Technical Report Number 2

Rapid Assessment of the Rioni and Alazani-Iori River Basins,

Republic of Georgia

Integrated Natural Resources Management for the Republic of Georgia Program

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LIST OF ACRONYMS AND ABREVIATIONS

1. INRMW – Integrated Natural Resources Management in Watersheds
2. USAID – United States Agency for International Development
3. AD - after death
4. ADB – Asian Development Bank
5. Al – Aluminum
6. As_2S_3 - Auripigment
7. a.s.l. – above sea level
8. As_4S_4 - Realgar
9. As_2O_3 – Arsenic Trioxide
10. BC - before Christ
11. Bi - Bismuth
12. BPO - Business Process Outsourcing
13. C – Temperature degree by Celsius scale
14. c – century
15. Cd – Cadmium
16. CO – Connecticut
17. Co – cobalt
18. cpu/100 ml - count per 100 ml
19. Cr - Chromium
20. Cu – Copper (Cuprum)
21. DDT - dichloro biphenyl trichloroethane
22. EVDO - Evolution-Data Optimized
23. EIA – Environmental Impact Assessment
24. EBRD – European Bank for Reconstruction and Development
25. ESCO – Electricity Sector Commercial Operation
26. ESIA – Environmental and Social Impact Assessment
27. et al - *et alii* (and others)
28. EURO – EU currency
29. FDI – Foreign Direct Investment
30. Fe – Iron (Ferrum)
31. FIZ – Free Industrial Zone
32. FSL – Full Supply Level
33. GDP – Gross Domestic Product
34. GEF – Global Environment Facility
35. GEL – Georgian Lari
36. GIG – Georgian Industrial Zone
37. GIS – Geographic Information Systems
38. g/l – grams per liter
39. g/m^3 –gram per cubic meter
40. GoG – Georgian Government
41. GWh – Gigawatt hour
42. ha – hectare
43. Hg – mercury
44. HPP – Hydropower Plant
45. H_2S - hydrogen sulfide
46. IDCDP – Irrigation and Drainage Community Development Project
47. i.e. - *abbr. Latin* id est (that is)
48. K - Potassium
49. $kcal/sm^2$ – kilocalorie per square centimeter

50. Kg – kilogram
51. km – kilometer
52. km/km^2 - kilometer per square kilometer
53. km^2 – square kilometer
54. km^3 – cubic kilometer
55. KFW – German Development Bank
56. kwh – kilowatt hour
57. kWh/m^2 – kwh per square meter
58. l – liter
59. l/s – liter per second
60. IT – Information Technology
61. LLC – Limited Liability Company
62. Ltd – limited
63. m – meter
64. mm- millimeter
65. m^2/day – quadratic meter a day
66. m^3 – cubic meter
67. m3/h – cubic meter per hour
68. m^3/24h – cubic meters per 24 hours
69. m^3/y – cubic meter per year
70. m^3/d – cubic meter per day
71. m^3/y – cubic meter per year
72. MAC – Maximum Allowable Concentration
73. MAGICC - modeling program
74. MCG – Millennium Challenge Georgia
75. MDF – Municipal Development Fund
76. MW – megawatt
77. mln – million
78. Mn – Manganese
79. m/s – meter per second
80. MoU – Memorandum of Understanding
81. Na – Sodium
82. NCDC – National Center for Disease Control
83. NEA – National Environmental Agency
84. Ni – Nickel
85. NH_4 – ammonium
86. NO_2 –Nitrite
87. NO_3 – Nitrate
88. PCB – Polychlorinated Biphenyls
89. PCDD/PCDF – Polychlorinated dibenzo-dioxins (PCDDs) and Polychlorinated dibenzo-furans (PCDFs)
90. pH - measure of acidity of (dilute) aqueous solutions: the negative logarithm (base 10) of the molar concentration of dissolved hydronium ions (H_3O^+);
91. PoPs – Persistent Organic Pollutants
92. PPA – Power Purchase Agreement
93. ppm – parts per million
94. RAK - RAS Al Khaimad
95. RDB – Red Data Book
96. Sb - Antimony
97. SCENGEN – statistical program
98. SHPP – Small Hydropower Plant
99. $SnHAsO_4$ - Tinarsenic Acid

100. t – ton
101. TEU - Twenty-foot Equivalent Units
102. TWh – terawatt hour
103. TRACECA –Transport Corridor Europe-Caucasus-Asia
104. t/ha – tons per hectare
105. TV – Television
106. WWF – World Wildlife Fund
107. UNDP –United Nations Development Program
108. UNFCCC – United National Framework Convention on Climate change
109. US – United States
110. USD – US dollars
111. US EPA – US Environmental Protection Agency
112. USDoS – US Department of State
113. US$ - US dollar
114. USSR – Union of Soviet Socialistic Republic
115. w/m^2 – watt per square meter
116. WB – World Bank
117. WWF – World Wildlife Fund
118. % - percentage
119. ‰ – slope gradient
120. µs/cm – Micro Siemens per centimeter
121. ~ - sign of approximation

SUMMARY

Georgia is a country rich in natural resources with many picturesque and pristine ecosystems, but in the presence of unclear environmental legislation and the weak law enforcement the condition of the country's environment has suffered for years. Many surface and ground waters are severely polluted due to waste dumping and untreated wastewater discharges, large areas of forests are cleared due to illegal logging that was very intensive after the break-up of the Soviet Union, populations of a number of valuable and unique fish and wildlife species are reduced due to poaching, and many grasslands are overgrazed. Inappropriate irrigation and agricultural practices have degraded large areas of arable land through soil erosion and salinization. The combined effects of these widespread practices in a synergy with adverse impacts of natural disasters and climate change undermines the natural resource base and ecosystem services that Georgia depends upon for sustainable development.

In order to address above issues, in September 2010 USAID-Caucasus launched a multi-year project: "Integrated Natural Resources Management in Watersheds of Georgia" (hereafter INRMW). The project is implemented within the framework of an umbrella program "Global Water for Sustainability" (GLOWS) by a consortium of international and national organizations under leadership of Florida International University (FIU) in a partnership with Care International, Winrock International, UNESCO-IHE and Caucasus Environmental NGO Network (CENN).

The primary goal of the INRMW Program is to improve current and future lives of people in Georgia by utilizing and managing natural resources more sustainably, including water, soil, vegetation, and the ecosystems that encompass them. The project aims to introduce innovative approaches and practical models of participatory integrated natural resources management in a watershed context in targeted pilot areas, by facilitating reforms to and harmonization of national policies, and by increasing the capacity of national and regional institutions to replicate these approaches and models throughout the country. These models will be introduced in four representative pilot watersheds/areas of Rioni and Alazani-Iori River Basins and efforts will be made to upscale and disseminate them across the country.

The project goal will be achieved by implementing a number of sequential activities, including: baseline assessments of existing laws, policies, institutions and, practices in the area of natural resource management and, other related sectors (e.g. potable water supply and sanitation, energy, agriculture, health protection, disaster management, etc.); rapid assessments of existing socio-economic and environmental situation in targeted river basins; selection of four representative upstream and downstream pilot watersheds/areas for on-the-ground interventions; detailed assessments of selected four pilot watersheds/areas; development of integrated natural resources management plans in a watershed context within selected pilot watersheds/areas; implementation of a number of priority interventions at community level through community small-grants program for demonstration of benefits out of sustainable and integrated natural resources management.

The project has already developed the rapid national assessment report that gives a general overview of the existing enabling environment in the area of natural resources management and related sectors mentioned above and an analysis of existing gaps and barriers to applying policies and practices for integrated natural resources management in a watershed context. The study looks at the nation-wide situation.

The Rapid River Basin Assessment is a second major deliverable under the project. Its general objective is to create a knowledge base around the targeted Alazani-Iori and Rioni river basins to lead to selection of four smaller representative pilot watersheds/areas for on-the-ground interventions, against a number of physico-geographic, environmental, social-economic, governance and other criteria. To this end, specific objectives of the study are: to collect, synthesize and analyze the baseline situation existing in Alazani, Iori and Rioni River Basins in terms of the ecological status and the use of natural resources; to identify linkages among the use of natural resources and ecosystem functions and; to define resource use opportunities, where sustainable and integrated management of these resources can bring immediate health, environment, ecological, and economic benefits. The focus is on sectors for water, land, biological and mineral resources management as well as on sectors having potentially adverse impacts on ecosystems, including agriculture, energy and industry. The current practices for management of wastes, natural disasters and climate change, which significantly affect the resource base of the targeted river basins, are also considered. The assessment analyzes the current situation, the gaps and the areas of conflicts among sectors in the context of integrated natural resources management. Information and analysis contained in this report will help the project identify and select those four pilot watersheds/areas within the larger geographic territories, which will be the most appropriate for demonstration of integrated natural resources management in a watershed context and as well, the most promising ones to bring tangible health, environmental and/or socio-economic benefits easily replicable in other areas.

The study has been developed through collection, compilation and analysis of available information as well as through face to face interviews with project partners and representatives of the Ministry of Environment, Ministry of Energy and Natural Resources, United Water Supply Company, various environmental NGOs, etc. Opinions expressed in this report are those of individual experts and may not coincide with the official positions of the government of Georgia or USAID Caucasus.

A number of limitations have been noted during the development of the Rapid Basin Assessment. These relate to availability and reliability of historical and current socio-economic and environmental data. More specifically, since we have not been tasked to generate our own set of data and given the time and the resource constraints, we have fully relied on available data and studies. While there is abundant information on Alazani River basin, given the past and current donor efforts, there are very limited studies on Rioni and Iori River Basins. Furthermore, various studies significantly differ in terms of the completeness of data and are not frequently consistent with each other. Therefore, we have not been able to assure the consistency and the same level of detail for all the basins and the sectors of interest.

The paper contains baseline information on current environmental and socio-economic situation in targeted river basins as well as on existing governance structures and processes; current and likely negative pressures and impacts on watershed ecosystems and natural resource base and, gives an analysis of linkages between use of watershed resources and ecosystem functions and services.

The report concludes that the Alazani-Iori and Rioni River Basins have possible functions and provide almost all possible ecosystem services (except for navigation) to local populations and economies that the watershed can have and can provide in theory, including health protection, maintaining ecosystem healthiness and integrity, disaster risk reduction, maintaining local subsistence economies and/or supporting large-scale economic schemes and, providing recreational resources. These functions and services differ in a degree of intensity and type across the basins as well as between upstream and downstream areas. For instance, in upper reaches of all the basins, with lower population densities, limited economic activities and insignificant technogenic pressures, ecosystems maintain high ecological value and largely exist in their natural form. The most important functions performed by the watersheds in upstream areas are health protection, maintaining wholeness of the ecosystems, disaster risk reduction, supporting local livelihoods and, providing high value recreation resources. Given the significant poverty level and the small-farm based agriculture existent in upstream areas, communities are highly dependent on local resources to maintain their livelihoods. These resources include but are not limited to timber and non-timber products, fish, water resources, and pastures. To a lesser extent, watershed resources are used as inputs for industries or are extracted to generate profits. Extraction of natural resources in all upstream, middle basin and downstream areas is carried out either illegally (tree felling, poaching, etc.) or legally without taking into consideration inter-linkages among various resources and the integrity of ecosystems. Environmental impact assessments are not carried out prior to start-up of mining activities or commercial logging and no environmental permits are issued for such activities. For instance, there are small to large scale mining activities across the targeted Basins to extract sand and gravel from river beds, banks and terraces. These activities can have serious impacts on river hydrology and hydraulics and can accelerate river bank erosion, landslides and mudflows, and floods. They can also impact fish spawning and the availability of other important aquatic habitats. In case of commercial logging, only maintaining the economic value of forests is taken into consideration during the planning of wood cuts, and due attention is not paid to potential environmental impacts (e.g. acceleration of natural disasters, increase in soil erosion, lake sedimentation, disturbance of wildlife, habitat degradation, etc.). Moreover, negative pressures and impacts from extractive and other commercial activities are likely to increase in the near future in all targeted river basins due to economic growth. These threats are expected to be higher in the Rioni river basin, which is exceptionally rich in water resources, forests and mineral resources in upper reaches. Therefore, the government plans to increase utilization of these resources by expanding concessions for resource use. This will ultimately lead to deterioration of ecosystems and resources of upstream areas of the Rioni basin and reduced quality of services provided by these ecosystems. For instance, extensive development of hydropower in upstream areas, if no concrete mitigation measures are carried out, will have both local and regional impacts on water regime, aquatic biota especially in lower reaches and delta areas, and on land resources by enhancing river bank and coastal erosion. It will also cause fragmentation of wildlife habitats.

In the middle reaches of the basins, population size and density increase together with degree of urbanization, which leads to increased demand and use of natural resources for both subsistence and commercial uses. As a result, large areas of natural landscapes are transformed into cultural landscapes with a high degree of degradation and contamination and thus, reduced ecological value. The degradation of natural ecosystems in middle reaches of the river basins is much higher in the Rioni River Basin than in the Alazani-Iori River Basins due to larger population and technogenic pressures imposed on the ecosystems. Therefore, ecological value of these landscapes is less than in the Alazani-Iori Basins. On the contrary, commercial uses of natural resources in the Rioni River Basin are higher than in the Alazani-Iori Basins. Types of uses are also different. In middle reaches of the Rioni river basin, for example, water resources are mostly used by hydropower, industrial and domestic sectors, while in the Alazani-Rioni river basins major uses are by hydropower, domestic, and agriculture sectors.

In the lower reaches of the basins, negative impacts come from both local and upstream pressures. Similar to upstream areas, the degree and types of pressures and impacts are different in the Alazani-Iori and the Rioni River Basins. Dedoplistskaro municipality, for instance, shared by Alazani and Iori River Basins is a very dry region with water scarcity, especially in the Iori Basin and with arid and semi-arid ecosystems. It is scarcely populated, predominately in the Alazani part of the municipality where the population is mostly rural. This imposes pressures on ecosystems from land cultivation and grazing. Coupling with the climate change effects, these anthropogenic pressures lead to further desertification and aridization of natural ecosystems and landscapes. The most downstream reaches of the Rioni include densely populated areas with relatively high degrees of urbanization and complexity of urban infrastructure. Water scarcity is not an issue here but water quality, flooding, and delta and coastal erosion are issues due to the cumulative effects of various upstream and downstream pressures.

Based on the analysis of baseline information, the report draws up following conclusions and recommendations:

<u>Conclusions:</u> The upstream areas of all targeted basins, due to low population density, do not experience significant pressures from technogenic activities and urban development. Therefore, large areas are occupied by natural landscapes and ecosystems of high ecological and aesthetic value that make these areas attractive for tourism development and recreation as well as for natural scientists; Tusheti and Batsara-Babaneuli PAs and Lagodekhi PA consist of unique ecosystems and components of the Greater Caucasus. In addition, there is a planned PA for the Central Caucasus in Racha-Lechkhumi region. Illegal hunting and fishing are the major threats to the species within the PAs and the most targeted mammals are bear, red and row deer, tur, chamois, and wild goat. Law enforcement is too weak to effectively cope with illegal activities.

Upstream, the Rioni and Alazani river basins are especially rich in timber resources, which mostly have ecological functions of soil protection and water regulation. But, due to the limited access to fire wood, local communities intensively harvest fire wood illegally. In addition, there are a number of concessioners in Tianeti, Akhmeta, Ambrolauri and Lentekhi municipalities who produce commercial timber from these high ecological value forests. Upstream areas are highly vulnerable to mudflows, landslides and avalanches. These geodynamic processes are extremely intensive in Racha-Lechkhumi and Lower Svaneti as well as on the southern slopes of the Greater Caucasus. Rivers Duruji and Kabali in Kvareli and Lagodekhi municipalities flow in mudflow basins and pose high threats to local populations. Geodynamic processes are intensified by unsustainable wood harvesting and overgrazing. Impacts of these natural disasters are high due to the non-existent of early warning systems and low capacities of local authorities and populations to cope with these phenomena.

Upstream areas, especially the Rioni river basin followed by Alazani river Basin, are rich in water resources, both surface and ground waters that are used for drinking water and hydropower generation. But these resources are underutilized. The existing HPPs are managed unsustainably and silting of reservoirs is not controlled. This reduces the efficiency of the plants on the one hand and causes river flow change resulting in flooding of surrounding areas (e.g. Lajanuri reservoir). Although urban areas have centralized water supply systems, such systems do not exist in the majority of rural areas. Moreover, sewerage coverage of the region is relatively low, mostly represented by urban systems, which do not have wastewater treatment facilities. Waste disposal sites also do not meet any minimum health and environmental standards. In rural areas wastes are dumped on river banks and beds.

Solar and wind energy is not used at all and fire wood is used as a principal energy source for heating.

Upstream areas, especially those of the Rioni river basin are rich in mineral resources, the majority of which is not currently utilized. That on the one hand prevents the environmental degradation but, on the other hand, does not support the economic development of the already poor regions with high levels of unemployment. The government has plans to restart many abandoned mining activities or to extract new deposits, e.g. arsenic and associated metal deposits in Racha-Lechkhumi and Lower Svaneti, and a new copper deposit in Kakheti region. At the same time, the state plans to develop tourism potential of upper reaches of the basins that might conflict with mining and other economic development objectives of the region as well as with conservation objectives of these areas. The largest mining operations are related to the extraction of limestone, clays, sand and gravel. Most of mines are open quarries that have significant impacts on surrounding environments. Inert material is extracted instream, from river banks and floodplain terraces, without any environmental considerations of impacts on river morphology, hydrology or aquatic biota.

In the middle reaches of the target basins agriculture and technogenic pressures increase in comparison with upstream areas, although current levels are much lower than during Soviet times. Therefore, many existing reversible or irreversible damages to the natural ecosystems are inherited from the past. For instance, during the 70-years of communist rule with its high urbanization and industrialization, large areas of virgin forests and other natural landscapes were transformed into cultural landscapes, settlements and industrial zones, especially in Imereti region. After the break-up of the Soviet Union there was an economic collapse and the majority of industrial facilities shut down their operations and many were completely abandoned, now left as brownfields with polluted soils and accumulated industrial wastes. A number of industries have now re-started their activities and, due to out of date technologies, release high amounts of pollutants into the environment. This is mostly the case for the Rioni river basin. In Alazani-Iori river basins, there was no such industrial development and industries were represented by food processing facilities and wineries having less impact on the environment than metal extraction and processing, heavy machinery, chemical and other industries located in Imereti. Particular danger from industrial activities comes from manganese extraction and smelting in Imereti region (Tchiatura, Terjola, Zestaphoni), seriously polluting waters and soils and posing high health threats to local populations.

With the development and full operations of the Kutaisi free industrial zone the technogenic pressures on the natural resource base will increase. Kutaisi is the second largest city in Georgia and is surrounded by many densely populated cities and towns upstream and downstream that pose high pressures on water, land and biological resources and air through urban run-off, vehicle emissions, untreated wastewater discharges and drainage water and leachates from waste disposal sites.

Regarding the use of water resources the largest volumes are consumed by domestic and power generation sectors. Industrial consumption is also high compared with that of Alazani and Iori River Basins, where after power generation and drinking water the water is used for irrigation purposes. Central water supply systems are at large concentrated in urban areas. The majority of rural areas do not have central water supply systems.

