IEE internally and can also coordinate with government agencies for necessary approvals. The DQMEP, however, requires support for implementation of EMP.

128. Implementation of EMP of this subproject require an experienced Environmental Management Specialist (EMS) to spend a total of around three months over the average 6 month design and 15 month construction period, conducting routine observations and surveys, and preparing monitoring reports. The EMS will also be responsible for: incorporation of mitigation measures in design and construction; and, baseline and construction-stage environmental quality monitoring. Support of an additional EMS is also required to oversee the EMP implementation, and collating and submitting bi-annual Environmental Monitoring Reports (EMR) to ADB. Since the specialist support is not

required continuously, it will be feasible and convenient to an individual consultant to assisting DQMEP in implementing these tasks.

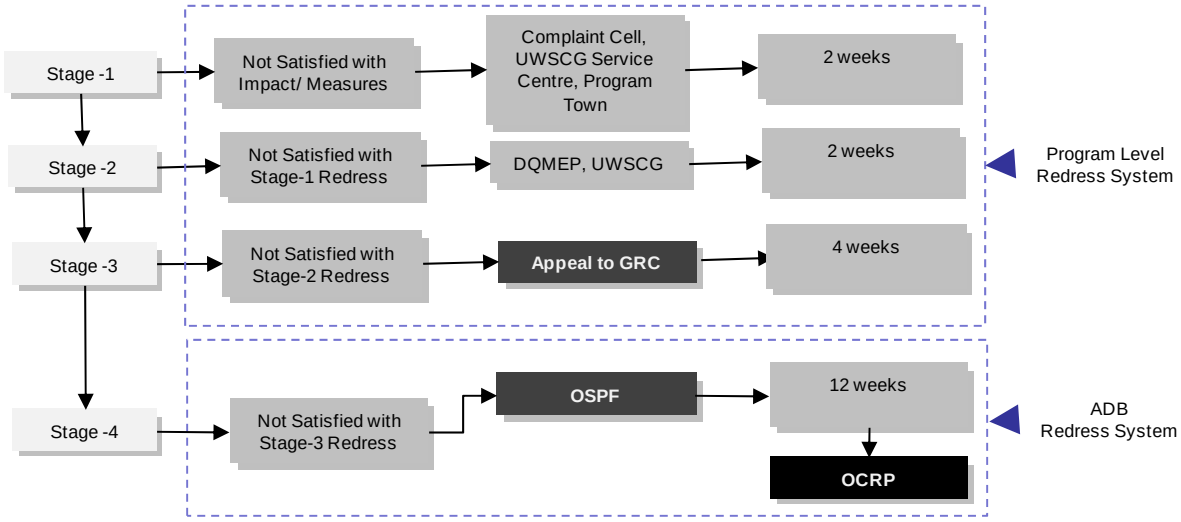
129. DC will be responsible for: incorporation of mitigation measures in design and construction; and, baseline environmental quality monitoring. SC will be responsible for construction-stage environmental quality monitoring and implementation of EMP by the Contractor. DQMEP with the assistance of EMS will review and approve IEE and/or EIA reports and oversee implementation of EMP. The civil works Civil Contractor will implement mitigation measures during construction. Implementation of mitigation and monitoring measures during operation will be the responsibility of DQMEP. Government regulatory agencies such as MoEPNR will also monitor the environmental performance.

B. Grievance Redress Mechanism

130. As the work is being done in inhabited areas, most of the impacts are construction-related, and therefore it is anticipated that improper or inadequate implementation of EMP may lead to disturbance and inconvenience to local people during construction. In order to provide a direct channel to the affected persons for approaching project authorities and have their grievance recorded and redressed in an appropriate time frame, UWSCG will establish a Grievance Redress Mechanism. A Complaint Cell and a Grievance Redress Committee will be established in Zugdidi Service Centre to function throughout the construction period.

131. The Complaint Cell at the UWSCG Service Center in Zugdidi will accept complaints regarding the environment safeguard issues in implementation of the subproject. A four stage grievance redress mechanism is indicated in **Figure 5** below. The grievances received and actions taken will be included into the environmental monitoring reports submitted to ADB.

Figure 5: Grievance Redress Mechanism



(i) Complaints received (written or oral communication) by the Complaint Cell (CC) will be registered in database system, assigning complaint number with date of receipt; Complaint Cell will inform the complainant the time frame in which the corrective action will be undertaken.

(ii) The Complaint Cell and UWSCG Investment Program Management Office (IPMO) will investigate the complaint to determine its validity, and assess whether the source of the problem is indeed subproject activities; if invalid, the Complaint Cell will intimate the complainant and may also provide advice on the appropriate agency to be approached.

(iii) If the complaint is valid, the Complaint Cell will check the environmental management plan (EMP) of the subproject whether this issue was identified and mitigation was suggested; if yes, the Complaint Cell and UWSCG IPMO will direct the civil works Contractor to take immediate actions as per the EMP.

(iv) If this is an unanticipated issue, the UWSCG IPMO will to identify mitigation measures and advise the civil works Contractor accordingly and a corrective action should be taken and a Corrective Action Plan (CAP) prepared.

(v) The Complaint Cell will review the civil works Contractor's response on corrective action and update the complainant within two weeks.

(vi) If the complainant is not satisfied with the action taken by the Contractor within two weeks from the start of corrective action as directed the Complain Cell, the grievance will be directed to the Department of Quality Management and Environmental Protection (DQMEP) of the UWSCG.

(vii) The DQMEP will review the issue with the IPMO and relevant Service Center and may ask for additional information or conduct site visit, and will advise the IPMO and relevant Service Center on actions to resolve the issue.

(viii) The Service Center will submit the interim report in a week to DQMEP on the status of the complaint investigation and follow-up actions, and final action taken report within two weeks of completing the action. The DQMEP will intimate the complainant of the same.

(ix) If the complainant is still dissatisfied with the action taken or decision, he/she may approach the Grievance Redress Committee (GRC, see below) established in the town

132. **Grievance Redress Committee (GRC)**. A GRC will be established to resolve the unresolved issues at Stage 2 and this will function throughout the construction period, and will have hearings on need-basis. GRC will have following members:

- Chairman, Zugdidi Municipality or an elected member nominated by the Chairman
- UWSCG Service Center Head
- Member of IPMO

133. Considering the anticipated impacts, it is not expected that there is any likely issue which will remain unresolved in the Stage 3 of the process. In the unlikely event of dissatisfaction after Stage 3, the complainant can approach ADB with the complaint. ADB has in place a system under the ADB Accountability Mechanism, where people adversely affected by ADB-assisted projects can voice and find satisfactory solutions to their problems. An affected person can file a complaint (mail, facsimile, electronic mail, or by hand delivery) with:

The Office of the Special Project Facilitator (OSPF), ADB, 6 ADB Avenue
Mandaluyong City, 0401 Metro Manila, Philippines
Tel: (63-2) 632-4825; Fax: (63-2) 636-2490; Email: spf@adb.org

Or

Georgia Resident Mission, which will forward it to OSPF

134. In the event of unsatisfactory redress from OSPF, the complainant can further approach Office of the Compliance Review Panel (OCRP) at ADB headquarters

C. Environmental Impacts & Mitigation Measures

135. The Following **Table 9** summarizes the environmental impacts and suggested mitigation measures as discussed in previous sections. It also delegates the responsibility of mitigation measures implementation to various project agencies.

Table 9: Environmental Impacts and Mitigation Measures

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
Pre-Construction						
Resettlement impacts due to laying of pipeline through private pasture lands	L	M	• Provide compensation and assistance to the affect persons as suggested by the Resettlement Plan of the subproject	UWSCG	Transmission line from Bashi Reservoir to Zugdidi	RP Cost
Construction						
Impacts due to disposal of dredged material from the dam	H	L	• Conduct detailed investigations for sediment bathymetry and volumes for removal • Characterization shall include analysis for heavy metals, hazardous substances, and soil nutrients • Prepare a Silt Management Plan, which should include o Appropriate sediment collection method with minimum disturbance in the water body and no disturbance to original bottom soil o Appropriate dewatering technology o Identifying temporary dredged material management site o Material management strategy - material processing, handling and beneficial utilization or disposal • In case of silt characteristics beneficial for agricultural purposes, it may be provided to the nearby farmers to increase the fertility of their lands • Ensure that there is no disruption of water supply to Enguri Power Plant during the dredging work	UWSCG	Enguri Dam	Part of project design cost
Impacts due to excavation and generation of waste soil	L	L	• Use the surplus soil where possible in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas	Contractor	All construction sites	Part of construction cost
Erosion due to excavation/refilling	M	L	• Ensure proper compaction of refilled soil and there shall not be any loose soil particles on the top; the material shall be refilled in layers and compacted properly layer by layer	Contractor	All construction sites	Part of construction cost
Impacts due to construction work along the river bank	L	L	• Work shall not be conducted during flood season (July-September) • Consult dam authorities to ensure that there is no discharge from dam	Contractor	Pipeline site on the river bank near	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
			during the construction • After completion of work, the site shall be cleared of any material/debris		Dzvari Town	
Impacts due collecting rain water in excavated trenches	L	M	• Protect open trenches from entry of rain water by raising earthen bunds with excavated soil, • Confine construction area including the material storage (sand and aggregate) so that runoff from upland areas will not enter the site • Ensure that drains are not blocked with excavated soil	Contractor	All construction sites	Part of construction cost
Impact on ambient air quality due to dust generation	M	L	• Cover or damp down by water spray on the excavated mounds of soil to control dust generation; • Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process; • Bring the material (aggregate and sand) as and when required; • Ensure speedy completion of work and proper site clearance after completion–; • Damp down unsurfaced/bad condition roads to avoid dust generation while using for transport of waste/material • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site • Restrict access to the work area except for workers to limit soil disturbance	Contractor	All construction sites	Part of construction cost
Impact on air quality due to emissions from construction equipment/ vehicles	I	L	• Ensure that all equipment & vehicles used for construction activity are in good condition and are well maintained • Ensure that all equipment & vehicles confirms to emission and noise norms	Contractor	-	Part of construction cost
Removal of vegetation/trees for construction	L	L	• Avoid tree cutting by local and small change of alignment • Avoid tree cutting by locating the pipeline below the drain or into the road tarmac as far as possible	Contractor	All construction sites	Part of construction cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
			• Avoid cutting of matured trees • In unavoidable cases, plant two trees of same specie for each tree that is removed • Do not cut tree species listed in the Red Book (Georgian maple, Chestnut, Floodplain oak and Megrelian) • Identify and mark all the Red Book species in the immediate vicinity of the alignment during the design, • Sensitize the civil contractor and supervising staff before the start of construction • Trees, bushes and shrubs shall be removed only in actual construction area, all other preparatory works (material storage) shall be conducted on barren lands where there is no vegetation.			
Disturbance to business, people, activities and socio-cultural resources due to construction work	L	M	• Inform all residents and businesses about the nature and duration of work well in advance so that they can make necessary preparations Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks • Provide wooden walkways/planks across trenches for pedestrians and metal sheets where vehicle access is required • Increasing workforce and use appropriate equipments to complete the work in minimum time in the important areas • Avoid construction work in sensitive times like festivals near religious places	Contractor	Pipeline works	Part of construc tion cost
Disturbance/nuisance/noise due to construction activity including haulage of material/waste	L	L	• Plan transportation routes in consultation with the Zugdidi Municipality and Police • Schedule transportation activities by avoiding peak traffic periods • Use tarpaulins to cover loose material that is transported to and from the site by truck • Control dust generation while unloading the loose material (particularly aggregate and sand) at the site by sprinkling water/unloading inside a barricaded area • Clean wheels and undercarriage of haul trucks prior to leaving construction site	Contractor	All construction sites	Part of construc tion cost
Disturbance/damage to other infrastructure	M	L	• Design alignment with minimum disturbance to the existing infrastructure	Contractor	Pipeline Sites	Part of construc

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
			• Identify the services likely to be affected and notify the respective service agencies about the construction work and if there is any need for shifting • Coordinate with respective agencies and provide prior information to public about the disruption in services during construction • In case of damage to storm water drains, temporary arrangements shall be made to let-off the runoff downstream to avoid flooding; rehabilitate the drains as early as possible to original position immediately after the pipeline work			tion cost
Safety risk – public and worker	L	M	• Follow standard and safe procedures for all activities – such as o provision of shoring in deep trenches (>2 m) o When working on height - testing structures for integrity prior to undertaking work and using appropriate safety belts • Restrict entry into the construction area, provide warning and sign boards and security personnel • Provide adequate lighting to avoid accidents • Ensure that all workers are provided with and use appropriate Personal Protective Equipment - helmets, hand gloves, boots, masks, safety belts (while working at heights etc); • Maintain accidents records and report regularly	Contractor	All construction sites	Part of construc tion cost
Socio-economic benefits from employing local people in construction work	L	M	• To the extent possible labor force must be drawn from the local community • Contractor should at least source 50% of unskilled labor force from local communities	Contractor	All construction sites	Part of construc tion cost
Impacts due to import of labor and establishment of temporary labor camps	L	L	• In unavoidable case of sourcing labor from other areas, provide adequate housing facilities so that there are no impacts and conflict with the local people: o Establish the temporary labor camps in consultation with the local authority o Shall be located away from water bodies o No clearance of trees vegetation shall be allowed for establishment of camp o Provide all basic amenities (water supply and sanitation, waste collection & disposal, first aid facilities, etc)	Contractor	Temporary labor camps	Part of construc tion cost

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
			o Contractor shall provide fire wood and no worker shall be allowed to cut any tree o Ensure regular and clean maintenance of the camp			
Disturbance due to construction noise	L	L	• No construction of activities in the night • Provide personal protection equipment like ear plugs to the workers at the noisy working site • Schedule material and waste haulage activities in consultation with local authorities • No nighttime haulage activity; limit to day time off peak hours • Educate drivers: limit speed and avoid use of horns • Earmark parking place for construction equipment and vehicles when idling; no parking shall be allowed on the roads, that may disturb the traffic movement	Contractor	All construction sites	Part of construc tion cost
Operation						
Impacts due to wastewater and sludge generation from the WTP	L	M	• Provide arrangements for re-circulation of wash water, which will optimize the raw water usage and reduce wastewater generation • Provide a sludge collection system from the settling tanks and clarifiers, and sludge drying system • Dispose the dried sludge properly – for land filling or can be used as soil conditioner	UWSCG	WTP	Part of project design cost
Impact on surface and groundwater due to disposal of increased volumes of sewage resulting from water supply augmentation	L	M	• Provide sewerage system with adequate treatment facilities, which can treat the sewage to Georgian standards and dispose safely; • The urban and tourism areas (Zugdidi City and Anaklia) shall be provided with sewerage system on priority	UWSCG	-	US$ 35.3 million as per FS Report
Air quality impacts due to spill/leak of hazardous oils, gases (like PCBs and SF6) and radioactive elements used in electrical/ laboratory equipment during repairs	I	M	• Avoid use of transformers and other electrical equipment containing PCB through alternative models (green models) • Minimize use of SF6 through appropriate selection of equipment • In unavoidable cases due to non-availability of appropriate equipment the following measures shall be put in place: o Supplier shall conduct awareness programs to workers/lab operators to know about the equipment containing hazardous material	UWSCG	-	As part of equipme nt costs