Sewerage systems exist only in urban areas without any wastewater treatment facilities. Wastes are disposed in so-called sanitary landfills, the majority of which is outdated and does not meet minimum health and environmental standards. Moreover, in rural areas wastes are dumped directly into river gorges.

As for the irrigation systems, although there have been some rehabilitation works on some of the major canals, the majority of systems need rehabilitation and proper maintenance. In addition, the lower level canals are in very poor condition. There are high losses in irrigation systems that cause irrigation erosion, salinization and bogging of large areas. Existing systems cannot recover the operational costs, since local communities do not have means to pay on the one hand, and state-owned irrigation companies do not have capacities to collect fees. Currently, it is planned to privatize the existing systems and introduce modern efficient technologies. However, the exact details and schedules of these plans are unknown.

Regarding the utilization of energy resources, in the midstream of the target basins the hydropower for electricity generation, and gas and wood for heating are utilized. There is no utilization of solar and wind resources. Geothermal resources at very limited level are used for greenhouses in Imereti and Samegrelo regions. The government is planning to build new HPPs on the Rioni to tap the potential of middle to low reaches. The first one is Namakhvani regulating HPP cascade, which will definitely have an impact on downstream areas in terms of decline in sediment flow. The reservoirs will need to be operated and maintained properly and minimum ecological flows should be guaranteed.

Similar to upstream areas, illegal logging and commercial timber production (Vani, Tskaltubo, Martvili, etc) pose threats to forest ecosystems as well as illegal hunting and fishing of terrestrial and aquatic fauna. In addition, mega-infrastructure projects, e.g. Black Sea transmission line have significant to moderate impacts on the natural environment in Imereti region.

Downstream of Kutaisi and Tskaltubo, in Rioni Delta and the Coastal zone, the population density is also high with the highest number of people living in the city of Poti, Black Sea port. These areas are highly impacted by floods, coastal zone and delta erosion due to change in Rioni flow, climate change, land use and land use change, eustasy and sea surges. The coastal zone needs constant artificial enrichment with sediments. It is expected that such pressures will grow due to new HPP schemes to be built on r. Rioni. The delta area known for its wetlands that have been designated as a Ramsar site. They are protected under the Georgian Law and are the part of the Kolkheti National Park. Even such status does not fully guarantee the full protection of these areas. Local population harvests timber, graze cattle and catch fish illegally, regardless of the fact that the law allows for such activities in the support zone. There is also peat extraction, but in smaller quantities and not for fuel use. Illegal fishing is the largest threat to the fish population, especially to the sturgeon that is transitory migratory fish in the Rioni River. Any medium- to large-size infrastructure project has an impact on the Rioni lower reaches and estuary with their abundant fish. Therefore, careful consideration should be given to environmental impacts of such projects during ESIA processes.

Downstream areas of Alazani and Iori basins are also extremely fragile since they represent the edge of the ranges for some endangered species, host unique riparian forest ecosystems untypical of arid and semi-arid areas, and very limited distribution of many rare and endemic plant species. Natural hydrometorological conditions are also very harsh there and any additional pressures can cause serious damages to such ecosystems. Meanwhile, regardless of low pressures from settlements due to the lower population density, there are pressures from sheep grazing, hunting by sports hunters and local populations, cutting riparian forests and from artificial fires made by hunters and shepherds. Furthermore, climate change impacts are high in downstream of the Kakheti region with more frequent, lengthy and intensive droughts. It is expected that this trend will be maintained within the next 50-year horizon. Moreover, climate change studies project that there will be significant reductions in Iori River flow and thus, adaptation measures have to be taken.

Regarding natural resource policies and management practices, they do not support integrated natural resources and watershed management principles. The only tool to take into consideration inter linkages among various resources is the ESIA and environmental permit which are granted to a limited number of economic activities. During the implementation phases of these projects there is practically no compliance or at best very weak environmental compliance monitoring and control. Water allocations are done without taking into consideration demands by various sectors and ecological flows are not guaranteed. Furthermore, currently, water flow is practically not measured and investment decisions are made based on old or estimated data. Climate change future impacts on infrastructure projects are also not taken into consideration.

The most regretful situation concerns environmental monitoring. While in the Rioni river basin water quality monitoring is more or less comprehensive, it is practically absent in Alazani and Iori River Basins. Ground water and soil quality data are absent and there is no effluent monitoring and control. Early warning systems for disasters exist at very premature stages and need further development at both national and local levels.

Recommendations. Based on the baseline study of the Alazani, Iori and Rioni River Basins and, for the purpose of the project, it is suggested to narrow the scope of project activities to upstream and downstream watersheds/areas of the major rivers (Alazani, Iori and, Rioni and its largest tributary - Tskenistskali) since they have the largest and most diverse functions and undergo the highest pressures from natural and anthropogenic factors. It is also suggested to consider municipalities, which most largely are delineated from each other by natural watershed boundaries (water divides), as units for INRMW planning, in order to guarantee manageable scale for assessment and planning of watershed resources, water safety, energy resources, disaster and climate vulnerability, mitigation and adaptation and, at the same time to ensure coherence of watershed resources planning with existing geo-political structures and processes. The criteria for selection of the pilot watersheds might be, but is not limited to: 1. Ecosystem richness and ecological value; 2. Economic importance of the natural resources and potential for economic development; 3. Poverty level; 4. Existence of local governance structures; 5. Willingness of local authorities to participate in the program; 6. Presence of a sufficient number of local communities; 7. Presence of USAID and other donor projects; 8. Degree of infrastructure complexity; 9. Population density; 10. Financial resource availability; 11. Ecological vulnerability; 12. Vulnerability to Climate Change; 13. Vulnerability to natural disasters; 14. Anthropogenic pressures and impacts; 15. High replication potential; 16. High likelihood for success, 17. Richness in energy resources; and 18. Interlinkeages among resource use and ecosystem functions etc. This is only an illustrative list of criteria. The final set will be elaborated through close consultations with all partners.

Based on above criteria, the following municipalities are prioritized for further consideration: Akhmeta, Tianeti and Telavi municipalities in the upstream sections of the Alazani Basin; the southern part of Signagi municipality and the entire Dedoplistskaro municipality in the downstream sections of the Iori and Alazani Basins; Ambrolauri and Oni municipalities in the upstream sections of the Rioni Basin; and the Poti municipalities of Khobi, Senaki, Abasha and Samtredia in the downstream sections of the Rioni Basin.

Upper reaches of the Alazani river, consist of wide areas of intact ecosystems, including protected areas (Tusheti, Batsara-Babaneuli, Ilto, etc) representing well the components of Caucasus mountainous ecosystems; are abundant in water and timber resources that are currently underutilized for power and fuel generation but having a high potential for further development; currently undergo pressures from unsustainable utilization fo natural resources (Akhmeta, Tianeti and upstreams of Telavi), agriculture (Telavi) and urban areas (Telavi, Akhmeta, Tianeti); have myriad environmental problems of drinking water quality, drinking water supply for rural areas, wastewater treatment, waste disposal, illegal logging, fishing and poaching (all municipalities), overgrazing, land erosion, unsustainable irrigation, etc.; have high tourism potential for PA-based (Akhmeta municipalities) cultural, agricultural and recreational (Telavi, Tianeti) tourism development; have high poverty level and are most widely dependent on natural resources to support their livelihoods. In addition, Akhmeta and Telavi have high success and replication potential, since there is a regional center in Telavi that could well-coordinate and support the project activities. Donors are active in both, Telavi and Akhmeta municipalities, including existing PAs. As for Tianeti municipality, it is far from the regional center and there are no donor-supported programs on-going. However, without considering upstream areas many problems in downstream areas cannot be solved. Besides there is a large hydrotechical scheme starting in Tianeti that utilizes a significant amount of water in Gardabani municipality that if not correctly managed and if the water is correctly allocated among the sectors might increase the water shortage in downstream areas of Signagi and Dedoplistsaro municipalities.

Downstream sections of Alazani and Iori rivers are represented by very fragile arid and semi-arid ecosystems of semi-deserts, steppes and floodplain forests. These areas form the maximal extent of the ranges of many endangered species and are inhabited by species (e.g. brown bear and linx) that are not typical to arid and semi-arid areas, and have various categories of PAs, including Vashlovani National Park. There is a conflict among various functions of ecosystems, including conservation function of the PAs and natural resources use. Therefore, they undergo pressures from sheep grazing, forest cutting by the local population, hunting by sports hunters and locals, killing of predators to avoid sheep loss, etc. In addition, these areas are short in water resources and it is likely that this problem will be further exasperated due to climate change impacts and potential increased use by upstream users. Desertification, soil erosion, salinization and bogging due to overgrazing, unsustainable agriculture management practices (plowing of pastures, burning of arable and pasture lands, inefficient irrigation, or absence of irrigation, and cutting of wind breaks). In addition, there are a number of mining activities for limestone and oil extraction that have significant impacts on local ecosystems. The area is rich in solar energy that can be utilized to produce electricity and heat. Finally, a number of donor-supported programs are on-going there, including EU-NACRES-FFI and GTZ biodiversity and climate adaptation programs.

Regarding the upstream sections of the R. Rioni, Ambrolauri, Oni and to a lesser extent Tsageri municipalities are represented by high ecological value forests, and sub-alpine and alpine meadows of the Western Caucasus which are habitats for Western tur and a number of other large mammals. There are high pressures from illegal and commercial logging, illegal hunting and fishing. The area is rich in water resources that have high power potential but are currently underutilized. The government plans to further develop this potential, which if not properly managed might have high impacts on the river regime in downstream areas. The area is also rich in biomass and the biomass fuel can be produced from wood chips, saw dust, manure, etc. The area is rich in mineral resources, particularly in non-ferrous metals of arsenic and associated metals, including gold, that are not extracted at present. Arsenic mines pose high pressures to local livestock and population and renewal and expansion of such activities will further enhance such pressures. This may conflict with the government goals to develop the tourism, both recreational and health in Racha-Lechkhumi region. Furthermore, the area is highly vulnerable to natural disasters, including earthquakes, landslides, mudflows and floods, which are accelerated by forest cutting and grazing on the slopes. Ambrolauri municipality, where the regional governor sits, is between Oni and Tsageri municipalities can coordinate the municipality-level activities and mobilize their resources. There are a number of donors or donor-support programs active in the region, e.g., Care has its program there, and USAID through its large-scale NEO program is going to enter the scene. UNDP is planning to implement flood management program in the upper and lower reaches of the Rioni Basin. Therefore, the catalytic effect of the INRMW program might be high.

As for the extreme downstream section of the Rioni basin, it is one of the vulnerable and fragile ecosystems undergoing severe pressures from all upstream and downstream activities. It shelters tertiary relicts of Colchic refugium and is a habitat of many endangered, rare, endemic and relic fauna species. In addition, it is a temporary shelter for a wide range of migratory birds and the waters there, including brackish and fresh water, are rich in both local and migratory fish, including sturgeon. There is Kolkheti National Park in the region, which is also undergoing constant pressures from the local population in terms of illegal logging, poaching, peat extraction, etc. Furthermore, many infrastructure projects end-up in the city of Poti, which is the major port for Georgia and therefore, have direct or indirect impacts on wetland ecosystems and the delta. The area is highly vulnerable to climate change that exasperates the already on-going delta and coastal erosion due to the reduction of river sediment flow as a result of upstream man-induced river diversion and its regime change, eustasy, and sea surges. The on-going Namakhvani HPP project, together with other planned HPP projects, will definitely have a negative impact on coastal zone. As for natural disasters, floods threaten populations of lower parts of Khobi, Senaki and Abasha municipalities as well as the city of Poti.

1.0 INTRODUCTION

1.1 Background

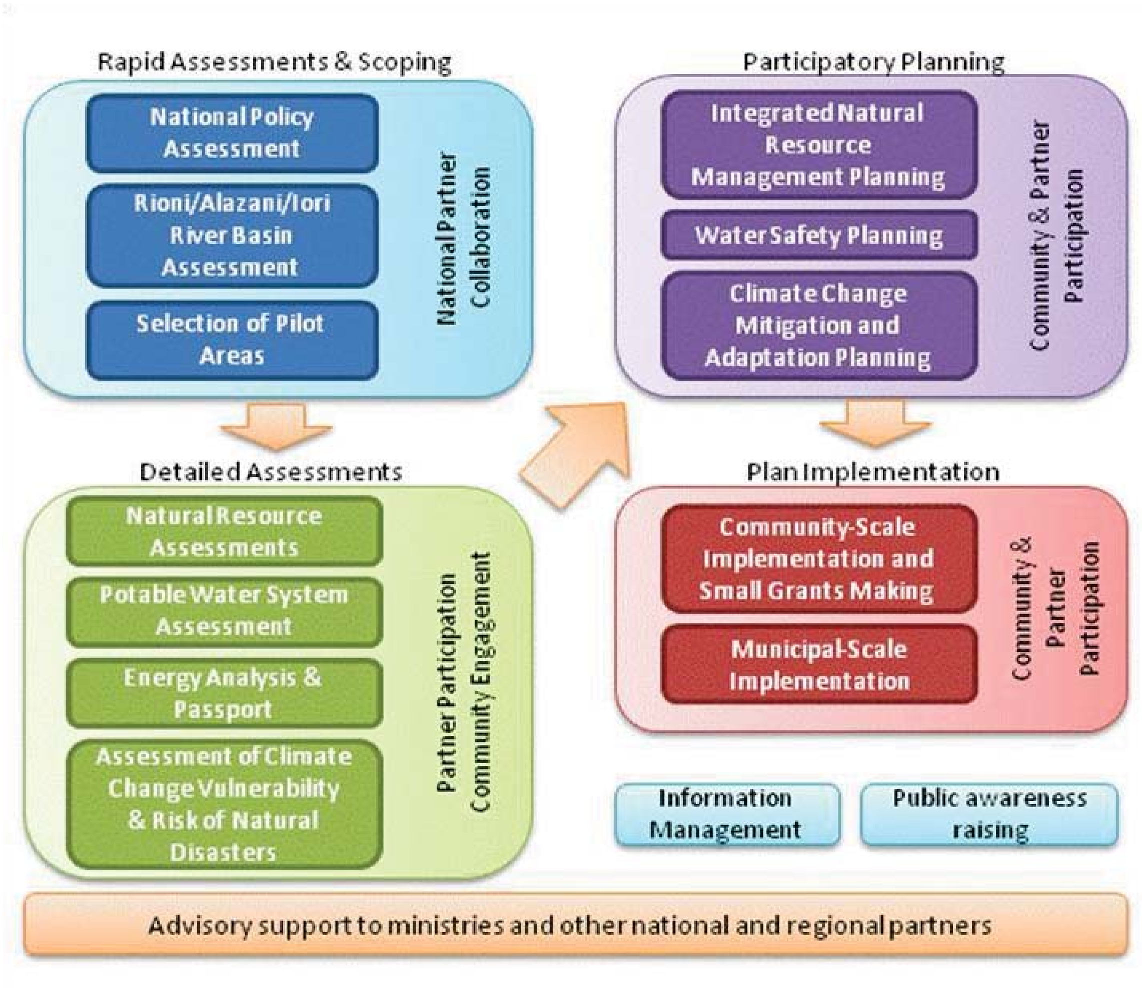
Georgia is a country rich in natural resources with many picturesque and pristine ecosystems, but in the presence of unclear environmental legislation and the weak law enforcement the condition of the country's environment has suffered for many years. Many surface and ground waters are severely polluted due to waste dumping and untreated wastewater discharges, large areas of forests are cleared due to illegal logging that was very intensive after the break-up of the Soviet Union, populations of a number of valuable and unique fish and wildlife species are reduced due to poaching, and many grasslands are overgrazed. Inappropriate irrigation and agricultural practices have degraded large areas of arable land through soil erosion and salinization. The combined effects of these widespread practices in a synergy with adverse impacts of natural disasters and climate change undermine the natural resource base and ecosystem services that Georgia depends upon for sustainable development.

In order to address above issues, in September 2010 USAID-Caucasus launched a multi-year project: "Integrated Natural Resources Management in Watersheds of Georgia" (hereafter INRMW). The project is implemented within the framework of an umbrella program "Global Water for Sustainability" (GLOWS) by a consortium of international and national organizations under leadership of Florida International University (FIU) in a partnership with Care International, Winrock International, UNESCO-IHE and Caucasus Environmental NGO Network (CENN).

1.2 Objectives and Scope

The primary goal of the INRMW Program is to improve current and future lives of people in Georgia by utilizing and managing natural resources more sustainably, including water, soil, vegetation, and the ecosystems that encompass them. The project aims to introduce innovative approaches and practical models of participatory integrated natural resources management in targeted watersheds, by facilitating reforms to and harmonization of national policies, and by increasing the capacity of national and regional institutions to replicate these approaches and models throughout the country. These models will be introduced in four representative watersheds of Rioni and Alazani-Iori River Basins and efforts will be made to upscale and disseminate them across the country.

The project goal will be achieved by implementing a number of sequential activities, including: baseline assessments of existing laws, policies, institutions and, practices in the area of natural resource management and, other related sectors (e.g. potable water supply and sanitation, energy, agriculture, health protection, disaster management, etc.); rapid assessments of existing socio-economic and environmental situation in targeted river basins; selection of four representative upstream and downstream pilot watersheds/areas for on-the-ground interventions; detailed assessments of selected four pilot watersheds/areas; development of integrated natural resources management plans in a watershed context within selected pilot watersheds/areas; implementation of a number of priority interventions at community level through community small-grants program to demonstrate benefits out of sustainable and integrated natural resources management. Below is a diagram of the project activities:



The project has already developed the rapid national assessment report that gives a general overview of existing enabling environment in the area of natural resources management and related sectors mentioned above and, an analysis of existing gaps and barriers towards applying policies and practices for integrated natural resources management in the watershed context. The study looks at the national-wide situation.

The Rapid River Basin Assessment is a second major deliverable under the project. Its general objective is to create a knowledge base around the targeted Alazani-Iori and Rioni river basins to lead to selection of four smaller representative pilot watersheds/areas for on-the-ground interventions, against a number of physico-geographic, environmental, social-economic, governance and other criteria. To this end, specific objectives of the study are: to collect, synthesize and analyze the baseline situation existing in Alazani, Iori and Rioni Basins in terms of the ecological status of targeted Basins and the use of natural resources there; to identify linkages among the use of natural resources and ecosystem functions and; to define resource use opportunities, where sustainable and integrated management of these resources can bring immediate health, environment, ecological, and economic benefits. The focus is on sectors for water, land, biological and mineral resources management as well as on sectors having potentially adverse impacts on ecosystems, including agriculture, energy and water supply. The current practices for management of wastes, natural disasters and climate change, which significantly affect the resource base of the targeted river basins, are also considered. The assessment analyzes the current situation, the gaps and the areas of conflicts among sectors in the context of integrated natural resources management. Information and analysis contained in this report will help the project identify and select those four pilot watersheds/areas within the larger geographic territories, which will be the most appropriate for demonstration of integrated natural resources management in a watershed context and as well, the most promising ones to bring tangible health, environmental and/or socio-economic benefits easily replicable in other areas.

1.3 Methodology, Limitations

The study has been developed through collection, compilation and analysis of available information as well as through face to face interviews with project partners and representatives of the Ministry of Environment, Ministry of Energy and Natural Resources, United Water Company, various environmental NGOs, etc. Opinions expressed in this report are those of individual experts and may not coincide with the official positions of the government of Georgia or USAID Caucasus.