Potential Negative Impacts	Mag	Sig	Mitigation measures	Responsi-bility	Location	Cost
			• The repair and maintenance of such equipment shall be conducted only by trained persons and in appropriate facilities; more appropriately the contract for procurement with supplier/ manufacturer shall include taking back the equipment after the useful life			
Safety risk from handling and application of chlorine	L	M	• Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include: o Chlorine neutralization pit with a lime slurry feeder o Proper ventilation, lighting, entry and exit facilities o Facility for isolation in the event of major chlorine leakage o Personal protection and safety equipment for the operators in the chlorine plant o Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be house within the chlorination facility Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Georgian Languages • During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures	UWSCG	Chlorination facility	Part of project design
Risk of delivery of unsafe water to consumers	L	M	• Conduct regular raw water quality monitoring; results of monitoring conducted at this feasibility stage can be used as base values to study the change in the water quality in future • Develop & implement water quality monitoring program for distribution system • Establish a water quality laboratory as part of the project, with adequate building, equipment and trained personnel	UWSCG	--	Part of design costs

H-high; M- Medium and L-Low; $ refer to US dollar

D. Environmental Monitoring Plan

136. A program of monitoring will be required to ensure that all concerned agencies take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. The DC will conduct the sampling and analysis of water quality and sediment quality as part of the detailed design and construction supervision. Regular monitoring of implementation measures by civil works contractor will also be conducted by the SC, and overseen by DQMEP's EMS. Monitoring during operation stage will be conducted by the UWSCG.

137. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.

138. The following **Table 10** shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies various monitoring activities to be conducted. It describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 10: Environmental Monitoring Plan

Mitigation Measures/ Monitoring Activities	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Construction Phase					
• All construction related mitigation measures	Implementation on site	All construction sites	Observations on/off site; CC records; interviews with people and workers	Weekly	SC
• All design related mitigation measures	Inclusion in the project design	-	Design review	As needed	DQMEP
• Enguri Dam water quality analysis	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride, Magnesium, Sodium, Zinc, Iron, Total coliform, E-coli and BOD	Water discharge from bottom sluice gates (2 random samples)	Comparison of analyzed parameters with GoG Surface Water Norms[7] for domestic use	Once during the design	DC
	pH, suspended solids, turbidity, DO	2 locations (near the dredging activity and near the diversion outlet of power plant)	Comparison with the base water quality established during the design	Fortnightly during the dredging activity	SC
• Enguri Dam sediment analysis	pH, Zinc, Iron, total, Barium, Boron, Arsenic, Mercury, Cadmium, Manganese, Nickel, Selenium, Copper ,Aluminum, Lead, Chromium, Antimony, Pesticides, Sediment fertility (N, P, K)	Dredging location (2 random samples)	Concentration of heavy metals/harmful substances to categorize as hazardous waste; use of desilted material as soil conditioner in fields	Once during the design	DC
•	Same as above	Random sample from the removed material	Concentration of heavy metals/harmful substances to categorize as hazardous waste; use of desilted material as soil conditioner in fields	Random sampling - periodically	SC

[7] Rules of Protection of the Surface Waters from Pollution, 2001 (Decree №297/N), Ministry of Labor, Health and Social Welfare, GoG (**Appendix 4**)

Mitigation Measures/ Monitoring Activities	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility
Operation					
Long Term Surveys					
• Raw water quality monitoring	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride, Magnesium, Sodium, Zinc, Total coliform, E-coli, BOD	Raw water quality near inlet of WTP	Comparison with the base values of design period monitoring	Quarterly	UWSCG (independent laboratory)
	pH, suspended solids, turbidity, DO	Raw water quality near inlet of WTP	Comparison with the base values of design period monitoring	Daily	UWSCG (WTP laboratory)
• Treated water quality	pH, Turbidity, Sulphate, Chlorides, Calcium, Nitrate, Nitrite, Fluoride, Magnesium, Sodium, Zinc, Total coliform, E-coli, BOD	1 sample after treatment	Comparison with GoG drinking water standards[8]	Quarterly	UWSCG (independent laboratory)
	Parameters as per footnote 8	Monitoring locations as per footnote 8	GoG drinking water regulation	Frequency as per footnote 8	UWSCG (WTP laboratory)

[8] Technical Regulation on Drinking Water, 2007, (Decree №349/N), Ministry of Labor, Health and Social Welfare (Attached at **Appendix 5**)

E. Costing & Budget

139. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal construction contract, so there are no additional costs to be included in the EMP. Costs of design-related mitigation measures are included in the budgets for the civil works. Detailed surveys and investigations to be conducted by the DC are part of the design costs.

140. Monitoring of implementation of mitigation measures by contractor during construction will be conducted by the Environmental Management Specialist (EMS) of the SC. The review of design and contract to check the inclusion of all design-related mitigation measures will be conducted by the EMS of the DQMEP. The inputs costs of these experts are included in the EMP.

141. The costs of environmental quality monitoring to be conducted during the detailed design and construction phase are included in the EMP. Long-term water quality surveys are proposed in operation phase. Periodic raw and treated water quality at WTP is to be conducted through an independent laboratory, the cost of which is included in the EMP. Water quality monitoring in distribution system will be conducted in the laboratory of UWSCG, which will be constructed as part of the subproject, and therefore no separate costs are included.

142. As presented in **Table 11** the costs of EMP implementation is estimated as US$ 77,000 during the design and construction. During operation phases, the annual costs will be US$ 2,400.

Table 11: Environmental Management Costs

Item	Quantity	Unit Cost	Total Cost
Implementation of EMP (1 year)		*US $*	*US $*
Environmental Management Specialist (SC)	3 months	10,000[9]	30,000
Environmental Management Specialist (DQMEP)	0. 5 months	10,000	5,000
Dam water quality during design	2 samples	1,000	2,000
Sediment analysis during design	2 samples	LS	10,000
Dam water quality during dredging		LS	10,000
Analysis of dredged material during construction		LS	20,000
Total			*77,000*
Ground Water Quality Monitoring (long-term)			
Raw water quality at WTP, costs per year	4 samples	300	1,200
Treated water quality at WTP, costs per year	4 samples	300	1,200
Total			*2,400/year*

$ refer to US dollar

[9] Unit cost of domestic consultants include fee, travel, accommodation and subsistence

VII. RECOMMENDATIONS & CONCLUSION

A. Recommendation

143. The environmental impacts of the all infrastructure elements proposed in the water supply improvement subproject in Zugdidi has been assessed and described in the previous sections of this document. Potential negative impacts were identified in relation to design, location, construction and operation of the improved infrastructure. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

144. Mitigation measures were discussed with engineering specialists, and some measures have been already been included in the designs. This means that the number of impacts and their significance has already been reduced by amending the design. These include:

- Locating the transmission mains within ROW of existing roads to minimize the need to acquire private land and related resettlement issues
- Locating WTP on government lands
- Inclusion of water laboratory and chlorination facility to avoid public health risk due to delivery of unsafe water into distribution system

145. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. Appropriate avoidances/mitigation/enhancement measures have been suggested for the likely impacts that are identified.

146. At this stage of the project, no specific details on the proposed dredging/desilting activity in the Enguri Dam are available. However, consider the following, it is envisaged that the impacts will not be very significant, and can be mitigated with appropriate measures:

- Indicative sampling and analysis conducted indicated presence of no hazardous substances in the sediment
- The aquatic life in the reservoirs is very limited due to poor biomass content
- Fish species in the river is limited to Trout which can live in comparatively turbid water and in cold conditions
- No commercial fishing activity and there are no dependent population
- Primary purpose of the desilting is to clear the silt near the gates to allow free flow from bottom sluices, and therefore the area to be desilted will be limited to just upstream side of the dam (may be 200-300 m)

147. Various measures are suggested including the following to minimize the impacts generally anticipated from the dredging activity in a reservoir:

- Conducting detailed investigations for sediment bathymetry and volumes for removal
- Preparing a Silt Management Plan with the following:
    - Appropriate sediment collection method with minimum disturbance in the water body and no disturbance to original bottom soil
    - Appropriate dewatering technology
    - Identifying temporary dredged material management site
    - Material management strategy - material processing, handling and beneficial utilization or disposal

- Ensuring no disruption of water supply to Enguri Power Plant during the dredging work

148. The other construction impacts include generation of dust from soil excavation and refilling; the disturbance of residents and traffic by the construction work, collection of water in trenches, etc. These are common impacts of construction and there are well developed methods for mitigation. Some of these are listed below:

- Utilizing surplus/waste soil for beneficial purposes
- Measures to reduce/control dust generation (cover/damp down by water spray; consolidation of top soil, cover during transport etc)
- Providing prior public information and work planning in consultation
- Planning transport routes/schedule carefully; awareness creation in drivers
- Following standard and safe procedures for public and worker safety
- Avoiding nighttime construction activities

149. Although limited, this environmental assessment process also identified opportunities for environmental enhancement. Certain measures suggested in this regard include:

- Employing the local people in construction work as much as possible to provide them with a short-term economic gain
- Employing local people in operation and maintenance of the improved system
- Avoiding the use of electrical equipment with PCBs and SF6

150. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. The main impacts associated are from the generation of wastewater and sludge from WTP and safety risk from operation of chlorinators. Measures required for safe handling chlorinators, collection, treatment and disposal of wash water and sludge, facilities for monitoring the quality of raw and treated water have been suggested.

151. The main beneficiaries of the improved system will be the citizens of Zugdidi, Anaklia and en route villages, who will be provided with a constant supply of better quality water, which serves a greater proportion of the population, including urban poor (and tourists as well). This will improve the quality of life of people as well as raising standards of both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

152. However, the benefits will be further enhanced if the increased sewage generation resulting from increased water supply is collected and disposed safely. This document identifies that there is no proper sewerage system in the project area. To mitigate the likely impact, it is suggested that sewerage system with adequate capacity is developed under the Investment Program (IP) on priority in Zugdidi and Anaklia. This has been included in the IP.

153. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged.

154. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting held in Zugdidi, after which views expressed were incorporated into the IEE and the planning and development of the project.

155. The recommendation of this IEE process is that all mitigation, enhancement and monitoring activities proposed here and through the parallel process of Resettlement Planning shall be implemented in full. This is essential to ensure that the environmental impacts are successfully mitigated; this is the responsibility of UWSCG.

B. Conclusion

156. The environmental impacts of the proposed water supply subproject in Zugdidi have been assessed by the Initial Environmental Examination reported in this document.

157. The overall conclusion of the IEE is that provided the mitigation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be positive benefits through major improvements in quality of life and individual and public health once the scheme is in operation.

158. There are no uncertainties in the analysis; thus there is no need for further study such as EIA.

Appendices

Appendix 1: Photographs of Project Sites

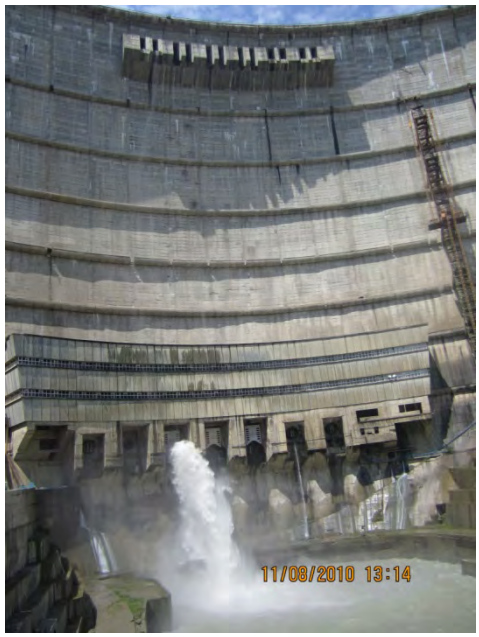


Photo 1 & 2: Enguri Dam and Bottom Sluices

Photo 3: Proposed WTP Site

Photo 5: Existing Bashi Reservoirs

Photo 4: Connecting Road to WTP Site

Photo6: Existing Bore Well in Anaklia

Photo 7: Pipeline Alignment near the Dam

Photo 10: Magana River

Photo 8: Pipeline Alignment along River

Photo 11: Existing Pipeline Crossing Enguri

Photo 9: Pipeline Alignment along River

Photo 12: Pipeline Alignment Along the Road

Photo 13: Tress along the Alignment

Photo 16: Flood Plain near Anaklia

Photo 14: Drains along the Alignment

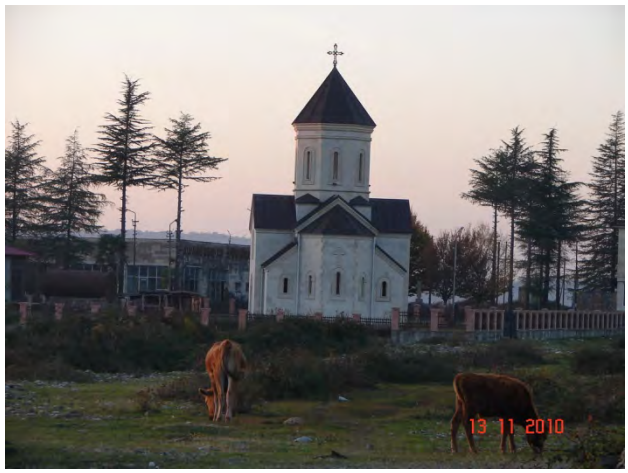


Photo 17: Church near the Pipeline Alignment

Photo 15: Pipeline Work at Anaklia (other project)

Photo 18: Cemetery near the Alignment

Typical Photographs of Red Book Species

Photo 19: Megrelian Birch (*Betula megrelica*)

Photo 20: Floodplain oak (Quercus pedunculiflora)

Photo 21: Chestnut usual (*Castanea sativa*)

Photo 22: Georgian maple (*Acer ibericum*)

Georgia Urban Services Improvement Project - Zugdidi

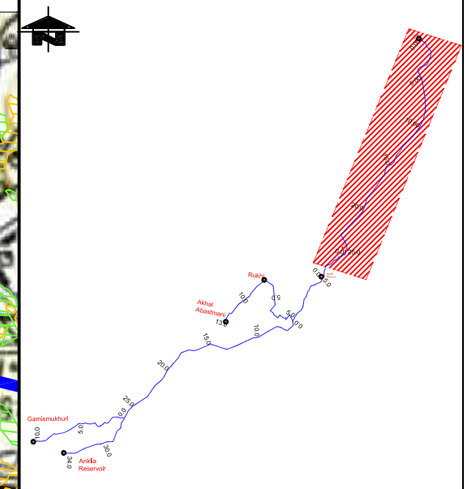
Proposed Alignment of Water Transmission Line
Ch 0.00 to 25.00