During the assessment limitations were noted for selected historical and current socio-economic and environmental data. While there is abundant information on the Alazani River Basin, given the past and current donor efforts, there are very limited studies on the Rioni and Iori River Basins. Furthermore, various studies differ in terms of the completeness of data and inconsistencies between reports are common. Consequently, we cannot take any responsibility for those data and information we have extracted from existing studies and our assessment could not be conducted at the same level of detail for all the basins and sectors of interest. Up-to-date information on forest resources is practically absent for many municipalities of the targeted river basins, due to the absence of national-wide forest inventory data since the late 80s. Past and recent data on soil quality are also scarce due to the very limited and intermittent monitoring of soil quality by the state in the past and the absence of such a system at present. With regard to water quality and quantity data, they are incomplete for the Alazani River Basin and completely absent for the Iori river basin due to the diminished water quality monitoring network. The quality of the data is questionable, given the absence of proper quality assurance and control systems (e.g. inter-calibration of laboratories, cross-checking of lab analysis data, etc.). For hydrometeorological data, long and complete records are available until the end of 80s, but for the last 30 years these data are intermittent or absent. Available long-term observation data do, however, give a general picture on river characteristics and existing data gaps have been filled by many researchers using predictions and interpolation. Currently, at the absolute majority of gauging sites only water level is measured and flow discharge is calculated. Gauging sites and stations are denser in the Rioni Basin than in the Alazani River Basin. In the Iori River Basin, there is only one gauge in the upstream section of the river. We tried to extract recent water quantity data from baseline studies of various ESIAs, but even they do not contain such data. We have also approached the National Environmental Agency (NEA) to request 2009 and 2010 water quantity data. It took over one month for the NEA to compile the data and they did not supply these data until after the assessment was completed and the report drafted. Therefore, we could not integrate those data into the report. Furthermore, data on the quantity and quality of water supply and sewerage systems are very scarce due to the absence of the state system of monitoring and control of drinking water quality on the one hand, and the absence of regular water quality monitoring and the operational database system within the United Water Supply Company (UWSC), on the other. Currently, UWSC is working on creating a GIS database of water supply and sewerage systems, which will significantly improve the data completeness, quality and will allow for easier data access by various customers.

2.0 GEOGRAPHIC, ENVIRONMENT AND SOCIO-ECONOMIC CONTEXT

2.1 Physical-Geographic and Environmental Context

2.1.1 General Characteristics of the Basins

Alazani River Basin

The River Alazani, one of the major trans-boundary rivers of the Kura-Aras River basin. It originates through the confluence of two mountain rivers, Tsiplovaniskhevi and Samkuristskali, flowing from the southern slopes (Mount Didi Borbalo) of the Main Caucasus Range at an elevation of 2,600-2,800m above sea level (a.s.l.). The river crosses an inter-mountainous depression, flows along Georgian-Azerbaijan border and joins the Mingachavir Reservoir, on Azerbaijan territory. The total length of the river is 351 km, average elevation is 850 m, average fall – 745 m and average gradient – 2.12‰. Total catchment area of the basin is 11,800 km^2, with 6,962 km^2 of the area located in Georgia. The basin is oriented from northwest to southeast, and at the entry of River Ayrichay in Azerbaijan it changes direction to the south (for more details please see physical-geographic maps of Georgia and the Alazani River Basin, figures 1, 2 and 3, annex 1).

Iori River Basin

The Iori River is another major river of the Kura-Aras river Basin. It originates on the southern slopes of the Main Caucasus Range at an elevation of 2,600 above sea level and, like the Alazani River, flows into the Mingecahvir reservoir at the southern edge of Gare-Kakhetian Plateau. Total length of the river is 320 km, total fall – 2,520m, average slope – 78.7‰, water catchment area – 4,650 km^2 (for more details please see physical-geographic maps of Georgia, figures 1 and 2, annex 1).

Rioni River Basin

The Rioni River is the largest water body in western Georgia. Its length is 327 km, total catchment area - 13,400 km^2 which is approximately 20% of the whole Georgian territory and, total fall - 2,960 m. The river originates from two sources on a southern slope of the Main Caucasus range and runs into the Black Sea near the city of Poti. In its upper reaches (Racha) it proceeds in a narrow, deep gorge with a width of 50-70 m. Here its length is 115 km with a 7.2 degree gradient. After passing through Kutaisi it flows on a wide area of the Kolkheti lowland (plain). The river discharges into the Black Sea through multiple channels, but the majority of the flow passes through bypass channel constructed in 1939 to protect Poti from flooding (for more details please see physical-geographic maps of Georgia, figures 1 and 2, annex 1).

2.1.2 Climate of the Pilot Basins

Alazani River Basin

The Alazani River Basin is surrounded by high mountains from three sides protecting the plain and foothills from cold air masses. An intrusion of air masses is only possible from the south-east and therefore, the area is considered one of the driest regions of Georgia (please see the maps of climate, temperature and precipitation of Georgia, figures 6-10, annex 1). However, it is characterized by climate conditions varying from sub-tropical continental to humid. The Northwest part of the plain has a moderate humid climate with relatively cold winters and hot summers and the east part – a relatively warm steppe climate, with hot and dry summers and moderate cold winters. Thus, the more humid climate is in the left part of the plain due to the nearby location of the Caucasus massif.

The average annual precipitation in the basin varies from 300 to 500 mm, with the highest values reported for the months of May (14-16% of the annual total) and September (10% of the annual total). January is the driest month (only 3-4% of the total annual). Summer months are very dry. The average annual air temperature is between +9°C and +14°C. The minimum temperature rarely drops below minus 23°C and the maximum temperature does not exceed plus 39°C. The average temperature of the coldest month is within the range of 0°C to +5°C and that of the hottest month is within the range of +22°C to +27°C.

Iori River Basin

In upstream areas of the Iori river basin, where river takes its origin the climate is moderately humid, with cold winters and long warm summers at altitude of up to 1,900m above sea level. At higher altitudes summer becomes shorter and at 2,400-2,500 m and above the climate is high mountainous moderate humid. Annual mean air temperature in lower parts is 8.5°C and at the altitude of 2,400m it drops to 0°C. January mean temperature in lower parts is -2°C and July mean temperature – +19°C; In high mountainous areas January mean temperature drops at -10°C and below and July temperature does not exceed 8-10°C. Absolute minimum is within the range of -28-40°C and absolute maximum – within the +20-22°C and +35-36°C. Annual sum of atmospheric precipitation at lower parts of Tianeti municipalities is 620mm and at highlands – 1,300-1400mm. Snow cover in winter periods is characteristic of entire Tianeti region with from 20sm (in Sioni) to 2m snow cover. Middle and lower reaches of the basin (Sagarejo, Gurjaani, signagi, Dedoplistskaro) are characterized by dry continental climate with cold winters and hot, dry summers. Average annual temperature is +10-11^{0}C, January temperature – minus 1-3^{0}C, July-August temperature – plus 22-24^{0}C. Average annual atmospheric precipitation is 400-500mm. Snow cover is rarely formed. Throughout the year wet winds are dominant (for more details please refer to the climate, temperature and precipitation maps of Georgia, figures 6-10, annex 1).

Rioni River Basin

The climate of the Rioni Basin differs in upper, middle and lower reaches. However, It is mostly mild subtropical and is more humid than that of Alazani River basin. More specifically, in upper reaches, the climate is moderate to humid subtropical. In high mountains humid mountainous climate with snowy winter is common. In low mountains and foothills moderately cold winter and temperate hot summer dominates. Average annual temperature in lowlands is +9-10^{0}C and in mountains – +4-5^{0}C. In lowland January mean temperature is +1.5-4^{0}C and July mean temperature – +18-24^{0}C. The annual sum of precipitation is 1000-1500 mm in lowlands and 1,600-1,800mm in highlands (for more details please refer to the climate, temperature and precipitation maps of Georgia, figures 6-10, annex 1).

In upper Imereti (upper middle reach of the Rioni Basin) the climate is also humid with moderately cold winter and hot relatively dry summer. Annual mean temperature at the altitude of up to 400-700 m is +10-14^{0}C, with +1.5-4.0^{0}C January and +22-24^{0}C July temperatures; Extreme temperatures are recorded at -16, -20^{0}C, and at +39-40^{0}C. Annual sum of precipitation is 1,100-1,200 mm with maximum precipitation recorded in fall and winter seasons. At higher altitudes temperature declines as per vertical zoning, while precipitation increases. The winter is characterized by north-east winds and the summer – by south-west winds.

In the middle reach of Rioni, where the city of Kutaisi is located the climate is between that of peculiar to Imereti highlands and the Kolkheti Lowland. The mean temperature for winter is +5.2^{0}C, with absolute minimum reaching -17^{0}C, the mean temperature for the warmest month of the summer is +23.6^{0}C, with absolute maximum reaching +42-43^{0}C. The wind rose distribution is as follows: north wind – 1%; north-east wind – 3%; east wind – 53%, south-east wind – 5%, south wind – 1%; south-west – 3%, west wind – 35%, north-west wind – 2%. Still weathers conditions have 27% occurrence. Annual sum of precipitation is 1,586mm, with maximum precipitation in January-February and minimum precipitation in May and September (92-95 mm). Relative humidity in the coldest month is 60% and in the hottest month – 50%.

Downstream of Kutaisi the climate is mild humid sub-tropical, with moderately cold winter and relatively dry hot summer. Annual mean temperature is + 13.9 – 14.10^{0}C, with +3.70 – 4.30^{0}C January temperature and +23.6 – 23.9^{0}C August temperature. Averaged minimum temperature never goes below -0.1^{0}C and averaged maximum temperature never exceeds +30.2^{0}C. Absolute maximum is +42^{0}C and absolute minimum -20^{0}C. Annual sum of precipitation is 1,190 mm, with maximum values recorded in winter and minimum values recorded I summer. In low-mountainous and up hills the temperate is slightly lower and the precipitation – higher. East and West winds are dominating there. Sometimes, the Black Sea breeze reaches the region.

The climate of Rioni Delta, where it flows into the Black Sea is humid subtropical. It is formed as a result of interaction between wet air masses intruding from the Black Sea and the southern slopes of the Greater Caucasus Range, and the western slopes of the Meskheti Range. The air flow regime is greatly affected by local circulation, resulting from the uneven heating of sea and land surfaces, manifested in breezes, monsoons and mountain-valley winds.

According to multi-year hydrometeorological observations, until 1990s the mean annual air temperature in the coastal area varied in the range of +14.4-14.5^{0}C and annual sums of precipitation from 1,400 mm to 2,600 mm (Batumi). In the last half-a-century, hydrometeorological parameters of the Black Sea coastal zone underwent certain changes in relation to the global climate changes. During the past century till the beginning of the 1990s, the air temperature here decreased by 0.2-0.3^{0}C though, for the last 16 years it increased by 0.2^{0}C. Compared to the 1960s, the precipitation in Poti for the last 15-20 years has grown by 13%, but in Batumi it has declined by 5%. Quite similar to the air temperature, the sea surface temperature had decreased by 1.0^{0}C, throughout 1924-1996. However, in 1990-2006 it had grown by 1.3^{0}C, as a result of which the cooling of the sea surface at present equals 0.8^{0}C, compared to the 1924 value.

2.1.3 Geo-morphology, Geology

General

Overall, there are following distinctive physical-geographic groups (regions) in Georgia: a. Mountain areas of the Greater Caucasus; b. Lesser Caucasus; c. Meskhet-Javakheti; d. Humid sub-tropical Kolkheti region and; e. Kura-Aras (Iberian) lowland (depression) (for more details please refer to the map of the physical-geographic regions of Georgia, figure 4, in annex 1).

Alazani River Basin

Alazani River Basin is located within two tectonic zones: the east slope of the Caucasian folded-fractured (fold- and thrust) mountain zone and the Alazani plain (valley). Steep slopes of mountain ranges and inclined and flat valleys are the major types of the relief of the basin. Oreographically, there are following two distinctive groups in the Basin: the Mountain Areas of the Greater Caucasus and the Kura-Aras or Iberian lowland.

The Mountainous area of the Greater Caucasus is divided into three sub-groups (sub-regions): a.1 the Western Caucasus; a.2 the Central Caucasus and; a.3 the Eastern Caucasus. In the Alazani river basin only the Central and the Eastern Caucasus sub-regions are represented.

The Central Caucasus sub-region encompasses the upper reaches of the Alazani River, including river source and covers the northern parts of the Akhmeta and Telavi municipalities of the Kakheti region.

The Eastern Caucasus almost entirely coincides with the southern slopes of the Kakhetian Caucasus and is represented by the ridges of Nakerala, Sakorne, Andarazani, Sajikhve, Girgali and Mskhalgori, etc. as well as by the basins of the left tributaries of the r. Alazani, including: Stori, Lopota, Chelti, Duruji, Bursa, Avniskhevi, Sharokhevi, Kabali, Baisubani, Chartliskhevi, Antsali, Mitsimistkhali, etc. Here the entire Kvareli and the part of the Lagodekhi municipalities are located.

The Kura-Aras or Iberian lowland is divided into following sub-regions: e.1 Shida or Inner Kartli lowland; e.2 Kvemo or Lower Kartli lowland; e.3 Iori-Ajinauri lowland and, e.4 Alazani-Gishitskhali lowland. Among these sub-regions only Alazani-Gishitskali and Iori-Ajinauri lowlands are represented in the Alazani river basin.

From the Alazani-Gishitskali sub-region its western part is represented in Georgia and consists of the Alazani plain (valley) and the Gombori range (a chain of various ridges). Parts of the Akhmeta, Telavi, Gurjaani, Sagarejo, Lagodekhi and the Dedoplistskaro municipalities are located within this geographic sub-region.

In Georgia, Iori-Ajinauri sub-region is represented by its north-west part and consists of the Iori or Gare Kakheti plateau and part of the Gombori range. It covers sections of the Sagarejo, Gurjaani, Signagi and Dedoplistskaro municipalities.

Mountain sides of the Greater Caucasus represent upper course of the river Alazani basin. This zone is striped with many small deep and steep gorges that are directed to the south, to the depression, and are filled with numerous small rivers. It is characterized by landslides, avalanches and floods as well. Geological composition of the mountainous parts is sandstone and clay shale, spread mostly on the left bank. Limestone and marls are spread on the right bank. Rocks are covered with clay and sandstones (for more details please see the geologic map of Georgia, figure 11, annex 1).

Mountain side of the Greater Caucasus is well represented by Tusheti, located on the northern slopes of the Main Caucasus range[1] (for more details please see the map of Tusheti with marked area of Alazani source, figure 5, annex 1). More specifically, Tusheti is situated on the northern slope of the Main Caucasus range, between the latitudes 42°32´ and 42°22´ north and, between longitudes 63°17´ and 63°22´ east. The elevation of Tusheti from the sea level is 1650-4493 meters; the region occupies about 896 m^2 of area and has the shape of an irregular pentahedral depression, with its southern-eastern axis reaching 40 km in length and 25 km in width. The climate is cold and belongs to Alpine Climatic Zone. Average annual temperature is

Only south-west part of Tusheti, where Tusheti National Park is located and where the river Alazani originates, belongs to Alazani river basin

5°C (average temperature in July is about 13-15°C). Annual precipitation amounts to approximately 450-900 mm and the precipitation mainly falls as snow. The region is bordered by Dagestan in the east, Pshav-Khevsureti in the west, Chechnya-Ingushetia in the north and Eastern Kaheti in the south. Tusheti is bordered with watershed high ridges with the height of 3000-4500 meters. Among them, the largest one is the northern ridge with its high peaks: Tebulo Mount (4492 m), Komito (4261 m), Dano Mount (4174 m) and Diklosmta (4285 m). These peaks make Tusheti Alp, dividing it from Chechnya-Ingushetia. The inner Tusheti is covered with ravines, including Pirikiti Kedi, directed from the heads of Amugo and both Alazani rivers to south-east dividing Tusheti into two gorges of Pirikiti Gorge in the north and Gometseri Gorge in the south. There are narrow footpaths over Pirikiti Gorge connecting the two gorges. These are the paths of Larovani (3317 m) (from Larovani Gorge to the Alazani source) and Nakle-Kholi (2903 m). The whole surface of this mountainous area is covered with ravines rapid flows from the high mountain peaks flowing into two big rivers of Tusheti – the Gometseri Alazani and Pirikiti Alazani. The Gometseri Alazani heads in Borbalo Mountain (3134 m) and flows fast to east. At the village of Gogrula, the Ortskali flows into the Gometsari Alazani and Chanchakhovani Tskali flows into it at the village of Khakhabo. Pirikita Alazani flows from Amugo Mountain (3839 m). At the site of ancient village of Hegho, the Larovani Tskali flows into it and the river flows north-east, in parallel to the Gometsari Alazani. On its way, it is joined by the waters from Tusheti Alp: Hashaki Tskali, Katsi Tskali, Dano Tskali, Kvavlo Tskali and others. The two Alazanis meet each other at the village of Shenako and the one large river flowing beyond the borders of Tusheti reaches the territory of Dagestan, where it becomes known as the 'Andis Koisu', which after flowing with the 'Avarias Koisu', flows into the Caspian Sea as the 'River Sulaki'. The whole territory of Tusheti is located in the basin of the two Alazanis and is divided into three gorges: Pirikiti Gorge, Gometseri Gorge and Chagma or Chanchakhovani. The modern ice-formation of Tusheti is quite weak due to its dry climate. The glaciers scattered on Pirikiti, Atsunta and Makratela ridges are very small in size. The most important are the glacier of Tebulo Mountain, two glaciers of Hatsunta Ridge and one glacier of Diklo Mountain, with their length reaching two or three kilometers. There are 21 glaciers survived in Tusheti with the total area of 17.77 km^2. Ice-formation in Tusheti in the past was much more significant. This is well seen at the sites of ancient villages and by the remains of ice-formation on the territories adjacent to those sites. In Tusheti, there is a lake of the ice-formation origination - Oreti, also known as a bottomless lake. The lake has not been yet studied scientifically and there are only legends and sayings about it. The whole territory of Tusheti is presented by the deposits of the Jurassic Period, with great amount of clay slates, which split into flat plates and are used to build and cover houses. Sandstones are also frequent here. At the villages of Khiso, Shenako, Chigho and Parsma, as well as at the village of Dartlo, in the eastern part of Tusheti, there flow 'Vedzebi' – high-value mineral waters used by the local population for drinking, treating and bath purposes.