Enguri Dam

0.0 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0

WTP Site

Bushes
Forest
Waterbodies
Proposed Alignment of ater Transmission Line



Note : - Alignment shown is indicative only

Client:
Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

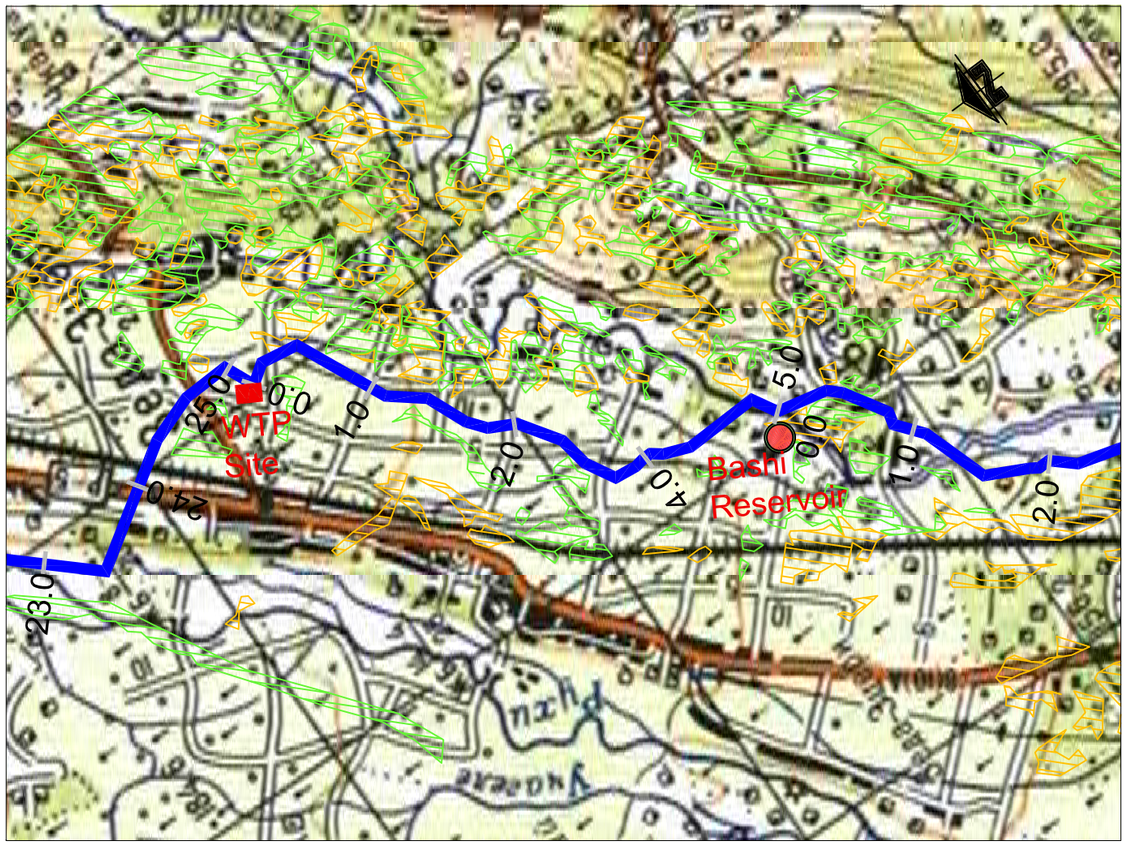
Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

Map - 2a

Sheet 1 of 4



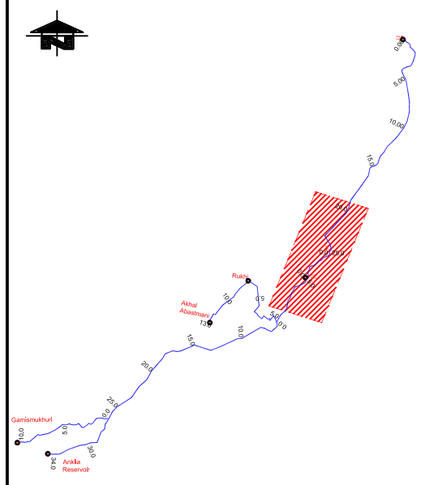
Note : - Alignment shown is indicative only

Georgia Urban Services Improvement Project - Zugdidi

Proposed Alignment of Water Transmission Line
Ch 0.00 to 5.00

- Bushes
- Forest
- Waterbodies
- Proposed Alignment of ater Transmission Line

Note : - Alignment shown is indicative only



Client:
Ministry of Regional Development & Infrastructure
Unlted Water Supply Company of Georgla

Consultant

Drawn:	Checked:
Date:	Approved:

Scale: NTS

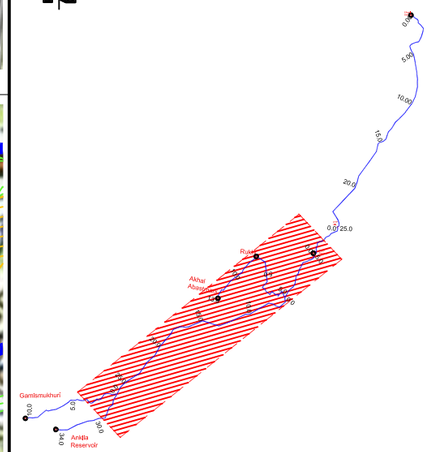
Map - 2b

Sheet 2 of 4

Georgia Urban Services Improvement Project - Zugdidi

Proposed Alignment of Water Transmission Line
Ch 0.00 to 26.00

Bushes
Forest
Waterbodies
Proposed Alignment of ater Transmission Line



Client:
Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

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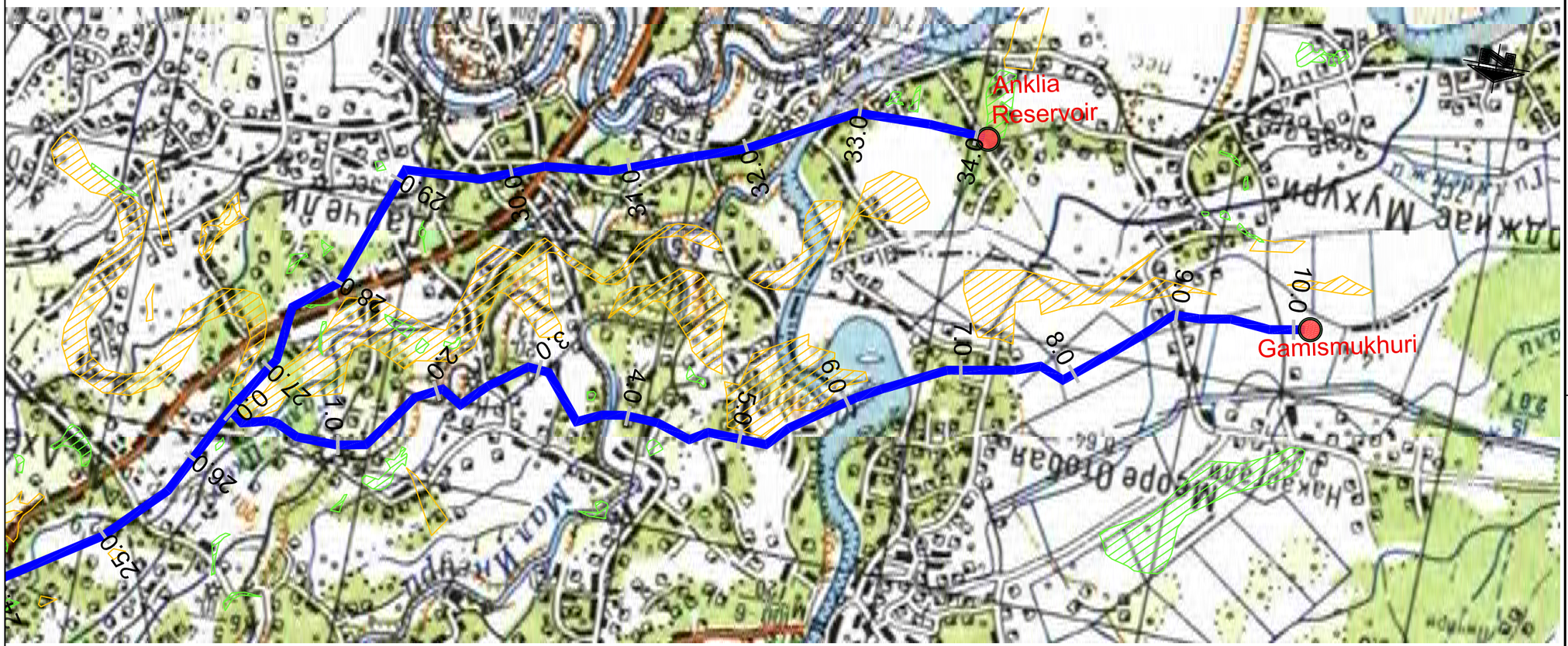
Date:	Approved:

Scale: NTS

Map - 2c

Sheet 3 of 4

Note :- Alignment shown is indicative only

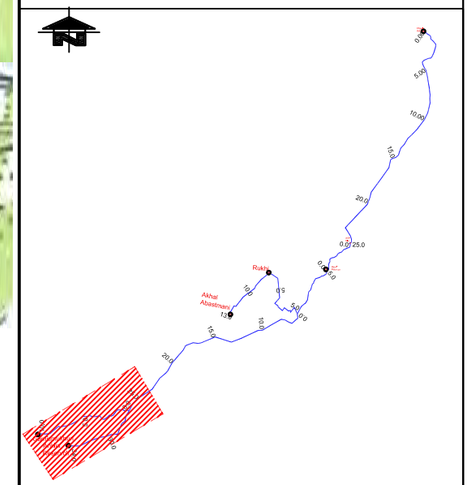


Note : - Alignment shown is indicative only

Georgia Urban Services Improvement Project - Zugdidi

Proposed Alignment of Water Transmission Line
Ch 26.00 to 34.00

- Bushes
- Forest
- Waterbodies
- Proposed Alignment of ater Transmission Line



Client:
Ministry of Regional Development & Infrastructure
United Water Supply Company of Georgia

Consultant

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Date:	Approved:

Scale: NTS

Map - 2d

Sheet 4 of 4

Appendix 3

Proceedings of the Safeguards Public Consultation Meeting at Zugdidi

A public consultation meeting was organized by Government of Zugdidi Municipality (GZM) on the request of UWSCG on November 19, 2010. The meeting was organized at the local Environmental Protection Office of the Ministry of Environment Protection and Natural Resources (MoEPNR) in Zugdidi. UWSCG has invited the elected representatives, non-governmental organizations (NGOs), and general public. Fifteen participants were present in the meeting (List attached in **Table 1**). The purpose of the meeting was to present to the stakeholders the proposed water supply improvement project to be implemented under the ADB funded GUSIIP, its likely environmental impacts and planned mitigation measures and to receive suggestions and feedback on the same.

A presentation on the proposed project and Initial Environmental Examination study was made by ADB TA consultants. The head of the Department of Quality Management and Environmental Protection (DQMEP) of UWSCG was also present at the meeting. Following were presented and discussed:

- Proposed project activities of Zugdidi Water Supply Improvement Subproject
- Policy, legal and administrative structure
- The possible negative impacts on the environment
- Mitigation measures, environmental management and monitoring
- Analysis of Alternatives
- Grievance Redress Mechanism

Stakeholders were most supportive of the project stressing the need to have suitable source for Zugdidi water supply and were of the view that the proposed project will improve the environmental quality of the project areas. Following are the queries/comments of the participants and replies by UWSCG and Consultants.

Question /Comment of the content	**Comments**
Who will conduct the monitoring of the environmental measures presented by you?	The project implementation body is the United Water Supply Company of Georgia (UWSCG). UWSCG will conduct monitoring through consultants. UWSCG Service Centre in Zugdidi will also oversee the monitoring.
If a violation is revealed during environmental monitoring, which sanctions shall be applied?	At first occurrence the project implementation organization could be notified. A Complaint Cell will be established in the UWSCG Service Centre in Zugdidi to receive complaints on environmental measures implemented in the project. Anyone can approach the Cell, and the issue will be addressed. If not satisfied can approach other level, as presented in the Grievance Redress Mechanism. The stakeholders can also approach Ministry of Environmental Protection and Natural Resources (MoEPNR)

	under the applicable law (order №538 of the MoEPNR dated 5th July, 2006 “on the Approval of the Methodology for the Calculation of the Damage Inflicted to the Environment”).
When is the project completion planned?	Detailed design of the project will be completed by March 2011, after which construction will take over a year, so all work should be completed by the middle of 2012.
Where will be constructed Water treatment plant?	Water treatment plant will be constructed on a government-owned land at Bashi village about 4 km from the existing Bashi reservoirs.
Will project construct the new reservoir in Anaklia?	In the Tranche-1, the project consist only water transmission main to bring water from the Dam. The distribution network and reservoir will be constructed in the Tranche-2.

Table 1: List of Participants

Name of the Participant	Organization	Contact Number
Tengiz kobalia	Zugdidi Municipality, infrastructure architecture and construction services	895 77 77 93
Rusudan Bachilava	Ministry of Environmental protection and natural recourse Department of Samegrelo-Zemo Svaneti	
Tinatis GiGiashvili	United Water Company of Georgia. Zugdidi Service centre	891 11 77 01
Ketevan lataria	Ministry of Environmental protection and natural recourse Department of Samegrelo-Zemo Svaneti	897 64 00 64
Lela Gvasalia	Ministry of Environmental protection and natural recourse Department of Samegrelo-Zemo Svaneti	896 46 28 08
Kilasonia Vova	United Water Company of Georgia. Zugdidi Service centre	895 22 30 62
Davit Fotskhveria	Company of Georgia. Zugdidi Service centre’	893 94 98 43
Mamuka Kobalia	Ministry of Environmental protection and natural recourse Department of Samegrelo-Zemo Svaneti.	895 13 71 77
Davit Sullukhia	Zugdidi Municipality, infrastructure architecture and construction services	877 95 24 08
Koba Shonia	Ministry of Environmental protection and natural recourse Department of Samegrelo-Zemo Svaneti.	893 28 20 22
Nugzar Jvania	Zugdidi Municipality, infrastructure architecture and construction services	895 35 11 22
Levan zarandia	United Water Company of Georgia	8 55 25 0577
Tinatin Zhizhiashvili	United Water Company of Georgia	-
Paata Chankotadze	TA Consultant, Asian Development Bank	-
Irakli Kaviladze	TA Consultant, Asian Development Bank	-

Photographs of Consultation Meeting

Appendix 4

General Requirements: Regulation of Water Composition and Features in Reservoirs According to Water Use Categories (Appendix 1 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

	Water Use Category			
			Fishery Purposes	
Indexes	**For potable-economic purposes of the population**	**For economic-household purposes of the population**	**The highest and first categories**	**The Second Category**
1	**2**	**3**	**4**	**5**
	The increase of the composition of the suspended particles is allowed for no more than:			
Suspended particles	0,25 mg/l	0,75 mg/l	0,25 mg/l	0,75 mg/l
	For the rivers containing 30 mg/l natural suspended particles during the lowest water level the increase of the composition of these particles is allowed within 5 %.			
	If the sewage waters contain suspended particles with sedimentation velocity not exceeding 0,2 mm/sec, their disposal into reservoirs (lakes) is banned and if the velocity exceeds 0.4 mm/sec – in rivers (channels)			
Floating mixtures (substances)	Layers of oil products, oils and fats and other mixtures should not be visible on the water surface			
Color	Should not be visible in water column:		Water should not gain strange color	
	20 cm	10 cm		
Odor, taste	Water should not gain odor and taste exceeding 1 score in intensity, which could be observed:		Water should not render fish products strange odor and taste	
	directly, after further chlorinating or other treatment	directly		
Temperature	The summer temperature of water should not increase for more than 30 C as a result of sewage water discharge in comparison with the average monthly temperature of the hottest month for the recent 10 years		The water temperature should not increase for more than 50 C in comparison with the natural temperature of the reservoir. In addition, in water objects where cold water fishes (salmon and whitefish) are present: 200 C in summer and 50 C in winter and for other water objects 280 C in summer and 80 C in winter	
Reaction (pH)	Should not exceed 6,5 - 8,5			
Water Mineralization	Not exceeding 1000 mg/l, of which: chlorides -350 mg/l, sulphates -500 mg/l	Standards are applied according to the above “taste” indexes	Standards are applied according to the taxation of the fishery water objects	

Oxygen in water	Should not be less in any water period:			
	4 mg/l	4 mg/l	6 mg/l	6 mg/l
BOD At $20^{o}C$ should not exceed:	3 mg/l	6 mg/l	3 mg/l	6mg/l
COD Should not exceed	15 mg/l	30 mg/l		
Disease causing	Water should not contain disease causing elements – viable helminth eggs, oncospheres of tenidia and viable protozoa cysts of pathogenic intestines			
Lactose positive intestine bacillus	1 in 10000	1 in 5000		
Coliphages not exceeding	1 in 100 l	1 in 100		
Water toxicity			Should not have severe toxic impact on test-objects at the points of discharge of the sewage waters into the water objects. The water from the water object at the control cross section should not have chronic toxic impact on test-objects	

Maximum Permissible Concentrations of the Contaminant Substances in Reservoirs According to Water Use Categories (Appendix 2 of Rules of the Protection of the Surface Waters of Georgia from Pollution)

S. No	Ingredient name	Hazard class	For potable-economic-household water use reservoirs		For fishery water use reservoirs	
			Limited indexes of harmfulness	Maximum Permissible Concentration mg/l	Limited indexes of harmfulness	Maximum Permissible Concentration mg/l
1	2	3	4	5	6	7
1.	amine nitrogen	3	sanitary-toxicological	0,39	toxicological	0,39
2.	aluminum	2	sanitary-toxicological	0,5	sanitary-toxicological	0,5
3.	barium	2	sanitary-toxicological	0,1	organoleptic	2,0
4.	beryl	1	sanitary-toxicological	0,0002	sanitary-toxicological	0,0002
5.	boron	2	sanitary-toxicological	0,5	toxicological	10,0
6.	arsenic	2	sanitary-toxicological	0,05	toxicological	0,05
7.	vanadium	3	sanitary-toxicological	0,1	toxicological	0,001
8.	quicksilver	1	sanitary-toxicological	0,0005	toxicological	0,00001(should not
9.	tungsten	2	sanitary-toxicological	0,005	toxicological	be)
10.	zinc	3	general sanitary	1,0	toxicological	0,0008
11.	cadmium	2	sanitary-toxicological	0,001	toxicological	0,01
12.	cobalt	2	sanitary-toxicological	0,1	toxicological	0,005
13.	caprolactam	4	general sanitary	1,0	general sanitary	0,01
14.	magnesium	3	organoleptic	0,1	toxicological	1,0
15.	molybdenum	2	sanitary-toxicological	0,25	toxicological	0,01
16.	nitrates	3	sanitary-toxicological	45,0	sanitary-toxicological	0,012
17.	nitrites	2	sanitary-toxicological	3,3	toxicological	40,0
18.	nickel	3	sanitary-toxicological	0,1	toxicological	0,08
19.	iron	3	organoleptic	0,3	toxicological	0,01
20.	selenium	2	sanitary-toxicological	0,001	toxicological	0,005
21.	copper	3	organoleptic	1,0	toxicological	0,0016
22.	sulphates	4	organoleptic	500	sanitary-toxicological	0,001 100,0

(Legislative Herald of Georgia 18.12.2007. art. N 179 1973)

Registered in The Ministry
of Justice of Georgia
Registration number
470.230.000.22.035.011. 242

Decree N 349/N of The Ministry of Labor, Health and Social Affairs of Georgia

December 17, 2007

About Approval of Technical Regulation of Drinking Water

According to "The Public Health Law", "V" sub-paragraph of the article #3 and the first paragraph of the article #23, I give order:

1. To approve the enclosed 'Technical Regulation of Drinking Water".
2. The decree comes into force from the date of publication.

D. Tkeshelashvili

Technical Regulation of Drinking Water

Article **1. General provisions**

1. The Technical Regulation is made on the basis of the Law of Georgia about "Public Health", recommendations of the World Health Organization, European directions, regional characteristics of the country and climate-geographical conditions and sets the safe sanitary norms of human being for drinking water.

2. Liabilities by this Technical regulation should cover the following:

a) Natural or treated water, which is used for drinking, in food and other domestic purposes, in spite of origin and the supply method (distribution network, tank or cistern, bottle or container);

b) Water, which is used in food-stuffs or food-stuff products.

3. Liabilities by this Technical regulation should not cover the following:

a) Curing-mineral waters;

b) Medical water and water with other special targets;

c) Drinking water supplied by some individual source, the capacity of which 10m3/per day serves less than 50 persons not included in commercial or public network.

d) Natural mineral waters, where the mineralization exceeds 1500 mg/L.

4. The following characteristics and their normative size are defined by the Technical Regulation of drinking water:

a) Organoleptic characteristics;

b) Microbiological, inframicrobiological and parasitological characteristics;

c) Chemical characteristics (general characteristics, inorganic and organic substance);

d) Characteristics of radiative safety;

e) Standards of harmful chemical substance, as a result of water treatment;

5. The compliance tests defined by the Technical Regulation, must be carried out as follows:

a) In cases of water distribution systems inside buildings and storehouses, directly from the tap that supplies water to the consumers;

b) In cases of tanks and cisterns from the delivery point;

c) In cases of canning in the bottling point of water and in the selling point;

d) At the point of usage in those enterprises involved with food-stuffs and food products;

6. Any organization implementing the supply service of drinking water, despite the organizational-legal structure and departmental subordination, is liable to carry out the control and monitoring of compliance of drinking water with the defined characteristics under the Technical Regulation; providing accessibility of information and collected data.

7. In cases where the required standards are not met under the Technical Regulation, the supplier of drinking water is liable to carry out appropriate measures, including report to relevant organs, urgent analysis of pollution reasons, restriction of water usage and other measures for the safety of population.

Article 2. Sanitary Requirements on Drinking Water

1. Drinking water must be safe from the epidemical and radiative point of view and by chemical composition; Drinking water must have benevolent organoleptic characteristics.

2. Quality of drinking water must be in compliance with the sanitary standards under this Technical Regulation.

3. The organoleptic characteristics of drinking water must be in compliance with the requirements in the schedule N 1:

Schedule N1

Index	Measuring unit	Standard not more than:
Smell	Numbers	2
Taste	Numbers	2
Coloration	Degree	15
Turbidity	Turbidity unit (by	3,5

	formazin) or mg/L (by kaolin)	 2

4. The existence of outer membrane and water organisms seen with the naked eye is not allowed in drinking water.

5. The following analysis in the schedule #2 (according to the reason) must be carried out for detection and elimination in case of deterioration of organoleptic characteristics of drinking water:

Schedule N2

Index	Measuring unit	Standard not more than:
Sulphate (SO_4^{2-})	mg/L	250
Chloride (Cl^-)	mg/L	250
Oil products, total	mg/L	0,1
Surfactant substance anionoactive	mg/L	0,5
Rigidity	mg–eq./L	7–10
Calcium (Ca)	mg/L	140
Magnesium (Mg)	mg/L	85
Sodium(na)	mg/L	200
Zinc (Zn^{2+}),	mg/L	3,0
Iron (Fe, total),	mg/L	0,3

6. Epidemical safety of drinking water is defined by microbiological, inframicrobiological and parasitological characteristics in accordance with the given standards in the schedule #3.