Lagodekhi and Kvareli Municipalities are also spread on the southern slopes and the foothills of the Greater Caucasus. The area is built of argillaceous slates and sandstones of Jurassic period and partially with carbonate rocks of Cretaceous period. Strongly fragmented relief of medium and partly high mountains and gorges with the steep slopes, short, transverse erosive gorges is developed in Kakheti Caucasus, within Lagodekhi municipality. More specifically, Lagodekhi municipality belongs to the section of the Main Caucasian watershed range, which is located between the peaks of Charasaldis Tavi (2,666 m) and Tinovroso (3,374 m). This section of the range (like Kakheti Caucasus) represents mountainous wall, formed as a result of tectonic destruction, very steeply sloping to the south (Alazani plain). Khochaldagi (3,426 m), Charasaldis Tavi, Nusurlo (2,829 m), Khimriki (3,108 m), Mskhalgora (2,900 m) and other peaks are located on the Caucasian range within the boundaries of the Lagodekhi municipality. The Range here is composed of schist of Jurassic period, marl slates, sandstones and, from place to place of wrinkled rows of limestone. Reliefs, formed in the result of denudation processes (physical exhaustion, impact of gravitation force, old icing, erosion caused by water) dominate in the top strip of the Caucasus and on its north slope – from 2,600-2,700 m above the sea level. Among these forms, cliff disintegrations in subalpine and alpine zones, old glacial formations in the form of short trogal gorges, circles and lake pits of glacial origin are met. Below 2,600 m above the sea level, the slope of the Caucasus range is fragmented by deep and narrow erosive gorges and gullies of the rivers Matsimi, Lagodekhiskhevi, Sromiskhevi, Ninoskhevi, Baisubani, Kabali, Areshi and their inflows. Between these gorges there are about two dozens of erosive branch-ranges, which lie from the top of the mail watershed range towards the south and swiftly decline towards the Alazani plain. Among them, the following branch ranges are to be mentioned: Khochldagi - watershed of the rivers Lagodekhis Khevi and Shromiskhevi; Ninigori range – watershed of the rivers Ninoskhevi and Shromiskhevi; Baisubani range – watershed of the rivers Ninoskhevi and Baisubani; Mskhalgori range – watershed between the rivers Baisubani and Kabali; Jvartkhevi range – watershed between the rivers Kabali and Sharokhevi, etc. The gorges of the mentioned rivers are narrow and steep-sloped, with canyon-type sections here and there. Almost all gorges have developed wide debris cones and tails in the front-hill strip.

Significant part of the Basin is occupied by the Alazani alluvial plain (valley), which slopes from the Caucasus foothills towards the river Alazani and is located at 200-350 m above the sea level. The Alazani Valley is spread from northwest to southeast, between steep mountainsides of the Greater Caucasus, the TsivGombori Range and the Gare Kakheti Plateau. It is strongly indented by many mountain rivers. There are three distinct morphological elements within the valley: floodplain, elevated flat strips of the banks and, the slope adjacent to the banks. The north part of the Alazani Valley within the boundaries of the Lagodekhi municipality is composed of coarse fraction of alluvial sediments, pebbles, partly cobbles and sands. To the north it gradually passes into foothill strip, the relief of which is represented by hill-hillocks, low hills and debris cones. The south part (adjacent to Alazani) of the plain is characterized by flat, insignificantly slopes surface and is mainly composed of fine sand and uliginous clays.

Terraces covered by marl and sandy conglomerates are represented on the edges of the floodplain that stretches along both sides of the river. The erosion depth of the river is from 2 to 10 m, with the deepest cuts found in places of river junctures. Sandy shoals, meanders and oxbow lakes are found in the lower part of the Floodplain. The part of the floodplain, where streams build alluvial fans is steeply declined towards the river. In some places (e.g. along the rivers of Intsoba, Duruji, Lagodekhi Tskali, etc.) these slopes cut into the sub-mountainous strips of the Caucasus and the Gombori ridges, forming wedge-shaped isolated areas. From the village Sabatlo up to the Mingechavir reservoir the river flows through a deep, narrow gorge and only isolated patches of flood relief are found there. Alazani floodplains are mostly built of alluvial, alluvial-proluvial and partly – deluvial sediments of the Quaternary period (clays, argillaceous soils, pebbles, gravel, grail). In the outer south-eastern part of Alazani plain accumulative plains are developed on the alluvial and preluvial-deluvial substrates of the Quaternary age with fragmented, flat, slightly undulated surface sequences and flat lands.

The TsivGombori Range is spread along the Greater Caucasus. The northeastern slopes of the Range descend to the Alazani Valley and are covered by many small rivers, characterized by flooding during high precipitation periods. In summer and winter times they get dry beds covered with sediments - pebbles and gravels. The conglomerates and loams dominate there. The erosive-denudative relief, with relatively low hills, sequencing with steep slopes and sometimes with flat bottoms is developed on the on weakly compacted conglomerates of Neocene age and, sandstones and clay is developed here.

The Gare Kakheti Plateau – southwestern part of the Basin is directed from northwest to southeast. The Plateau is covered by few small rivers and is therefore short of water. Conglomerates and pebbles are common here. Flat surfaces are covered by alluvial sediments and the slopes of the ranges – alluvial – talus surfaces. The Plateau is mainly covered by loam.

Iori River Basin

In terms of geographic location, the Iori River Basin is stretched on the southern slopes of the Greater Caucasus (Central Caucasus) and between the Kakheti and Kartli ridges. More specifically, extreme upper reach of the river basin is located on the southern slopes of the Central Part of the Greater Caucasus, upper and middle reaches – in the Saguramo-Gombori middle-mountain area, bordered with Kartli and Gombori Ridges and, middle to lower reaches – on the Iiori Plateau and very small part – on the Lower Kartli Plain (for more details please refer to the map of the physical-geographic regions of Georgia, figure 4, in annex 1).

In the Iori River Basin, the upper reaches are located on the southern slopes of the Central Caucasus region and encompass the northern part of the Tianeti municipality. Towns Tianeti and Sioni are situated in the Saguramo-Gombori middle-mountain sub-region and represent upper-middle reaches of the Iori Basin. Downwards the Sioni reservoir the river Iori flows on the Iori or Gare Khakheti plateau, where parts of the Sagarejo, Signagi, Gurjaani and Dedoplistskaro municipalities are located. Some area of the basin (western part) covers the Kvemo Kartli foothill and lowland region and encompasses a very small part of the Gardabani municipality of the Kvemo Kartli region. The mountainous part of the basin outstretched in latitudinal direction consists of the Kartli and Kakheti ridges having the height in the range of 2,000-3,000m, and depressing with their south ends down to 1,000-1,500m. The Kakheti and Kartli ridges are characterized by pointed erosive forms of the slopes, dissected by narrow and deep ravines. In the northern part they have a southward direction, and below the influx of the river Adedi turn to the south-east. The valley of the river Iori positioned between the Kartli and Kakheti ranges forms a chain of Tianeti, Ertso, Samgori and Gare Kakheti plateaus. The Tianeti plateau lies at the height of 1,100m. The highlands surrounding the plain from all sides are elevated up to 1,500m and have soft contours with abruptly descending slopes. The Ertso plain is situated on the right side of the river. Its average height is 1,100m. It is massively irrigated by numerous minor streams and, is surrounded by mountains from all sides, the flat slopes of which are covered with woods. Samgori plain is extended also on the right-bank side of the river from the Yalno-Saguramo range. Its northern part is slightly elevated, whereas the north-eastern part represents a hilly terrain covered with woods. The plain is the most ancient and highest terrace among the alluvial terraces in this region. Following the Samgori ridge from the village Mukhrovani till the river outlet, there extends a broad Gare-Kakheti plateau (same as Iori Plateau) elevated between the streams of Iori and Alazani. It is spread over 170 km, with a width of 60 km and a height 80-1,000 m. The topography of a plateau is represented by interchanging anticlines and synclines displayed by gently sloping hilly ranges, flat plains, terraces, ravines, gullies, badlands, pseudo-karst, mud volcanoes, etc. The west, south and east borders of the plateau descend with steep benches and the north against the foothills of the Yalno and Tsivi-Gombori ranges. The vast area of the plateau is irrigated by several streams flowing through deep ravines, and on a whole it is almost devoid of water. Major orographic elements of the Iori Plateau are as follows: Didi (Big) Shiraki, Patara (small) Shiraki, Taribana, Natbeuri, Iori steppes (same as Patara Taribana), Nagomrebistavi and Chachuna valleys and hills. The largest among the valleys is Didi Shiraki with 30-35 km length and 14-15 width. From south it is encompassed by Quchebi, Nazarlebi, Shanamta hills, from north – by Arkhiloskalo-Khashi low ridge, whose top is a flat and together with the Zilicha hill divides the Iori basin from the Alazani basin. To the east, the Shiraki valley merges with the Kasristskali erosion valley, which in turn transforms into the Jeiran (gazelle) erosion valley. The lowest point of the valley is located at the river mouth, where Iori flows into the Mingechavir reservoir (90 m above the sea level). There are following mountains there: Uzundura, Chalkhevi, Kvabebi, Bilenta, Ori Dzma and Nikorastsikhe (1,001m).

Mainly, sandstones, marls, limestone, breccias with an admixture of porphyries and conglomerates participate In building the geological structure of the relief of the mountainous part of the Iori basin (for more details please see the geologic map of Georgia, figure 11, annex 1). The middle and lower parts of the basin, including slopes of the Gombori range as well as anticline ranges and hills of the Gare-Kakheti (Iori) plateau are formed with Neocene clay, sandstones, weakly cemented conglomerates, sandy loam, also alluvial sediments covering the flat areas with their strong layer. On the hillsides the alluvial-delluvial deposits are developed. South-western section of the Gombori Range in the northern part of Sagarejo Municipality is composed of Neocene continental weakly cemented conglomerates, sandstone and clays. From place to place there are carbonate rocks of Cretaceous and Paleocene age. The height of Gombori Range in the Sagarejo municipality is up to 2,000, (Mount Tsivi, 1,991 m). The top of the range is smoothed and is characterized with slightly sloped plain surfaces. Its south-western slopes are deeply fragmented by the left tributary of Iori River – Vashlliani, Gomboriskhevi, Lapiankhevi, Tvaltkhevi, Manaviskhevi, Chailuriskhevi gorges and ravines. On this section of Gombori Range main signs of the mesorelief are determined by the mentioned erosive gorges and low ranges and hills among them of erosive origin. Where the rivers pass through the places composed of friable molassic sediments of Neocene the bottoms of gorges are wide (in some places their width is 400-500 m). In the zone of spreading of more dense cretaceous and Paleocene rocks the gorges are much narrower, with steep slopes. On the cliffy tops of mountains composed of friable Neocene rocks, under the impact of erosion- denudation processes there is developed typical badland relief deprived of soil and vegetation cover (especially at the origins of rivers Manaviskhevi, Lapiankhevi and Tvaltakkhevi). Along the river gorges, in some places there are terrace steps built of boulders and on the ridges of erosive watershed branch ranges - plain denudation surfaces. To the south, south-western slopes of Gombori Range transform into the hilly undulating foothills zone, absolute height of which is 850- 950 m. Relief of the hilly undulated foothills is quite fragmented by the wide-bottom gorges of the above rivers, which, at outcome to the plain create large debris cones. The widely spread in the basin is the Shirak formation, with 2,500 m thickness and composition of sandy-clayey deposit at the bottom and conglomerates and sandstones at the top. Upper Pliocene Agchagil deposits are trans-gressively located on the Shirak layer. Bassets of limestones of Jurassic period in a form of local erosion spots in the territory of Dedoplistskaro municipality (Bilanta, Nikoras Tsikhe etc.). Accumulative plains are developed on the alluvial and preluvial-deluvial deposits of the Quaternary age with slightly fragmented, flat, slightly undulated surface sequences and flat bottom tablelands of the plains and tablelands of Iori Plateau.

The section of the Iori Plateau composed of Neocene and Quaternary period continental and marine sediments (sandstone, conglomerates, clays) is located in the southern part of Sagarejo municipality. The relief here is created by narrow anticlines and monocline elevations, low mountains, hillocks, hills and syncline caves filled with sediments of quaternary period. Among the temporary forms of the relief there should be mentioned Natakhtari (966 m); Didi Udabno (995 m); Demurdali (990.6 m); Naomarigori (972 m); Aklemisgori (946 m); and other mountains, slopes of which are extensively fragmented by dry gorges, ravines and badlands. Between the anticline and monocline hillocks and mountains there are quite wide syncline depressions and planes, with flat, slightly sloped and less fragmented surfaces. Such are: in the north section of the Iori Plateue Sartichala, Tsitsmatiani and Kachreti accumulative plains – in the northern part of Iori Elevation, Azamburi, Udabno, Aji syncline plains and depressions – in the southern part of Iori Elevation.

Geotectnonically, mountainous areas of the Iori Basin belong to the Mestia-Tianeti techtonic zone of Late Jurassic and Cretaceous Carbonate flysch of the Fold-and-Thrust Structure of the Southern Slopes of the Greater Caucasus, more specifically, to the Djinvali-Gombori techonoc sub-zone. The flysch is mostly composed of sandstones, murls, liemstones, breccia (sedimentary rocks) mixed wih porphyries and conglomerates. The very upstream sections of the basin, where the river source is located are mostly represented by fluvio-glacial deposits composed of sands, cobbles and clays. The northern parts of the Basin (Tianeti municipalities) are represented by mudy or sandstoney and clayly deposits of Early Jurassic period and, souther parts – by Late Jurassic sandstones, marls as well as by Late Creatceous limestones, murls and sandstones. In addition, Tertiary sandstones, murls, calys and conglomerates are met here. Tianeti and Ertso depressions (valley) are formed by Quaternary sands, clays and pebbles. Near Sioni reservoir downstream of Tianeti and Ertso depressions the geological structure is represented by Tertiary and later age rocks and at limited extent, by Cretaceous sediments. The Tertiary rocks are composed of Oligocene and Miopliocene sandstones, slays, murls and conglomerates. There are also tuff conglomerates and breccias. Furthermore, Quaternary prolluvial and alluvial sediments that form the left bank of the river Iori within the 4-km length are also met and they play significant part in the formation of Sioni valley. These rocks are well-exhibited in river terraces and at some places are covered by delluvial deposits. They are composed of clay and gravel. Old riverine alluvion is met as a narrow line, cut by numerous gorges and is composed of gravel, sands and conglomerates. Clayly conglomerates at some places are of more than 200m thikness. The recent alluvial sediments form the river bed and the reservoir bottom as well as floodplain terraces and, are represented by sedimentary and vulcanic gravels. In addition, sandstones, marls, granites and tuffy sands are met. The width of riverine sediments varies significantly from place to place and their thicknes varies within 5-12 m. Ground waters are met at 0.5-2.0 m depth. Clayly delluvial deposits are spread on the left slope of the river gorge, covering old Quaternary deposits here and main rocks – at upper parts of the slope. They are composed of gravel. The right slope of the gorge is mostly formed by clayly sediments of large rubbles. Their thickness is 10-30m and cover main rocks. Lower Cretaceous sediments are composed of marls, limestones and sandstones. They are exhibited on the surface in narrow parts of the river gorge and create numerous folds. The thikness of the layer is no more than 10cm. Falts are filled with calcites and, vulcanic tuffs and teshenites (dikes) are met here. Late Createceous deposits are composed of gray sands and pebbles as well as sandy and murly clays, where pebbles transform into microcongomenrates and microbreccia. The thikness of the layer in 150m. Two Intrusive vulcanic formations with 600-700m length and 40m thikness are met in cretaceous deposits. Paleogenic deposits are represented by non-calcareous blackish clays, sands and pebbles. In addition, coloured rubbled congolmerates and breccias are found there. These vucanogenic porphyries outcrop the ground surface on upper terraces of the left bank of the river. Tuffogenic layer from place to place consists of sedimentary and vucanogenic rocks. So-called "Kint (steeply plunging axes of cristalloid elipsoid) formations" are widely spread here, composed of dark clays, sands and pebbles. The thickness of the layer is several hundreds of meters. In upper parts, "Kint formation" turns into Maykop formations composed of non-calceraceous clay and thin layers of sandstones. They are met in North-easth of the Tianeti municipality. Mid-Sarmate deposits are found near v. Orkhevi and South-West Slope of the Elebi ridge. It is represented by bluish-gray marly clays, with sandstone and concglomerate midlayers found from place to place. Late Sarmat deposits represented by thick conglomerates are spread on the right bank of the Sioni reservoir and outcrop the surface on the bottom of the right bank of the lake. On the left bank these deposits are covered by thick delluvial sediments. At the place, where the dam is located the geological structure of the right bank of the river is fully represented by conglomerates, while the left bank – only partially. In the river bed conglomerates are covered by recent riverine alluvion. Conglomerates are of 10-50 m thikness and consist of sandstones and bluish-gray clays represented mostly by fine clayly sandstones and murls. Downstream of Sioni reservoir in the middle reaches of the Basin (Tsivgombori Range, Iori Plateau), Mestia-Tianeti tectonic zone turns into Eastern zone of molassic deposits of the Iverian Intermountainous Depression, more specifically, into Mukhrano-Tiriphoni sub-zone. Very small part of the basin in the middle to lower reaches is located in the southern zone of the depression, namely in Sartichala Sub-zone (Samgori and Gardabani plains). Sartichala sub-zone is composed of Quaternary alluvial-delluvial-prolluvial deposits of sedimentary rocks (e.g. gravel, cobbles, sands, clays). Mukhrani-Tiriphoni sub-zone is represented by Alazani sediments composed of thin layers of conglomeratres and clays (Tsiv-Gommbori range and Iori Plateau) and Dusheti formations composed of strong conglomerates with sand and sandstone midlayers (Lateral parts of Iverian Intermountainous depression). The Mukhrani-Tiriphoni sub-zone downstream Sagarejo municipalities transforms into Gare-Kakheti sub-zone (Iori Plateau) represented by low thikness Shiraki molassic formations of clays and allegorites with conglomerate and sandstone interbeds; medium-thikness Eldar deposits of clays with sandstone and conglomerate mid-layers (Iori Plateau) and; mediun thickenss Agchagil-Apsheron marine deposits of clays, sandstones and conglomerates. Quaternary deposits are found on Taribana valley, mid and late cretaceous – in v. Khirsa, Late Eocene - in Udabno and quaternary alluvial-prolluvial sediments - in flood plains.

Rioni River Basin

Rioni River basin is located on the southern slopes of the Greater Caucasus range and within the sub-mountainous immersion zone (depression). In terms of physical-geographic features, it is represented by the Mountain Areas of the Greater Caucasus, the Lesser Caucasus and the Kolkhida humid sub-tropical regions (for more details please refer to the map of the physical-geographic regions of Georgia, figure 4, annex 1).

Mountain areas of the Greater Caucasus are divided into three sub-groups: a.1 Western Caucasus and a.2 Central Caucasus and a.3 Eastern or Kakhetian Caucasus. Within the Rioni Basin, only the Western Caucasus sub-group is represented, encompassing the southern slopes of the Greater Caucasus. Here the upper streams of the rivers Rioni, Tskenitkhali and Kvirila and the ridges of Racha, Lechkumi, Egrisi and Svaneti are located (Racha-Lechkhumi and Lower Svaneti region, upper parts of Samegrelo region located within the Tskhenistskali basin, etc.).

The Lesser Caucasus group is divided into following sub-groups: b.1 Adjara-Imereti; b.2 Trialeti-Loki ridge. In the Rioni Basin, Adjara-Imereti sub-group is represented by: r. Khanistskali basin, where on the slopes and the foothills of the Meskheti ridge the upper part of the Bagdati municipalities is located; the part of the Vani and Kharagauli municipalities located on the northern slopes of the Meskheti ridge and; the parts of the Chiatura, Kharagauli, Sachkhere and Zestaphoni municipalitiess, located on the western slope of the Likhi ridge. Trialeti-Loki ridge sub-group is not represented in the Rioni river basin.