Schedule N 3

Index	Measuring unit	Standard
Mezophilic aerobes and facultative anaerobes	Colony forming unit/ML 37^0 C 22^0 C	Not more than: 20 100
Total coliformic bacterias	Amount of bacteria in 300 ML	not allowed
E. coli	Amount of bacteria in 300ML	not allowed
Pathogenic microorganisms, including Salmonella	In 100 ML	not allowed
Coliform	Negative colony forming unit in 100ML	not allowed
Pseudomonas aerugiosa (only for pre- aliquoted)	In 250ML	not allowed

Streptococus faecalis	In 250LM	not allowed
Lamblia cysts	Amount of cysts in 50L	not allowed
Dysentery (amoebiasis) cysts	Amount of cysts in 50L	not allowed

7. Amount of mezophilic aerobes and facultative anaerobes must not exceed 100 colony forming unit in 1 ML in case of flood and other natural calamities.

8. Amount of mezophilic aerobes and facultative anaerobes and standards of total coliformic bacteria must not exceed in 95% of tests during 12 months in the water intake points of the water line network.

9. Definition of total coliformic bacterias and E. coli is implemented in the three parallel 100-100 ML tests.

10. Definition of lamblia cysts and Dysentery (amoebiasis) cysts is implemented in the water supply systems of surface sources.

11. Chemical composition of drinking water must satisfy requirements in the schedule #4.

Schedule N 4

Index	Measuring unit	Standard not more than:
Common characteristics		
Hydrogen index	PH	6-9
Permanganate oxidation	mg O_2/L	3,0
Total mineralization (dry remains) mg/L		1000–1500
Nonorganic substance		
Barium (Ba^{2+})	mg/L	0,7
Boron (B,total)	mg/L	0,5
Arsenic (As,total)	mg/L	0,01
Quicksilver (Hg, nonorganic),	mg/L	0,006
Cadmium (Cd, total)	mg/L	0,003
Mangan (Mn, total)	mg/L	0.4
Milobden (Mo, total)	mg/L	0,07
Nickel(Ni, total)	mg/L	0,07
Nitrate(short impact by $NO^-_{3)}$	mg/L	50
Nitrite (long impact by $NO^-_{2)}$	mg/L	0,2
Selenium(Se, total)	mg/L	0,01
Copper(Cu, total)	mg/L	2,0
Lead (Pb, total)	mg/L	0,01
Flourine (F^-)	mg/L	0,7
Chromium (Cr^{6+})	mg/L	0,05
Antimony(Sb)	mg/L	0,02
Cyanide(CN^-)	mg/L	0,07
Organic substance		
Total content of pesticides	mg/L	0,05

12. The control and monitoring must be implemented only on those pesticides, which can be contained in the water supply source. Together with this, the accordance of index must be defined individually for each pesticide and standard of aldrin, dieldrin, hectochlore and heptachlor epoxide content must be 0,030 microgram in Liter.

13. The following pesticides, their metabolites and products of reaction and dissolution are regulated for the provision of safety of drinking water:

a) Organic insecticides;
b) Organic herbicides;
c) Organic fungicides;
d) Organic nematocides;
e) Organic acaricides;
f) Organic alhycides;
g) Organic rodenticides;
h) Organic slymicides;
i) Similar products (including growth regulators).

14. Content of those harmful substances which occur in the water supply sources as a result of economic activity (not listed in the schedule #4), must not exceed quality standards set by the Ministry of Labor, Health and Social Affairs.

15. Radiative safety of drinking water is defined by the accordance of total α and β– radioactive characteristics with the standards in the schedule #5.

Schedule N 5

Index	Measuring unit	Standard not more than:
Total α– radio-activity	bk/L	0,1
Total β –radio-activity	bk/L	1,0

16. Identification of radionuclide in water is implemented in case of exceeding of total radio-activity standards. Estimation of revealed concentrates is implemented according to the radiative safety regulations.

17. Content of harmful chemical substance in the process of water treatment in the water supply system must be in compliance with the requirements given in the schedule #6. Together with this, the index of control is defined according to the concrete treatment technology.

Schedule N 6

Index	Measuring unit	Not more than:

Chlorine remains free	mg/L	0,3 –0,5
Chlorine remains connected	mg/L	0,8–1,2
Chloroform (during chloration)	mg/L	0,3
Ozone remains	mg/L	0,3
Aluminium (Al^{3+})	mg/L	0,1
Formaldehyde (during ozonization)	mg/L	0,05
Acrylamide	mg/L	0,0005
Active silicate acid (with Si)	mg/L ^{3}	10
Polyphosphate (according to PO^{3}_{4-})	mg/L	3,5

18. Duration of the chlorine contact with water during deactivation with free chlorine-no less than 30 minutes, with connecting chlorine-no less than 60 minutes.

19. The total concentration must not exceed 1,2 mg/L during simultaneous content of free and connected chlorine in drinking water.

20. The control of the ozone remains is implemented after mixing box; The contact of ozone with water-no less than 12 minutes.

21. In case of detection of several chemical substances in drinking water, which are regulated by the same limitative index, total correlation of each must not exceed 1 with the utmost admissible concentration.

Article 3. The Internal Control and Monitoring of Drinking Water

1. The internal control and monitoring of drinking water is implemented by the supplier.

2. The definition characteristics of drinking water and amount of research tests must be in compliance with the requirements in the schedule #7.

3. During the analysis of microbiological and organoleptic characteristics, the water samples are taken once in month in the distribution system of water supply, which supplies water to 20 000 residents.

4. With coordination of the competent state organs, the enhanced control regime must be implemented in case of flood and other natural calamities.

Schedul

e N7

	Number of samples per year/no less than				
Index	Number of consumers connected to the water supply system (thousand consumers)				
	Ground source			Surface source	
	Up to 20	20–100	More than 100	More than 100	More than 100
Microbiological	12	24	365	365	365

Parasitology	(is not implementing)			4	4
Organoleptic	12	24	365	365	365
General characteristics	4	6	12	12	24
Nonorganic and organic substances	1	1	1	4	12
Radiological	1	1	1	1	1
Index/ Connected to the technology of water treatment	Chlorine remains, ozone remains (no less than one in an hour), reagent remains (no less than one in shift				

5. The necessary control samples which must be taken after the repair of the distribution network and other maintenance are not included in the amount of samples defined in the second item.

6. In case of detection of total coliformic bacteria and E. coli in the sample of drinking water, it is necessary to define them urgently in the secondary sample. Chloride, nitrites and nitrates must be defined simultaneously for detection of pollution reasons.

7. In case of detection of total coliformic bacteria and E. coli in the secondary sample, the analysis of water is implemented according to the existence of pathogenic bacterium of intestinal group and (or) streptococus faecalis.

8. All the samples from the ground and surface water supply lines require definition of organoleptic characteristics (except samples for the analysis of neutralizing reagents).

9. The laboratory analysis must be implemented according to the following criteria for the routine monitoring:

a) Organoleptic: smell, taste, coloration, turbidity;

b)Microbiological: Mezophilic aerobes and facultative anaerobes, total coliformic bacterias E.coli ;

c) Chemical: PH, nitrogen forms (ammonia, nitrate, nitrite), chlorides, rustiness, chlorine remains.

Article 4. The State Control of Drinking Water

1. The scheme of the state control and monitoring of drinking water, sequence, characteristics for definition and amount of samples are defined according to the law of the relevant state controlling unit.

2. The samples of drinking water must be taken in accredited independent laboratory in compliance with the law.