The Kolkhida region is divided into following sub-groups: e.1 Kolkheti plain (lowland) and; e.2 Imereti Upland (Plateau). The Kolkheti plain encompasses entire Black Sea region including the city of Poti – the mouth of the r. Rioni as well as the lower reaches of the rivers Tskenistskali and, Rioni and Kvirila up to Zestaphoni. The Imereti upland consists of: the Likhi ridge, a watershed of the rivers Kura and Rioni, Chiatura and Dzirula denudative plateaus and, the parts of the rivers Chkherimela and Kvirila.

The extreme upper course of the Basin is represented by Oni municipality. The relief is mountainous and the height varies from 600 to 4,462 m. The highest point is pick Tchanchakhi (4,462 m) located on the Central Caucasus. The other mountains are Phasi, Tsiteli, Laboda, Taimazi, Karaugomi, etc. The climate is mountainous moderately humid subtropical.

In accordance with geotectonic zoning, upstream areas of the Rioni river basin are located within the lower zone of the Crystal Core of the Main Caucasus Anticline and, the Folded System of the Southern Slope of the Greater Caucasus (i.e. zones of the Mestia-Tianeti carbonaceous sediments of upper Jurassic and cretaceous periods represented by Shovi-Pasanauri sub-group and, the Gagra-Java represented by upper and lower Jurassic porphyries and Racha-Lechkhumi syncline) (for more details please see the geologic map of Georgia, figure 11, annex 1). Lower Paleozoic, Mesozoic and Cenozoic formations are met here. The Crystal Core of the Main Caucasus range is represented by metamorphic formations with a numerous faults and folds. Mesozoic sediments (Mamisoni formation) are represented by Jurassic and cretaceous formations of limestone with 600 m thickness. Clayey and Quartzite sands and stones are located above and turf sands and stones - below (200-300 m depth) Mamisoni formation. Upper Jurassic deposits composed of porphyries and limestone fascias are common nearby village Tsesi. Limestones are widely met in upper Jurassic formations of Racha. Lower cretaceous deposits are met in Racha-Lechkhumi Syncline represented by limestone crystals of about 450-500m-depth in Nikortsminda. Upper cretaceous deposits are met in Racha-Lechkhumi syncline and are represented by glauconitic sandy stones. Cenozoic sediments are represented by Oligocene, Miocene and quaternary formations. They are also met in Racha-Lechkumi syncline and are composed of clayey, sandy-stony conglomerate and limestone. Quaternary sediments are represented by sands, gravels, pebbles and clays.

The geological structure of of foothills are represented by paleogenic and neogenic deposits. Imereti upland, located to the east of Kolkhida lowland (plain) within sub-mountainous immersion zone (depression), is represented by Meso-Cenozoic and Quaternary thick carbonaceous and effusive deposits. The Quaternary and Cenozoic sediments have the widest distribution. Lower Cretaceous rocks overlap Jurassic sediments and they are composed of dolomites, limestone, marls, and clays in 600-meter depths. Upper Cretaceous sediments outcrop in foothills and mountainside banks of Adjara-Trialeti ridge. They are represented mostly by limestone at a depth of 500-600 meters. Paleogenic system is composed of clayey Limestone, Marls and Clays at depths of about 1500 m and non-carbonaceous layered Clays at depths of 600 meters. The Neocene layers are formed with compact sandstones, calcareous sandstones, clays and limestone with an Overall depth of 1,000 meters. Quaternary sediments have a wide distribution in the region and represent continental formations. They are described with facial changes and miscellaneous geological-structural and geomorphologic features. The depth of Quaternary sediments decreases from west to east and ranges from several meters to 300 meters. Recent sediments are divided into River, Alluvial, Prolluvial and Delluvial formations. Recent Quaternary sediments are distributed in river valleys and represented by riverbed and floodplain facieses; their depth is changing within 2-20m limits and decrease from east to west. Delluvial-Prolluvial sediments are distributed at the bottoms of banks and represented by pebbles, clays and clayey soils. Alluvial-Delluvial sediments are distributed in watersheds and hillock banks and clays and sandstones one to two meters deep.

The Kolkhida lowland is the most submerged structure in Georgia, filled with thick Quaternary formations. Its fundament is parted with deep tectonic fractures. Kolkhida accumulative (Alluvial) lowland area and South Kolkhida hilly line region are marked out here. The Kolkhida accumulative lowland covers a wide area, relief is plain and its elevation is less than 200 meters above sea level. Alluvial sediments are generated by Rivers as shallow terraces. The relief is crossed by large number of gorges and river channels. Oligocene and Miocene clays, sandstones, and marls are present on the hilly zones. The surfaces are crossed by the tributaries of the Kvirila River.

2.1.4 Landscapes, Biodiveristy

Alazani River Basin

In high mountains of the Alazani River Basin (2,000 - 2,500 m and above) ***alpine and sub-alpine landscapes dominate*** that transform into the broad-leafed forests of oak, ash, elm, etc. at an altitude between 600-800m and 1,800-1,900m (for more details please refer to the Map of Land Cover of Georgia, figure 1, annex 2).

Tusheti area well represents the mountainous landscapes and the biodiversity of the Greater Caucasus. It is covered by mosaics of forests, subalpine shrubbery, subalpine and alpine meadows, sub-nival areas and nival zone with permanent snow cover. The landscape in its present form is a result of a combined action of various landscape generating natural forces (e.g. geological, geographical and bio-geographical, climatic, etc) and historical human factors. In historical times major human factors were livestock grazing and agricultural activities. Local needs for cereals were almost entirely satisfied by agriculture. Hence, vast areas were cleared in the upper forest and subalpine zones. Later on, land cultivation was gradually abandoned as lowlands became easily accessible. Since then sheep and other livestock breeding became the dominated form of human activity. Formerly cultivated areas were transformed into pastures. As a result, large proportions of land in the upper forest zone (1800-1900 m.a.s.l.) and on southern aspects of subalpine zone have become open secondary meadows with limited productivity.

Sub-nival habitats and nival zone are well represented on Atsunta and Pirikita ranges of Tusheti area, namely at the Tebulo, Amugo and Diklo mountainous massifs. The development of sub-nival vegetation at these locations is associated with not only high altitudes (3,200-3,400 m.a.s.l.) but also with the old age of these mountains. Sub-nival vegetation is poorly represented on the main watershed range. The nival zone with permanent snow and glaciers is found above 3,400 m a.s.l.

Alpine and sub-alpine meadows are dominating features of the Tusheti landscape covering about 70,000 ha in total. They are especially wide-spread in the upper reaches of the Pirikita Alazani and are represented by mezophilous, hemixerophilous grassy meadows, sub-alpine tall meadows as well as by so called alpine moles. The first is found on the main range of the Caucasus and northern slopes of the Makratela range. Hemixerophilous meadows are dominated by grasses and are developed on southern and eastern aspects in relatively humid gorges as well as on northern and western aspects of more dry gorges. Alpine moles are found in especially wet localities on the northern aspects of the main range of the Caucasus and the Makratela ridge, as well as in upper alpine areas of Tsovata and Atsunta ridges. Sub-alpine tall meadows are rare. They are mainly found on the bottoms of deep, humid canyons, where a lot of snow accumulates. They are present on northern slopes of the main range of the Caucasus and the Makratela range, on the bottoms of the gorges of the Ortskali, Salmiskhevi and other rivers.

Alpine moles include many rare and endemic species (*Pseudovesicaria digitata, Vavilovia formosa, Symphyoloma graveolens)* and there are some endemic genera, for example *Pseudobetckea (Ps. caucasica).*

Meadows are found within the altitudinal range 1,900 m.a.s.l. to 3,200 m.a.s.l. Both the structure and species composition vary with the altitude as well as with the aspect. There are four main variants including *Festucetum izoides, Festucetum supinae-parvomixtoherbosum, Festucetum variae-variograminosum, Nardetum strictae-parvomixtoherbosum*. The most important species is *Festuca spp*. Other characteristic species are: *Agrostis planifolia, Alchemilla caucasica, Anthoxanthum odoratum, Briza marcoviczii, Bromopsis variegata,Calamagrostis arundinacea, Campanula biebersteiniana, Carex huetiana, Carum caucasicum, Colpodium variegatum, Festuca ovina,Gentiana angulosa, Gentiana dschimilensis, Helictotrichon asiaticum, Luzula spicata, Poa alpina, Poa iberica, Potentilla gelida, Primula algida, Ranunculus oreophilus, Sibbaldia semiglabra, Taraxacum stevenii, Veronica gentianoides.*

Sub-alpine shrubbery habitats are represented by Caucasian rhododendron (*Rhododendron caucasicum)* communities and cover about 13,000 ha at the altitudes of 2,400-2,800 m.a.s.l. The larger fragments of this shrubbery are developed as a strip along the Pirikita gorge above subalpine forests at 2600-2800 m.a.s.l. The shrubbery is often disrupted by barren rocks, crumbling slopes and denudated rock formations. The distribution pattern of rhododendron shrubbery is generally associated with the distribution of humid air masses within the Tusheti depression. Rhododendron shrubbery is represented by several variations, including: i) pure rhododendron shrubbery *(Rhododendretum purum); ii)* rhododendron with occasional birch trees *(Rhododendretum betulosum); iii)* rhododendron with moss cover *(Rhododendretum hylocomiosum), iv)* rhododendron with herbs *(Rhododendron graminoso-mixtoherbosum),* etc.

Juniper shrubbery (*Juniperetum*) is found at 1,700 – 2,000 m a.s.l. along the southern aspects of the main gorges. There are two juniper species *Juniperus oblonga* and *Juniperus sabina.* There are also pine trees (*Pinus kochiana*) found from place to place. Other important plant species are: *Spiraea hypericifolia, Berberis orientalis, Rhamnus pallasii, Rosa canina, Rosa pulverulenta, Calamagrostis caucasica, Poa nemoralis, Koeleria cristata, Verbascum thapsum, Thalictrum foetidum, Scabiosa owerinii, Scabiosa bippinata, Festuca ovina, Campanula hohenackeri, Euphorbia squamosa, Scutellaria orientalis, Gnaphalium supinum, Potentilla crantzii, Pyrethrum leptophyllum.*

Marshes are distributed fragmentarily in sub-alpine and lower alpine zones. The vegetation is dominated by sedges (*Carceta dacicae, Cariceta kotschianae)* and *Blismeta compressi.* Various mosses are also common including: *Calliergonela cuspidata, Cratoneurum commutatum, Drepanocladus aduncus, Calliergon giganteum, Aulocomium palustre.* Among herbs and grasses there are: *Carex dacica, Juncus articulatus, Cardamine uliginosum, Parnassia palustris, Epilobium palustre, Primula auriculata.* There is also the Caucasian endemic *Primula luteola.*

Sub-alpine forests are found at an altitude between 1,700 -2,600 m a.s.l. Pine forests are composed of *Pinus kolchiana* covering about 15,000 ha in total within the altitudinal range 1700-2,200 m a.s.l. Forests and especially, pine forests, are mainly found in the eastern parts of the Tusheti depression where the altitude is lowest (Shenako-Diklo areas, Vebu, Igone and Oreti massifs). Conifer forest has a more limited distribution on the Chachakhovani range, and in the gorges of the Pirikita and Gometsari Alazanis. Birch forests (including crook-stem subalpine birch forests) are found at the altitudinal range 1700 to 2,200 m a.s.l. on average (in certain parts upper tree line is at 2500-2600 m a.s.l.). With an increase in altitude pine trees are gradually replaced by birch. Half of all forests in Tusheti are birch forest. Deciduous mixed forest has a very limited distribution and cover about 1,400 ha. Subalpine pine and birch forests cover about 6,200 ha. Most of the crook-stem subalpine birch forests are composed of Litvinov's birch (*Betula litwinowii*) in some areas mixed with Raddea's birch (*Betula raddeana).* Most common type of birch forest is composed of *Betula pendula* and they are found mainly on northern aspects. Litvinov's birch (*Betula litwinowii*) also cover important proportion of the forested areas. More specifically, birch forests are represented by following variations: i) birch forests with black bilberry and mixed-herb cover (*Betuletum vaccinioso-mixtoherbosum)* at the altitude of 1,700-2,200 m a.s.l. of the northern slopes of the Pirikita gorge (Tsovata and Vebu-Oreti massifs). The canopy cover is 60-70%. In addition to *Vaccinium myrtillus,* there are *Millium effusum, Deschampsia flexuosa, Valeriana alliariifolia, Geranium sylvaticum, Galium odoratum, Pirola minor, Solidago virgaurea, Vicia balansae Asplenium trichomane, Linnaea borealis, etc.;* ii) Rowan and birch forest with *Allium victorialis (Sorbeto-Betuletum alliosum)* occurs at 2,200 m a.s.l. along the northern aspects of the upper Pirikita Alazani gorge. The canopy cover is 60-70%. Dominant tree species include: *Betula litwinowii, Betula raddeana, Sorbus caucasigena.* Important herbs are: *Milium effusum, Geranium sylvaticum, Rubus saxatilis, Vicia balancae;* iii) Birch forest with Caucasian rhododendron and bilberry (*Betuletum rhododendroso-myrtillosum)* occurs at 2,000 – 2,400 m a.s.l. along the northern and western aspects of the Pirikita and Gometsari gorges as well as on the Vebu-Oreti massif. Apart from *Betula raddeana*, *Salix caprea* is also important. Among herb species there are *Calamagrostis arundinacea, Solidago virgaurea, Chamerion angustifolium; iv)* Birch forest with herb cover (Betuletum pendulae altherbosum) is found in the upper forest belt along the Oreti gorge up to the state border with Dagestan (Russia). The canopy cover is 70-80%. Among herbs there are: *Campanula latifolia, Symphytum asperum, Galega orientalis, Heracleum asperum, Milium schmidtianum, Chaerophyllumaureum, Aconitum orientale, Tephnoseria subfloccosa, astrantia maxima, Inula grandiflora.*

Tusheti protected areas encompasses ecosystems and biodiversity of Alpine,Sub-Alpine and high-mountainous forest zones of the Greater Caucasus (for more details please refer to the maps of Georgian and the Alazani river basin protected areas, figures 2,3, annex 2). It consists of Tusheti Strict Nature Reserve, Tusheti National Park and Tusheti Protected Landscape. The total area of the PAs is about 113,660.2 ha.

In terms of fauna, there is a lack of information on birds and animals especially, on invertebrates. It is so far known that up to 55 species of mammals, about 88 species of birds and 3 species of reptile inhebit the territories of Tusheti. The mammalian fauna is very diverse and includes: wild or bezoar goat *(Capra aegagrus* - 130 adults, 95.6 km^2 total habitat area, Andis Koisu, Piriqita Alazani and Tuseti Alazani vallies rocky forest distribution area*)*, East Caucasian Tur *(Capra cylindricornis:* density - 2.26 individuals/km^2; population size – 750 individuals; distribution area – Borbalo mount, Amugo mount and surrounding ridges and valleys: Chigo, Tshesho, Larovani, Diklo, Tchsheso; Atsunta range and Madnis Khorkhi); Chamois *(Rupicapra rupicapra),* Roe deer *(Capreolus capreolus),* Red Deer *(Cervus elaphus),* and Wild Boar *(Sus scrofa).* This is in addition to the Brown Bear (*Ursus arctos)*, Gray Wolf *(Canis lupus),* lynx (*Lynx lynx*) and Caucasian Leopard (*Panthera pardus ciscaucasica*). Tusheti is particularly important due to its wild goat population (for more details please refer to wild goat and the East Caucasus tur habitats in Tusheti, figures 4,5, annex 2). This species remains only in Tusheti and Pirikita Khevsureti in Georgia. Tusheti is also one of the few areas in Georgia where leopards are thought to remain.

The avifauna of the Tusheti Protected Areas counts about 88 species. It includes two Caucasian endemic birds: the Caucasian Black Grouse *(Tetrao mlokosiewiczi*) and Caucasian Snowcock *(Tetraogallus caucasicus).* The territory is rich in vultures, including Bearded Vulture (*Gypaetus barbatus),* Griffon Vulture (*Gyps fulvus),* Black Vulture (*Aegipius monachus*), Kestrel (*Falco tinnunculus)*, Goshawk (*Accipiter gentilis),* Sparrowhawk *(Accipiter nisus),* Golden Eagle (*Aquila chrysaetos),* etc.. Among all species 6 are included in the Red List of Georgia, of which one Black Vulture is globally threatened species and included in the IUCN red list. The recent surveys conducted under the UNDP/GEF PAs Financial Sustainability project have detected the Great Rosefinch (*Carpodacus rubicilla)*. The bird is only distributed in Central Asia and Caucasus as isolated populations (for more details please refer to the map of important areas for bird watching, figure 6, annex 2).

Three species of reptiles have been recorded in the park, i.e. *Coronella austriaca, Vipera ursini* and *Lacerta spp.* There are also at least one amphibian species, common toad (*Bufo viridis)* and one fish (*Salmo trutta*).

In addition to wild biodiversity, Tusheti is rich in agrobiodiversity. The region is the site of origin of three endemic breeds: Tushetian horse, Tushetian sheep and Georgian sheepdog. Selected primarily for nomadic life style the Tushetian horse is perfectly adapted to the life at high altitudes. This small-sized horse is characterized by swiftness, agility, Overall durability, high fertility, good hearing ability (to distinguish between a vast range of audio signals) and more importantly by good temper. The Tushetian horse is an important part of local culture and biodiversity. Its maintenance is also important from the tourism development view point. Tushetian sheep is also worth of noting. It can tolerate long-distance migrations twice a year (to and back from summer and winter graze lands). It is characterized by moderate size (average weight 60-70 kg) and compact body architecture. This sheep is known for its good quality meat and wool. The wool is used for the production of local traditional handcrafts such as carpets, socks, cloths, etc. The Georgian sheepdog is a sub-breed of the Caucasian sheepdog which is believed to be around for six thousand years. It is a massive (45-65 kg) sheep herder, guard and defense dog. It is characterized by a strong build, understanding nature and ability to adapt to the most varied weather conditions and by other physical and behavioral characteristics necessary for the survival on alpine pastures and adaptation to nomadic life style. This dog requires little care and is the best protection against depredation from wild carnivores. The breed is also kept as pet throughout the world. There are a number of native plant varieties that were grown in Tusheti. They are no longer cultivated. As of 1950s crop growing has been abandoned in the region. Among these varieties the endemic barley "Kershveli" is noteworthy. Due to its morphological and other characteristics this variety is a valuable component of Georgia's agro biodiversity and it is preserved in the national seed bank of Georgia.

The Batsara-Babaneuri Strict Nature Reserve and the Ilto Managed Reserve were established in 2003. Total area of the Batsara Reserve is 3,042 ha; that of the Babaneuri Strict Reserve - 770 ha and; that of the Ilto Managed Nature Reserve – 5,273 ha. All three Protected Areas are located in the Akhmeta municipalities. More specifically, Batsara State Reserve is located in the north-eastern part of Georgia, 900 – 2000 meters above sea level, on the southern slope of the Caucasus range and is spread within the river Batsara basin, right tributary of the r. Alazani. Climate is moderately humid. Babaneuli State Natural Reserve is located bellow East (Kakhetian) Caucasus Range, on its foothills, on the left side of river Alazani and on the right side of the river Stori. It is in the eastern part of Akhmeta municipalities and 45 km away from the Batsara Strict Nature Reserve. Babaneuri Nature Reserve was established to protect and conserve a relic groves of yew-tree woodlands of tertiary period. It also protects animal species inhabiting this area. The Ilto Managed Nature Reserve covers a part of the Ilto River basin near Akhmeta.

In the middle of the Batsara River watershed the Tertiary period yew (*Taxus baccata*) forests occupy almost 240 ha. Such a large yew grove is nowhere in the world. Most of the trees are 500-1000 years old, and some others are even older. Batsara yews are enlaced with lianas, the Pastuchov's Ivy (*Hereda pastuchowii*) and climber (*Smilax excelsa*). In this part of the Strict Nature Reserve the untouched beech forest (*Fagus* *orientalis*) and alder forest (*Alnus barbata*) are also preserved. In the upper streams of the same Batsara River groves of high-mountain Sycamore maple (*Acer pseudoplatanus)* can be found. In the Babaneuri part of the Reserve there is a grove of Caucasian Zelkova *(Zelkova caprinifolia)* – the Caucasian-Iranian endemic species, the relict of dendroflora of the Tertiary period, which occupies 750 ha. The Ilto River watershed is known with its well preserved beech forests *(Fagus orientalis).* Together with the beech, the hornbeam *(Carpinus caucasica),* maple *(Acer laetum),* lime*(Tilia cordata),* Georgian oak *(Quercus iberica)* and other different trees participate in creation of the forest cover. Cornel, common nut-trees, red hawthorn and honeysuckle grow in the subforest.

Among small mammals the Caucasian squirrel (*Sciurus anomalous*) and the Radde's shrew (*Sorex raddei*), Caucasus endemic species are met. Among medium and large mammals following species are found in the Ilto Managed Natur Reserve: Roe deer(*Capreolus capreolus*), chamois (*Rupicapra rupicapra),* wild boar (*Sus scrofa*), brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*), jackal (*Canis aureus*), Red fox (*Vulpes vulpes*), badger (*Meles meles*), Stone marten *(Martes foina*), Pine marten (*Martes martes*), wild cat (*Felis sylvestris*), otter *(Lutra lutra), et al.* Otter is very rare to be seen.

Ornithofauna of Protected Areas is also rich in species. It counts about 60 species, including but not limited to Wood-pigeon, Mistle Thrush, Blackbird, Raven, Goldfinch, several kinds of woodpeckers and many other species of small birds. Caucasian chiffchaff (*Phylloscopus lorenzii)*– endemic species to Caucasus, as well as the predators: Bearded vulture (*Gypaetus barbatus),* Griffon vulture *(Gyps fulvus)*, Black vulture (*Aegypius monachus),* goshawk *(Accipiter gentilis),* sparrow hawk *(Accipiter nisus),* Golden eagle *(Aquila chrysaetos), et al.* Kestrel (*Falco tinnunculus)* are worth of noting*.*

The Batsara River and its tributaries, as well as the Iltio River are rich in Brown trout *(Salmo trutta).* Among amphibians 7 species are found, including: Caucasian toad (*Bufo verrucosissimus*), Common tree frog (*Hyla arborea*), green toad (*Bufo viridis*), Long-legged frog (*Rana macrocnemis*), *et al*.

About 14 species of reptiles are found in the Protected Areas. Among them are the following tree endemic species of lizards – Caucasian lizard (*Darevskia caucasica*), Meadow lizard (*D.praticola*) and Artvin lizard (*D. derjugini*), though existence of Georgian lizard (*Darevskia rudis*) is supposed as well. Among the other species of reptiles the Caucasian Viper (*Vipera dinniki*) can be noted. Greek tortoise (*Testudo graeca)* can be noted as well among reptiles.

Lagodekhi Protected Areas that includes Lagodekhi Strict Nature Reserve and Lagodekhi Managed Nature Reserve are located in the most northeastern part of Georgia, in the Lagodekhi Municipality along the southern slopes of the main range of the Great Caucasus. The altitude of the Protected Areas varies within 400-3,500 m above the sea level. The area is characterized by temperate humid subtropical climate and is rich in water. The Ninoskhevi, Shromiskhevi, Lagodekhistskali and Matsimistskali are the main rivers originating in the high mountains and creating many water cascades and waterfalls, which then flow quietly in the lower zone of the forest. In the alpine zone, there are several lakes of glacial origin, the Black Cliff Lake with the depth of 14 m being the largest of them. It is located on the Russian-Georgian border.

There is an alternation of vertical zoning in the protected areas. 121 plant species of Lagodekhi are endemic to the Caucasus and 9 – endemic to Georgia. Among Georgian endemics, 7 species are endemic to Kakheti or endemic to Protected Areas. Lagodekhi is famous for its very well preserved beech and hornbeam virgin forests. In the Strict Nature Reserve the most widespread plant type is a beech forest, though in the

Protected Areas one can find the alder-groves, hornbeam groves, small tracts of Georgian oak and mixed deciduous forests, as well as the maple groves and high-mountain oak groves. In the subalpine zone the birch forest is widespread with the shrubbery of Caucasian rhododendron *(Rhododendron caucasica)*.

126 species of vertebrates are count in the Lagodekhi PAs, out of which the 4 species of fish, 5 – of amphibians, 12 – of reptiles, 150 – of birds and 53 species of mammals are widespread. Lagodekhi Strict Nature Reserve and Lagodekhi Managed Nature Reserve are rich in fauna of invertebrates as well, but it is not studies enough. Endangered and threatened species included in the Red List of Georgia are as follows: chamois *(Rupicapra rupicapra),* East Caucasian tur*(Capra cylindricornis*), Red Deer *(Cervus elaphus),* its only several population have been remained in Georgia, Roe deer *(Capreolus capreolus)* and Wild boar *(Sus scrofa).* Among carnivores lynx *(Lynx lynx)* and Gray wolf *(Canis lupus)* are distinguished, as well as the Brown bear *(Ursus arctos)* – included in the Georgia's Red List. Among raptors Lammergeyer or Bearded vulture *(Gypaetos barbatus),* Imperial eagle *(Aquila heliaca),* Peregrine falcon *(Falco peregrinis),* Golden eagle *(Aquila chrysaetos)* and Steppe eagle *(Aquilla nipalensis)* are found. Among the Caucasian endemic birds Caucasian Black grouse *(Tetrao mlokosiewiczi)* and Caucasian Snowcock are widespread in Lagodekhi *(Tetraogalus caucasicus).*

In the Alazani plain, ***Thermo-Moderate Semi-Humid landscapes*** are spread, characterized by sloppy alluvial, alluvial-proluvial plains, in some places covered by alluvial cones composed of Quaternary deposits. The banks of the lowland are distinguished by plains of hilly erosive-denudate and erosive-accumulative relief. Saline parcels are met occasionally. Untransformed (natural) landscapes occupy no more than 5-10% of the lowland represented by Riparian (Tugay groves) forests grown on alluvial meadow and saturated soils. Dry terraces are over-grown by oak forests with various shrubberies, whilst much drier terraces with alluvial soils are grown by beech and hornbeam forests. Forests are usually grown on wide terraces and floodplains with different types of grey soils. The landscapes in the Valley currently are dominated by a mixture of natural landscapes and agriculture lands with vineyards and grain crops and inhabited territories dominating there. Meadow forests are widely used as pastures.

In general, the landscapes and the vegetation cover of the right and the left banks of the Alazani Floodplain are very distinct from each other attributed to the climate and the relief differences. While the steppe environment represented by desert and semi-desert vegetation, steppes, arid light woodlands, Shibliak, phryganoid vegetation, rock xerophytes, halophyte communities dominates on the right bank of the River Alazani, dense growth of forests is found on the left bank. More specifically, plain areas of the northern part of the right bank are characterized by isolated patches of secondary steppes and degraded forests with lianas, developed into arable lands and vineyards and, elevated areas of the same part – by spiny shrubs and oak and beech forests (*Quercus pedunculiflora* and *Carpinus orientalis*) also transformed into cultural landscapes. Arid landscapes represented by spiny shrubbery valleys grown on meadow brown and black soils (in few places also on salty soils) are found in the eastern part of the right bank. Here, much of the land is used as croplands and vineyards needing intensive irrigation. Therefore, this part of the plain is cut by numerous irrigation canals. The left bank of the river is represented by unique dense forests (*Quercus pedunculiflora*, *Populus hybrida*, *Pterocarya pterocarpa*, *Fraxinus excelsior*, *Tilia caucasica*) with lianas as well as with mixtures of cultural landscapes and secondary meadow-shrubs in the flat areas and cultural landscapes and heavily degraded meadow-shrubs on the slopes.

Although found in the Alazani river basin, steppes are more characteristic of the Iori river basin (for more details see below Iori River Basin part).

Shibliak and *phrygana* vegetation are found in dry gullies, depressions, northern slopes of quests, etc. *Paliureta-typus shibljak* and *Astragaleta*, *typus phrygana* are major types of scrub found in the zone and include a variety of communities such as: *Caraganetum-Artemisioso-ephemerosum*; *Caragaletum-Paliurosum*; *Cotineto-Paliuretum-Stiposum*; *Astragaletum-Kochiosum*; *Paliuretum-Bothriochloosum, etc*. In terms of small mammals areulebi are characterized by the highest species richness. A total of 21 small mammal species have been recorded including: *Allactaga willamsi, Apodemus fulvipectus, Apodemus ponticus, Apodemus uralensis, Cricetulus migratorius, Driomys nitedula, Eptesicus serotinus, Hystrix indica, Lepus europaeus, Microtus socialis, Mus macedonicus, Mus musculus, Myotis blithi, Myotis mystacinus, Nyctalus noctula, Pipistrellus kuhli, Pipistrellus pipistrellus, Pipistrellus pygmaeus, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Talpa levantis.* Three of these species, *Allactaga willamsi, Cricetulus migratorius, Driomys nitedula*, are exclusively associated with shibliaks. Due to physical and vegetation features these biomes provide shelter for large and medium-sized mammals. Chucar is a typical bird of this habitat. Shibliaks also provide nesting sites for raptors such as gryphon vulture, black vulture, Egyptian vulture and long legged buzzard.

Arid light woodlands are composed of two main species: pistachio (*Pistacia mutica)* and juniper (*Juniperus foetidissima).* Other species of juniper such as *Juniperus oxycedrus, J. oblonga, J. polycarpos* are also found in the zone, but they are less important in light forests and create only small communities. Juniper forests are found in many areas of the semi-arid zone shared by both Alazani and Iori River Basins, including Vashlovani Reserve. Juniper formation includes *(Junipereta, J.foetidissima)* the following associations: (1) *Juniperetum-Rhamnosa-Stiposum,* (2) *Juniperetum-Loniceroso ibericae-Stiposa;* (3) *Juniperetum-Mixtofruticoso (typus shibljak)-graminossum*; (4) *Juniperetum-Paliuroso-Bothrichloosum*; (5) *Juniperetum-Astragaloso-Mixtoherbosum*; (6) *Juniperetum-Cotinoso-Bothrichloosum*; (7) *Juniperetum-Rhamnoso-Bothriochloosum*; (8) *Junipereum-Paliuroso-graminosum*; (9) *Juniperatum-Ephedroso-Graminosum*; (10) *Juniperetum-Pistacioso-Paliurosum*; (11) *Juniperetum-Pistacioso-Graminaosum*; (12) *Juniperetum-Cotinoso-Paliurosum*; Pistachio forests (*Pistacieta*) are mainly distributed on foothills and river-side terraces. In Vashlovani pistachio forest includes the following associations: 1) *Pistacieta semidesertosa* with characteristic species such as *Botriochloa ischaemum, Salsosa ericoides, Kochia prostrata, Artemisia fragrans, Stipa capillata, St. lessingiana* etc 2) *Pistacieta-Botriochloosa* which mainly occurs on stony slopes and hills; 3) *Pistacieta stiposa*, which is characterized by steppe grasses.

Arid light woodlands are relatively poor in small mammals and only three species have been recorded including *Microtus socialis, Meriones libycus* and *Mus macedonicus.* Colonies of these species in light woodlands are characterized by relatively low densities compared to other habitats. However it is important that they survive even severe population depressions and apparently serve as reservoirs for the rest of the populations inhabiting other habitats where they are more vulnerable to various types of changes. Arid forest habitats are also significant for large mammals; for brown bears light woodlands are principle habitats.

Alazani floodplain or Riparian forests occupy areas of land adjacent to a stream, river, marsh, or shorelines of the r. Alazani, which form transitional ecosystems between land and water environments. According to historic data, floodplains of r. Alazani were covered with dense forest groves along the entire river. In botanical literature the above forests are often referred as Tugay woodlands due to certain degree of similarity with Central Asian riparian forests, although woodlands developed on the banks of r. Alazani grow under different soil conditions and are characterized by specific floristic composition. Due to long–term human-induced impacts, landscapes of Alazani floodplains are currently drastically changed and the area occupied by riparian forest ecosystems is extremely reduced. Despite this, the floristic composition and vegetation structure of the forests under consideration is preserved in certain areas, especially in the vicinity of villages Pichkhovani and Laliskuri.

Alazani floodplain forests similar to Kolkhic forests, are rich in lianas and include relic Colchic elements such as Zelkova carpinifolia, Vitis sylvestris, Clematis vitalba, smilax excelsa, Hedera pastuchovii, Populus hybrida, Querqus pedunculifora, etc. Alazani floodplain forests can be regarded as intermediary bioms between Kolchic forests and dry forests of east Georgia. Tertiary relic species, white poplar (Populus hybrida) and riparian oak (Quercus pedunculifolia) are major components of the floodplain forests. First and second terraces from the river bed are dominated by poplars and abound in lianas. Further from the water where ground waters are deep, the forest becomes dryer and is dominated by oak (Quercus pedunculiflora). These forests are relatively well-preserved on the banks of r. Alazani, while they have been almost entirely eliminated from the other riparian habitats of eastern Georgia. Oak-dominated riparian forests are rich in associated species; the total number of species is estimated at approximately 30-40 per hectare of riparian oak woodland. Oak woodlands are also characterized by the presence of a highly diverse tree layer and abundant growth of lianas of such as the wild vine grape (Vitis sylvestris), silk-vine (Periploca graeca), traveler's joy (Clematis vitalba), etc. Besides, a mid-story composed of large shrubs is very well developed. All floodplain forests are secondary and immature (polidoninat). Apart from oak and poplar there are Carpinus caucasicus, Fraxinus exelsior, Ulmus carpinifolia, Acer platanoides, Robinia pseudoacacia, etc. The under-forest is composed of Crataegus kytostyla, C. curvisepala, Mespilus germanica, Ligustrum vulgare, Swida australis, Lonicera kaprifolia; among lianas there are: Smilax excelsa, Vitis sylvestris, Periploca greca, Hedera helix, H.pastuchovii, etc.

A number of communities are distributed as populations of isolated patches and have a high conservation value. Following forest communities are found in floodplain areas***: i) Hybrid poplar dominated forests with understorey of Swida australis.*** Frequent associates of hybrid poplar are oak (Quercus pedunculiflora), ash (*Fraxinus excelsior*), elm (*Ulmus foliacea*), wing-nut (*Pterocarya pterocarpa*), etc. Understorey is characterized by abundant growth of *Swida australis* with occurrence of privet (*Ligustrum vulgare*), tamarisk (*Tamarix ramosissima*), etc. Like in other riparian communities of Alazani basin, lianas are abundantly developed in the forest under consideration; their floristic composition is typical for floodplain woodlands and composed of wild vine grape, smilax, silk-vine, etc. Ground flora is species-poor and consists of several grass species (*Brachypodium sylvaticum, Festuca gigantea, Dactylis glomerata*) with admixture of some widespread taxa such as creeping cinquefoil (*Potentilla reptans*), goldenrod (*Solidago virgaurea*), etc; ii) ***Poplar dominated forests with understorey of tamarisk and Russian olive.*** Treelayer is dominated by two poplar specis-*Populus canescens* and *P. nigra*. Understorey is almost entirely composed of tamarisk (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*); of other understory elements mention should be made of exotic false indigo (*Amorpha fruticosa*), etc. Ground flora is not diverse and consists of *Glycyrrhiza glabra, Erianthus ravennae,* etc. This specific riparian community covers negligible areas at the first terrace of Alazani river; iii) ***Riparian oak-dominated forest communities.*** Generally, oak woodlands dominated by *Quercus pedunculiflora* occupy drier areas in comparison with typical willow or poplar floodplain forests, and due to higher diversity of econiches, their floristic composition is richer. Frequent associates of *Q.*

pedunculiflora are elm (*Ulmus foliacea*), willow (*Salix excelsa*), ash (*Fraxinus excelsior*), hornbeam (*Carpinus caucasica*), maple (*Acer campestre*), lime (*Tilia caucasica*), etc. Mid-story in oak-dominated woodlands is rather diverse and comprise quite a few species of shrubs such as privet (*Ligustrum vulgare*), *Swida australis*, medlar (*Mespilus germanica*), dogwood (*Cornus mas*), hazel (*Corylus avellana*), etc.

Oak woodlands are characterized by presence of abundant lianas that frequently suppress natural regeneration of forest communities. The most frequent evergreen and deciduous natural climbers associated with oak forests are smilax (*Smilax excelsa*), ivy (*Hedera helix*), silk-vine, traveller's joy, etc. In addition to forest communities mentioned above, small isolated areas are populated with relict forest fragments, where common species of tree layer are associated with Tertiary relicts such as wing-nut (*Pterocarya pterocarpa*), water-elm (*Zelkova carpinifolia*), The hydrophitic vegetation does not present a peculiar feature in the local vegetal landscape. Wetlands and associated floristic complexes are distributed as small fragments; they mostly consist of common species, including reed (*Phragmites australis*), reedmace (*Typha latifolia, T. minima*), flowering rush (*Butomus umbellatus*), etc. Stagnant waters, small ponds and ditches are populated by typical aquatics of which mention should be made of fennel pondweed (*Potamogeton pectinatus*), broad-leaved pondweed (*Potamogeton natans*), etc.

Riparian forests are inhabited by several plant species of high conservation value, included in the Georgian Red List. These are as follows: Ivy *(Hedera pastuchowii)*; Wing-nut *(Pterocarya pterocarpa)*; Oak (*Quercus pedunculiflora*); Water-elm (*Zelkova carpinifolia*)

Small mammals typical of both forests and plains are common to floodplain forests. Some 42 mammals are found in the area, of which several species are included in the IUCN list for rare and endangered species, including: Lesser horseshoe bat *(Rhinolophus hipposideros),* Greater Horseshoe Bat *(Rhinolophus ferrumequinum),* Lesser Noctule *or* Leisler's Bat (*Nyctalus leisleri),* Caucasian squirrel *(Sciurus anomalus),* Common or European Otter *(Lutra lutra),* Eurasian Lynx *(Lynx lynx)*. Species like Gueldenstaedt's Shrew *(Crocidura gueldenstaedti),* Forest Dormouse *(Dryomys nitedula),* Black Sea Field Mouse *(Apodemus ponticus),* Steppe Field Mouse *(Apodemus fulvipectus),* Ural Field Mouse *(Apodemus uralensis),* House Mouse *(Mus musculus),* Macedonian Mouse *(Mus macedonicus),* Black Rat *(Rattus rattus), Broun Rat (Rattus norvegicus),* The European Water Vole (*Arvicola terrestris*), Serotine (*Eptesicus serotinus),* European Hare or Eastern Jackrabbit (*Lepus europaeus)*, Social Vole *(Microtus socialis)* Nutria (*Myocastor coypus*), Daubenton's Bat (*Myotis daubentoni*) Noctule Bat*, (Nyctalus noctula*), Common Pipistrelle *(Pipistrellus pipistrellus*), Levantine Mole (*Talpa levantis)* are common species. *Three of above species Arvicola terrestris, Myotis daubentoni* and *Nyctalus leisleri,* are only found in floodplain forests. *The Red Fox (Vulpes vulpes)* and the Golden Jackal (*Canis* aureus) being regulators of the common species, can be also considered as key species.

Among large mammals wild boar (*Sus scrofa*) is characteristic to floodplain forests. Roe deer is also present there. Raccoons are abundant in these habitats. Pheasant *(Phasianus colchicus*) is typical to floodplains. Black storks (*Ciconia nigra*) are met in Alazani floodplains.

The Alazani flood-plains and the flat plains developed along its both banks are inhabited by following amphibians: Marsh frog (*Rana ridibunda),* which is characterized by high ecological flexibility, some one hundred individuals can be found in the flood-plain within 1km from the river; European Green Toad *(Bufo viridis)*, commonly found in areas adjacent to the flood-plain, during breeding it tends to migrate towards the river bank and backwards, European Tree Fog (*Hyla arborea),* inhabiting both the flood-plain forests and its adjacent plain areas and Banded Newt (*Tritorus vitatus), endangered species included in the red book of Georgia.*

It should be mentioned that several areas within the Alazani floodplain forests are designated as hunting grounds.

From spring to fall, the Alazani floodplains become a corridor for migratory birds and provide resting and feeding grounds for these migratory species. In winter time, large flocks of Anseriformes and others invade the area. Information on the birds is scarce and is based on a sporadic field works. Based on these data, there are following species in the floodplains: galiforms – 2 species; Charadriiformes – 1 species; Falconiformes – 1 species; Anseriformes – 1 species; Strigiformes – 1 species; Cuculiformes – 1 species; Caprimulgiformes – 1 species; Coraciiformes – 3 species; Passeriformes – 29 species; Piciformes – 3 species. Some of the above species are included in the list of endangered species, for example Syrian woodpecker (Dendrocopos syriacus Hemprich et Ehrenberg), and other species. From migratory species Antropoides vigro is quite common in the fields and open meadows adjacent to the Alazani flood plains; it uses these areas mainly as resting grounds during migration (in February-March). Anas qverkudella is also found in the areas along the river during its migration (pre-winter) period Alazani plain, in the flood plain forests developed along the Alazani river bed, the adjacent plain areas and in the submontane strip: *Ophisaurus apodus*, its key habitats are in cultural landscapes (arable lands, orchards/gardens), secondary, manmade, meadows, meadow-shrubs and forest-shrubs; *Anguis fragilis, which* is mainly found in forests, but can also be found in secondary forest-shrubs; *Typhlops vermicularis*, an inhabitant of the Alazani plain, who inhabits the riverside areas but avoids the flood plains that are subjected to periodic inundations; *Natrix natrix*, is another typical inhabitant of the river flood plains which can also be found in cultural landscapes; *Natrix tessellate*, inhabits the river flood plains and the adjacent areas; *Coluber schmidti,* mainly found in the plain areas adjacent to the left bank of the Alazani; *Elaphe quatuorlineata sauromates*, that has been reported in the plain areas of the municipalities of Lagodekhi; *Lacerta strigata*, is characterized by a rather high ecological flexibility, is common in the Alazani plain and the adjacent submontane strip but avoids thick forests; *Emys orbicularis*, is a typical inhabitant of flood plains; *Mauremys caspica*, its distribution pattern coincides with that of *Emys orbicularis; Testudo graeca ibera,* they avoid the river flood plain areas and prefer the adjacent plain areas as a habitat.

Vashlovani Protected Areas, consisting of Vashlovani Strict Nature Reserve (10,142 ha), Vashlovani National Park (25,114 ha) and Natural Monuments: Artsivis Kheoba (Eagle Gorge), Takhti-Tefa Mud Volcanoes (238.5 ha), Juma Bay and Alaznis Tchala (Alazani Flood Plain forests) are located in the extreme eastern part of Georgia, in the Dedoplistskaro municipalities. Total area of the protected areas is about 24,924 ha. The Protected Areas are located between Iori and Alazani River Basins. The gorge is a deep and very beautiful canyon cut by a little ravine through the cliffs of limestone origin. The territories of Vashlovani are distinguished with rare wild pistachio trees (Pistacea mutica), arid light forests and bluestem-feather grass steppes. Foothills are covered with oak trees and ash-tree groves mixed with maple and elm. Here can be found barberry, Jerusalem thorn, smoke tree, peashrub, et al. There are unique floodplain forest of Alazani and two little bays (Juma and Mijna) in Vashlovani National Park.

About 700 plant species are described in Vashlovani, though among them can be distinguished the distribution of diversity of orchids (7 species), Georgian iris (Iris iberica), Eichler's tulip (Tulipa eichler)

Fauna of Vashlovani is quite diverse and attractive. 46 species of mammals inhabit Vashlovani. There are many jackals (Canis aureus), Red foxes (Vulpes vulpes), hares (Lepus europiacus), wolves (Canis lupus), lynxes (Lynx lynx), Jungle cats (Felis chaus) and Indian porcupine (Hystrix indicus) and even Brown bears (Ursus arctos) in Vashlovani, which is so rare for semi-desert areas.

At the end of 2003 leopard (Panthera pardus ciscaucasica) was discovered in Vashlovani. Scientists have photographed this animal (NACRES), which unique for Georgia.

In the site of "Alesilebi" of Datvis Khevi (Brown bear gorge) deposited layers of exposed rocks there are mollusk chitins that are well preserved. These mollusks are the oldest habitants of Vashlovani; they belong to the time when the local territories were covered with sea. In the same Datvis Khevi you can see one more comparatively "young" pre-historical animal: in clay hill extrudes the hardened shoulder bone of the southern elephant.

Iori River Basin

In terms of landscapes, in very upstream of the Iori Basin, at an altitude of 2,000 - 2,500 m and above ***High Mountain Meadow Landscapes (alpine and sun-alpine landscapes)*** dominate: i) Caucasian High-Mountain Sub-Alpine Forest-Shrubbery-Meadow Landscapes are characterized by denudative and palaeo-glacial reliefs. Following natural landscapes are met here sub-alpine oblong forests (beech, birch, highland maple, etc.); Sub-alpine shrublands; High-herbaceous lands); Sub-alpine meadows (grasslands, loose turf, multi-herbaceous, multi-herbaceous-grassy, etc). The vegetation is grown predominantly on mountain-forest-meadow, typical mountain-meadow and turf soils. Rendzins are also met. Ii) Alpine landscapes are composed of various mountain rocks. However, crystal and metamorphic rocks and Jurassic schist prevail on the Great Caucasus structure, the relief is also characterised by high variety. Both volcanic and karst reliefs are found here. Alpine meadows (Festuca supina, Carex tristis, C.Medwedewii Alchimilla caucasica, Lofus caucasica, etc) are the dominant natural landscapes. The "Alpine carpets"-thickets of low-grown compact turf forming plants resembling the multicolored Persian carpets, emerge occasionally. The Northern slopes are grown by thickets of the Caucasian rhododendron (for more details please the map of land cover of Georgia, figure 1, annex 2).

Sub-alpine landscapes transform into ***Middle mountain, Low mountain and foot-hill landscapes*** with broad-leafed forests of beech, hornbeam, oak, ash-tree, elm, etc. at altitude between 600-800m and 1,800-1,900m. These forests are met on the foot-hills and slopes of low mountains of Tianeti municipality as the well as on slopes and foothills of Kakhetian, Kartlian and Tsiv-Gombori ridges, covered by beech trees (Fagus Orientales). On the Sabaduri Ridge beech forests with Colchic forests elements are met. The relief is middle-mountain erosive-denudative, rarely, erosive-accumulative, with slopes of medium and high steepness. Near the Sioni reservoir, downstream town Tianeti, the young forest groves are found on the right bank of the river. They are composed of beech, Georgian oak (Quencus Iberica), field maple (Acer campestris), cornel tree (Cornus mas), Caucasus Hackberry (Celtis caucasica), basswood (Tilia caucasica), hornbeam (Carpinus caucasicus), etc. From herbaceous perennial plants, lily-of-the-valley (Convallaria trancaucasica), Peony (Paeonia), Solomon's Seal (Polugonatum multiflorum) and others, characteristic to eastern Georgia and in particular, Gare (Outer) Kakheti. On the left bank of the river Pine plantations and orchards are spread.

In middle and lower parts of the basin along both riversides, especially at the outlet, the coastal, ***Riparian (Tugayan groves) forest*** is developed bordering on the west and east with treeless spaces and lifeless prairies. The Iori basin, especially downstream areas, is poor in species composition and the forests occupy smaller areas relative to the Alazani basin. Iori floodplain forests are fragmented. Important relic species such as *Hedera pastuchovii, H. helix,* have not been recorded in Iori forests. Unlike Alazani floodplain forests, Iori forests include *Pistacia mutica* and *Celtis caucasica.* It is rich in rare and endemic, as well as relic species from cretaceous period and onward.

On the right-bank side of the basin closer to the river valley *lays* ***a semi-prairie***. Isolated small areas are covered with mountain-prairie vegetation with grain plants and big intermixture of xerophytes. The semi-prairies, as well as the semi-deserts on gristly-sandy soil bases are met on the left-bank side of the basin.

Arid light woodlands are composed of pistachio (*Pistacia mutica)* and juniper (*Juniperus foetidissima).* Other species of juniper such as *Juniperus oxycedrus, J. oblonga, J. polycarpos* are also found in the zone, but they are less important in light forests and create only small communities. Juniper forests are found in Vashlovani Reserve, mount Nazarlebi, Pantishara, Shiraki Plateau, Kotsakhura Ridge, Western slopes of Eldari Ridge, etc. In the Iori river basin, pistachio forests are composed of the following major associations: 1) *Pistacietum-Paliuroso-Bothriochloosum*; 2) *Pistacietum-Juniperoso-Paliurosum*; 3) *Pistacietum-Paliuroso-Juniperosum*; 4) *Pistacietum-varioherbosum*; 5) *Pistacietum-Paliurosum*; 6) *Pistacietum-Bohtriochloosum*; 7) *Pistacietum-Graminoseum*; 8) *Pistacietum-Tamaricoso-varioherbosum*

Arid light woodlands are poor in fauna (for more details please see above Alazani river basin part)

North Sub-Tropical Semi-Arid Landscapes occupy significant part of the Iori upland (plateau). These landscapes are met at 200-800m above sea level. Plain, sometimes ridged accumulative and arid-denudative relief is characteristic of these landscapes. The Iori upland is characterised by plateau, depression, arid-denudatiative relief composed of molassa formations. Shiblyaks and steppes are spread on chermozems, while brown and grey-brown soils are met in areas with significant humidity. Dry steppes on ash-brown soils with semi-desert vegetation are also met here. Natural landscapes and agriculture lands with orchards and gardens are concentrated on irrigated lands. Lands unsuitable for irrigation are used for winter pasturing.

More specifically, steppes are characterized by bearded grass (*Bothriochloa ischaemum),* which in association with scrub also creates small patches on more rugged terrain. Steppe vegetation also is found in combination with Shibliak and phrygana mainly on foothill areas with less saline soils. In association with light woodlands, steppe communities in addition to bearded grass (*Bothriochloa ischaemum)* also include *Stipa lessingiana, St. stenophylla, St. capillata, Festuca rupicola*. Fragments of steppe habitats are also present on riparian terraces. Varieties of bearded grass communities include: (1) *Glycyrrhizieto (G. glabra)-Bothriochloeta* (on chernozem type soils, mainly on terraces and lower areas); (2) *Bothriochloeta–xeroherbosa* (found on northern slopes with brown soils); (3) *Bothriochloeta - ephemerosa* or *Bothriochloeta in lapidosis* (on southern slopes with stony soils) (4) *Bothriochloeta-Pratohebosa* (found on lower areas and depressions with chernozem). Bearded grass formations *(Botriochloeta, B. ischaemum)* occur in a number of associations such as (1) *Bothriochloetum-Stiposo-Artemisiosum*, (2) *Bothriochloetum-Stiposum*, (3) *Bothriochloetum-Stiposo-Festucosum,* (4) *Bothriochloetum-Artemisiosum,* (5) *Bothriochloetum-Stiposo capillatae,* (6) *Bothriochloetum-varioherbosum.* Steppe communities with *Stipa spp*. are less widely distributed and often occur as small patches in scrub and light wood complexes. Their species composition mainly includes three species: *Stipa lessingiana, St. capillata, St. stenophylla.*

The fauna of the steppe habitats includes such small mammals as Apodemus fulvipectus, Crocidura gueldenstaedti, Erinaceus concolor, Lepus europaeus, Microtus socialis, Mus macedonicus, Mus musculus, Pipistrellus kuhli, Pipistrellus pipistrellus, Meriones libycus, Myotis blithi, Rhinolophus ferrumequinum, R. hipposideros. These species also occur in other habitats of the area. All large mammals present in the zone use steppe habitats. For gazelles steppes are principle habitats in addition to semi-deserts.

Shibliaks are widely distributed in dry gullies, depressions, northern slopes of quests, etc. *Paliureta-typus shibljak* and *Astragaleta typus phrygana* are major types of scrub found here. The area is rich in small mammals and reptilia (for more details please see above Alazani River Basin part).

North Sub-Tropical Arid Landscapes are mostly distributed in the Eldar lowland. Flat lowlands, and rarely wavy and terraced plains made of Quaternary deposits prevail here. In terms of their origin, they represent alluvial, delta, alluvial-proluvial and marine abrasive-accumulative plains and lowlands. In some places, there are sections with hilly arid-denudative relief. The climate is sub-tropical, arid, moderately and slightly continental. Natural landscapes with fragrant-absinthe, saltine desert and semi-desert vegetation on grey and grey-brown soils dominate here.

Semi-deserts are met only on Eldar Lowland in Dedoplistskaro municipalities. They are composed of formations dominated by *Artemisia fragrans.* Other important components of these formations include: *Salsola ericoides, Salsola dendroides, Salsola nodulosa, Gamanthus pilosus, Suaeda microphylla, Perosimonia brachiata, Poa bulbosa, Bromus japonicus, Eremopyrum orientale, Allyssum desertorum, Helianthemum salicifolium, Tamarix ramosissima*, etc. Most important formations and associations of semideserts:1) *Artemisietum-Salsolosum nodulosae*; 2) *Artemisietum-salsolosum ericoidis*; 3) *Artemisietum-ephemerosum* I. *Artemisieta, A. fragrans*; 4) *Artemisietum-Salsolosum ericoidis – Tamaricosum*; 5) *Salsoletum-Artemisioso-ephemerosum*; 6) *Salsoletum – Kalisdioso*; 7) *Salsoletum – Anabasiosum* II. *Salsoleta, S. dendroides*; 8) *Salsoletum – Tamaricosum*; 9) *Salsoletum – ephemerosum*; 10) *Salsoletum – Artemisioso – ephemerosum* III. *Salsoleta, S. nodulosa*; 11) *Salsoletum-Petrosimonioso-Gamanthosum*; 12) *Artemisietum-Bothriochloosum*; 13) *Artemisietum-Bothriochlooso-varioherbosum*; IV. *Bothriochloeto-Artemisieta, A.fragrans*; 14) *Artemisietum-Bothriochlooso-Stiposum.*

Typical semi-desert fauna includes reptiles such as Mediteraniean tortose, Lebetine viper, etc.; from birds, little bustard (*Tetrax tetrax*), that winters there in large numbers. In the past great bustards (*Otis tarda*) were also present. Quails (*Coturnix coturnix*) are also known to winter in semidesert habitats of the zone, while elsewhere in Georgia the quail is a breeding bird. Semideserts are also very important staging sites for migrating Demoiselle crane (*Anthropoides virgo*). Thirteen species of small mammals have been identified in semideserts: *Allactaga elater, Apodemus fulvipectus, Erinaceus concolor, Lepus europaeus, Meriones libycus, Microtus socialis, Mus macedonicus, Myotis blithi, Myotis mystacinus, Pipistrellus kuhli, Pipistrellus pipistrellus, Rhinolophus ferrumequinum, Rhinolophus hipposideros*. Two of them, *Allactaga*, *elatior* and *Suncus etruscus* are associated exclusively with semideserts. As part of the large habitat semideserts are inhabited by most of the large mammals (except red deer) present in the zone, which use semideserts at various stages of their daily or seasonal activity. Semideserts are a primary habitat of the goitered gazelle.

Vashlovani, Chachuna and Mariamjvari Protected Areas are located within the Iori River Basin. Vashlovani PA is shared by both Alazani and Iori River Basins and it is described in detail above in Alazani river basin part (for more details please refer to the map of the Protected Areas of the Iori River Basin, figure 7, annex 2).

Chachuna Managed Nature Reserve with a total area of 5,200 ha is located in Kiziki. Geologically Chachuna Managed Nature Reserve belongs to the Transcaucasian intermountain region, covers the Molassic zone of its eastern hollow within the intermountain depression of the Mtkvari River and is presented with Molassic sediments composed of find sands, sandstones, clay with the layers of volcanic ash and gravelites. Part of the Managed Nature Reserve is constructed with limestone conglomerates. Near the Managed Nature Reserve the limestone sources for flux and lime are observed, as well as the outcrops of limestone of bitumen composition and the bitumen deposits presented as small lakes.

The relief of the Managed Nature Reserve is not homogeneous. Barrow, clay hills, steep slopes, terraces and dry gorges are interchangeable with each other and create specific, quite beautiful landscape. The Iori River creates a marsh with the area of 24 hectares in the territory of the Managed Nature Reserve. Chachuna is characterized with a warm continental, mild climate. Average temperature in January is - 2.5^0, and in July the average temperature is + 22^0 in the shadow. Dark brown, alluvial, black soils and alkali soils are characteristic to the Managed Nature Reserve.

Chachuna is very rich in flora. Along the Iori River the floodplain forest is growing, and its adjacent hills and terraces are covered with fragments of arid, light forests, semi-desert and steppe plants of different species. The fauna is also diverse. Among insects the grasshoppers are found in great amount. Sun spiders and scorpions can be found there as well. Among reptiles the Greek Tortoise *(Tesdudo graeca)* and the most poisonous snake of our fauna – Levantine viper *(Macrovipera lebetina)* - are also found there. There are 82 species of birds in the Managed Nature Reserve and 10 out of them are included in the Red List of Georgia. There are also many Wood-pigeons, Turtle-doves, Sparrowhawks, Goshawks, Magpies, Chukars and Imperial eagles there. Griffon Vultures and Egyptian Vultures nest in the holes of the cliffs of limestone origin in Chachuna, while the Cinereous Vultures do so in juniper trees. Chachuna is important with the population of the very beautiful bird – Black Francolin. Among mammals several species of rodents, jackal, Red fox *(Vulpes vulpes),* hare *(Lepus europaeus)*, jungle cat *(Felis chaus)*, lynx *(Lynx lynx)*, badger *(Meles meles)* and Wild boar *(Sus scropha)*inhabit Chachuna. Scientists hope that few Striped hyenas *(Hyaena hyaena).*still survive in the Managed Nature Reserve.

Korughi Managed Nature Reserve (2068 ha) is located in Kakheti in the densely populated municipalities. Geologically, the Korughi Managed Nature Reserve is included in the Trans-Caucasian intermountain region and covers its eastern sinking Molassic zone; it is constructed mainly by marine Molassic sediments of Middle Miocene (Tarhan, Chokrac, Karagan, Concki), which are presented by clays, sandstones, sometimes by basalt conglomerates, marls, oolitic sandy limestones. Minerals are not found on the territory of the Managed Nature Reserve.

Mariamjvari Strict Nature Reserve is located on the southern slopes of Tsivgombori range, at a distance of 60 km from Tbilisi nearby the Antoki village of Sagarejo Municipalities (1040 ha). It is located at the altitude of 700-800m – 1300-1400 m. The local climate is not homogenous. The lower zones are characterized with moderate warm climate; the central zone – with moderate climate and the upper zone – with cold climate. The entire Strict Nature Reserve represents the forest moderate cool climate region. The annual amount of atmospheric precipitation is 744 mm. Main objective of establishing the Mariamjvari Strict Nature Reserve was protection of the Caucasian relict – Caucasian pine (Pinus kochiana) and carry out the scientific researches on it.

90 % of the Mariamjvari Strict Nature Reserve is covered with forest. Pine forests can be found both on the southern and northern slopes of Tsivgombory range. Relatively larger pine groves are located in the upper parts of Giorgitsminda, Antoki, and Mariamjvari and Tokhliauri gorges. Pure pine groves and mixed forest with deciduous plants can be found in the Strict Nature Reserve. Deciduous forests generally are represented by Oriental beech (Fagus orientalis), Georgian oak (Quercus iberica)and hornbeam (Carpinus caucasica). Alder groves (Alnus barbata) can be found in some places. Underbrush is rich in cornel, medlar, hawthorn, nut and blackberry. Approximately 50 species of trees and shrubs are widespread in the Mariamjvari Strict Nature Reserve.

Following mammals are found in the Strict Nature Reserve: Roe deer (Capreolus capreolus), Brown bear (Ursus arctos), Pine marten (Martes meles), wild cat(Felis silvestris), badger (Meles meles), Red fox (Vulpes vulpes), hare (Lepus europaeus)and Caucasian squirrel (Sciurus anomalis). 34 species of birds can be found in the Strict Nature Reserve; among them the following can be distinguished: Chafffinch, Blackbird, Wren, Common Wood-pigeon, Hoopoe, Cuckoo, Black Kite, Tawny Owl, Green Woodpecker, Sparrowhawk, et al.

Fragmented patches of floodplain forests are found on the banks of the Iori River in Korughi Managed Nature Reserve. Willow, Floodplain aspen (Populus hybrida), Black poplar (Populus nigra), alder (Alnus barbata), Floodplain oak (Quercus pedunculiflora), and some other trees compose these forests. Christ's thorn, Sea-buckthorn, barberry, narrow leaf doleaster, liana, eastern clematis, climber, Silk vine, etc. grow in the underbrush. The floodplain forest is bordered by steppe vegetation, mainly by beard grasses.

Mariamjvari Strict Nature Reserve is an abundant with vineyards and grape types. Since the ancient times, the population of Kakheti was engaged in farming, namely in viticulture. The ethnographic culture of local people preserved the polyphonic folk songs and old rituals dedicated to grape-vine.

Rioni River Basin

Landscapes of the Rioni Basin vary from Alpine and sub-alpine high mountain, middle-low mountain and, foot-hill to lowland landscapes (for more details please refer to the map of the land cover of Georgia, figure 1, annex 2).

Caucasian Sub-nival, High-Mountain Alpine Shrubbery-Meadow and Sub-alpine Landscapes are spread on the Main Caucasus Range where River Rioni originates in upper Racha. High locations of the landscapes are mostly determined by thermal conditions. An important role is also played by the continental nature and humidity of the climate. Here alpine landscapes are distributed at the altitudes between 2,400-3,000 m. The climate is High Mountain severe. Alpine meadows are spread here. Soils are mostly mountainous-meadow and peaty; Rendzins prevail in the karst regions. Similar to sub-alpine landscapes, alpine landscapes are composed of various mountain rocks. However, crystal and metamorphic rocks and Jurassic schist prevail on the Great Caucasus; Limestone appears from place to place. Due to the diverse geological structure, the relief is also characterized by high variety. Both volcanic and karst reliefs are found here.

The entire territory of the Racha-Lechkhumi and Lower Svaneti belongs to the Kolkhetian (Same as Colchic and Colchic) botanical-geographical region, specifically, to the Black Sea East Basin. Here Kolkhic plant cover is widely spread and is characterize by well-defined vertical zonality. Namely broad-leafed forest with an increase of altitude transforms into beerch-pine trees, sub-alpine and alpine meadows and finally to subnival vegetation cover. Here the Tertiary Colchic relics and endems are met as well as species specific to the east

Georgia continental climate (oak, pine, etc.). In total, there are 1,200 species in the region, of which 272 are Caucasus and Georgian endems. In addition, there are 33 species of endems of limestone ecotones. Of the total area 46.6% is occupied by forests. Here all types of coniferous trees are spread at the altitude of 1,100-1,600 m. Broad-leafed forests are met at the height of 1,000-1,100m. Beech dark forests are spread at the altitude of 1,100 m and higher as both pure beech growths or as mixed growths with coniferous trees.

Overall, in the region nival-glacial and sub-nival (3,300-3,500m above sea level), high-mountainous alpine (2,500-2,600m above sea level) and high mountain sub-alpine meadow (2,000m above sea level), high mountain, Caucasus middle coniferous, Colchic middle mountain (1,000-1,200m above sea level) low mountain, foothill and lowland (600-800 m above sea level) landscapes and vegetation cover are met.

Among the plants found in the region, 164 species are endemic to Caucasus, 26 –endemic to Georgia and 5 – endemic to Racha-Lechkhumi – Kvemo Svaneti flora.

Law mountain forests are dominated with oak (Quercus iberica; Quercus hartvissiana), Hornbeam (Carpinus caucasica), chestnut (Castanea sativa). Beech (Fagus orientalis), pine (Pinus sosnovski), field maple (Acer campestre), ash (Fraxinus excelsior), lime (Tilia caucasica), elm (Ulmus carpinifolia), alder (Alnus barbata) are also met. Sub forest is presented by Hazelnut (Corylus colchica), hawthorn (Crataegus kyrtostilla), boxwood (Buxus colchica), yew (Taxus baccata), medlar (Mespilus germanica), rhododendron (Rhododendron luteum), bladdernut (Staphylea colchica), elderberry (Sambucus nigra), barberry (Berberis vulgaris). Forests are rich in wild fruits pear (Pyrus caucasica), dogwood (Cornus mas), rowan (Sorbus torminalis), apple (Malus orientalis), viburnum (Viburnum oulus), whortleberry (Vaccinium artostraphylos) etc.

Middle mountain forest is presented by oriental beech (Fagus orientalis) with hornbeam (Carpinus caucasica), chestnut (Castanea sativa), fir (Abies nordmanniana), spruce (Picea orientalis), mulberry (Morus alba), common aspen (Populus tremula), acacia (Acacia delbata). Sub-forest is presented with blackberries (Rubus caucasicus, Rubus haceralicus), bilberry (Vaccinium arctostaphylos), hazels (C. avellana, C. iberica), cherry laurel (Laurocerasus officinalis), Black Sea holly (Ilex colchica) etc. On the altitude of 1400- 1500 m above sea level forests are formed by the following three species: oriental beech (Fagus orientalis), Nordmann fir (Abies nordmanniana) and oriental spruce (Picea orientalis). Evergreen sub-forest here is presented with holly (Ilex colchica), rhododendron (Rhododendron ponticum), cherry laurel (Laurocerasus officinalis) etc. On the elevation of 1800-1900 m high mountain forests are met with oriental beech (Fagus orientalis), maples (Acer trautvetterii, Acer psevdoplatinus); willow (Salix caprea), mountain-ashes (Sorbus cracea, Sorbus subfusca, Sorbus colchica) etc.

Sub-alpine and alpine ecosystems are presented here at 2200-3300 m above sea level by birch (Betula pendula, Betula litwinowii), willow (Salix caprea), beech (Fagus orientalis), maple (Acer trautvetterii), rhododendron (Rhododendron caucasica), bilberries (Vaccinium Myrtillus, Vaccinium vitis-ideae).

In Svaneti forest ecosystem on 450 -1300 m above sea level is presented with mixed broadleaf forests composed of beech (Fagus orientalis), oak (Quercus iberica) and Chestnut (Castanea sativa) and coniferous and mixed coniferous and broadleaf forests with oriental spruce (Picea orientalis), Nordmann fir (Abies nordmanniana) oriental beech (Fagus orientalis). Among the species of plants found in the Planned Protected Areas the following are included in the Red List of Georgia are yew tree (Taxus baccata), chestnut (Castanea sativa), Imeretian oak (Quercus imeretina), Hophornbeam (Ostrya carpinifolia).

Fauna of the Racha-Lechkhumi – Kveda Svaneti is poorly researched. According to the existing data in 51 species of mammals and 152 species of birds can be found. From the species of mammal included in the Red List of Georgian here inhabit: Chamois (Rupicapra rupicapra), Brown Bear (Ursus arctos), Linx (Lynx lynx) etc. The species of tur found here the East Caucasian Tur (Capra cylindricornis) and West Caucasian Tur (Capra caucasica) are endemic to Caucasus. Among birds of the Protected Areas following representatives of ornithofauna are included in the Red List of Georgia: Bearded Vulture (Gypaetus barbatus), Griffon Vulture (Gyps fulvus), Golden Eagle (Aquila crysaetus), Caucasian Black Grouse (Tetrao mlokosiewiczi), et al.

Endemic species of the region are: Capra cylindricornis, Capra caucasica, relic species - Buxus colchica, Taxus baccata, Laurocerasus officinalis, Ilex colchica, Quercus iberica, Abies nordmanniana, Picea orientalis and, species of the Red List of Georgia – Taxus baccata, Castanea sativa, Quercus imeretina, Ostrya carpinifolia, Rupicapra rupicapra, Ursus arctos, Lynx lynx, Gypaetus barbatus, Gyps fulvus, Aquila crysaetus, Tetrao mlokosiewiczi.

Colchic Middle-Mountain Forest Landscapes are spread in the mountainous areas at 400-600 – 1,200-1,400 m above sea level and along with the Racha-Lechkhumi are met in Imereti region. In some places, (e.g. southern Imereti), they wedge out low mountain forest landscapes and come close to Kolkhic foot-hill and hilly landscapes, from place to place breaking a zone of middle mountain beech-dark coniferous forests, joining immediately uphill-forests and even high mountain sub-alpine landscapes of the Kolchida. The greater part of these landscapes is composed of porphyries, Jurassic schist and Paleocene volcanic sedimentary rocks. An erosive-denudated relief with slopes of high and medium steepness is characteristic of these regions. Natural landscapes with beech forests and evergreen under-woods grown on dark brown (in karst region – humus consisting carbonate) soils prevail within the Kolchic Middle Mountain Forest Landscapes. Drier areas such as crests or ranges of southern macro-slope are occupied by beech-hornbeam herbaceous forest grown on dark brown (or rendzin) soils. Transitional location is occupied by beech forests with deciduous shrubs or herbaceous tier grown on dark brown soils (or rendzin). In the South, the morphological structure of landscapes becomes simpler. Beech-chestnut forests, with thick evergreen under-woods are found there. Populated areas, orchards and vegetable gardens emerge only on bottoms of wide terraced gorges.

Middle-Mountain Dark Coniferous Forest Landscapes are characterized by the optimum combination of heat and moisture. They are distributed in the western part of the Caucasus. The relief is erosive-denudate and karst. The erosive-denudate relief is characterized by slopes of medium and high steepness, composed of various geological deposits: crystal and metamorphic rocks of Paleozoic, Jurassic slates and porphyries, paleogenic and neogenic sandstones. On the Ajara-Imereti and Trialeti ranges widely-spread are the volcanic sedimentary rocks of paleogenic period. It is noteworthy, that the high diversity in geological structure is not reflected in relief, vegetation and even soils. The climate is cold moderate, humid, littoral and weakly continental. There is no deficit of humidity. The snow cover is stable from the end of October-November through April. Beech-dark coniferous forest with Colchic under-woods, grown on brown forest acid and podsolized soils are met only in the are met here. The landscapes are only slightly changed by man. The plots with settlements, vegetable gardens and small arable lands are mostly met on the bottoms of broader terraced parts of river gorges.

Colchic Low-Mountain (Foot-hill) Forest Landscapes infringe the Colchic foot-hills as a relatively narrow (5-10km) strip, widening up to 10-12 km in Upper Imereti and Guria. Mountainous-valley landscapes of Racha-

Lechkhumi and also belong to this sub-type of landscapes. In the Racha-lechkumi depression they are distributed as high as 900m above sea level. The relief and geological structures are distinguished by high diversity. Karst relief is widely spread here. Slopes of high and medium steepness with erosive-denudate relief composed of paleogenic volcanic-sedimentary rocks prevail on the north macro-slope of the Ajara-Imeretian range. Various mountain rocks represent the Racha-Lechkhumi depression. The major part of the depression is composed of terrigenic and carbonate rocks with erosive-accumulative and karst relief. The climate is transitional from humid sub-tropical to thermo-moderate. Hemi-xeric oak herbaceous forests on yellow-dark brown and brown forests soils prevail on the steep southern macro-slope, composed of limestone. Poly-dominant forests with thick evergreen under-woods grown on dark brown soils are dominant in shady gorges. In upper parts of gorges and on the northern macro-slope, they are replaced by beech forests with evergreen under-woods. Natural landscapes composed of hornbeam and hornbeam-beech forests with leaf-shedding under-woods grown on dark brown forest soils occupy intermediary habitats. The south Imereti foothills join with the northern slopes of the Ajara-Imereti ridge, and the Guria and Imereti hills. Humidity is lower and the seasonal distribution of precipitation is more Mediterranean. There are fragments of secondary *Carpinus* spp. woodland, mixed broad-leaved woodland and *Q. imeretina* (Red List of Georgia, **RDB**) and *Zelkova carpinifolia* (Red List of Georgia, **RDB** Georgia and the former **USSR**) forests. There are large areas of forest preserved on the left bank of the Rioni and in Ajameti Reserve. In mountain depressions, lands are extensively cultivated. Natural-agrarian landscapes with vegetable gardens, tobacco plantations are widely spread here.

Kolkheti (Same as Kolkhida) Lowland’s relief is very simple: it is characterized by almost ideally flat surface, which is slightly inclined toward the sea. Within the coastal zone relief forms of marine-accumulative origin are developed. Along the whole coast line coastal sand ridges and dune ridges (100-300m width and 1.5-3.5 height) are spread. In humid areas of the central part of the Kolkhida lowland, natural landscapes composed of Quaternary alluvial deposits with sphagnum-reed marshes and marshy alder-thickets on peat bog and mineral- bog soils are distributed. Overall, red and yellow soils characteristic of sub-tropics prevail in Kolchic landscapes. A comparatively low marshy part of the Kolchic lowland with its depression-accumulative plain relief and sphagnum-reed marshes is of special mention. Swamp alder forests and unique lowland peat bogs are found here (in the lower reaches of the Rioni River in the Kolkhida Lowlands around Paliastomi Lake). The Kolkhida lowlands are considerably changed by human activities and natural-agrarian landscapes with maize crops, tea, and more rarely citrus occupy drained lands.

There are following Protected Areas in the Rioni Basin: Borjomi-Kharagauli National Park, Ajameti Manager Reserve and Imereti Caves Protected Areas with Sataplia Strict Natural Reserve located in Imereti Region, Katsoburi Managed Natural Reserve and Kolkheti National Park located in Samegrelo-Zemo Svaneti region. In addition, there is a planned Central Caucasus Protected Area to cover Racha-Lechkhumi and Kvemo Svaneti region (for more details please refer to the maps of the protected areas of Georgia, figure 2, annex 2 and the Rioni Basin, figure 8, annex 2).

Total area of ***the Central Caucasus planned PA*** makes up 229, 532 ha and is stretched from the mountain Ailama (4546m) and to the mountain Zekara (3828m) at an altitude of 500-4,600m a.s.l. It comprises following categories of PAs: 1. Racha-Lechkhumi and Kvemo Svaneti National Park of high ecological value with promising prospects of ecotourism development in combination with biodiversity and ecosystems conservation, ecological education and sustainable utilization of natural resources; 2. twelve natural monuments of Sasashi forest, Skhvava Ice Cave, Kvabtkari, Glola Boulders, Shareula Gorge Jonoula

Boulders; Saelio Range-Sakudali and Khidiari areas; Chvardia Narrows, Sairme Rocks, Lajanuri Canyon, Samchikia and Muri Kidekari areas. These PAs are unique in terms of geology, geomorphology and vegetation cover developed on karst and limestone substrates; 4. managed natural reserves of Askhi plateau, Khvamli massif, Shaori-Khikhati area and, Sadmeli area. These landscapes are prominent for their karst relief, including caves, plateau-like sections, limestone hillsides and deep canyons; 5. Racha-Lechkhumi and Lower Svaneti protected landscape, with high visual-aesthetic and unique ecological and historic-cultural values. The landscape is to be established on the northern, and partly on the southern slopes of the Racha range and, Zeskho-Koruldashi section of upper course of the R. Tskhenistskali watershed. Approximate area of the landscape is 63,294 ha (for more details please refer to the map of the Central Caucasus Planned PAs, figure 11, annex 2)

Borjomi-Kharagauli Protected Areas consists of National Park (BNP) and the Natural Reserve. The BNP is the first National Park established in 1995 and officially opened in 2001. In 2007 the Borjomi-Kharagauli National Park became a member of European network of Protected Areas – Pan Park. The Park is located in the territories of Tori, Imereti and Samtskhe. Total area is about 61235 ha (for more details please refer to the map of the Borjomi-Kharagauli National Park, figure 9, annex 2).

Geologically, the Borjomi-Kharagauli National Park belongs to the fold system of the Lesser Caucasus Mountains and covers the central subzone of Adjara-Trialeti fold zone. The region is mainly constructed with so called Borjomi flysch sediments of lower Eocene: marl clays, marls, limestone sandstones and marl limestones; its construction also includes the sediments of Oligocene and Neogene ages and volcanic sediment formations.

Forests of the Kharagauli part of the Borjomi-Kharagauli National Park are presented by dark coniferous, deciduous and mixed forests. Mixed deciduous forests are mainly consisted of chestnut trees *(Castanea sativa)*, beech trees *(Fagus orientalis)*, hornbeams *(Carpinus orientalis)*, Caucasian lime *(Tilia begoniifolia)*, Colchis oak *(Quercus hartwissiana)*, Caucasian rhododendron *(Rhododendron caucasica)*and ash tree *(Fraxinus excelsior)*. With changing the altitude a deciduous beech forest is replaced by mixed deciduous forests with subforest of colchis type, and further – the hornbeam groves, beech-chestnut groves, spruce-groves and silver fir-groves. In the upper zones of the forest belt the dark coniferous forests of spruce-groves and silver fir-groves dominate, which are composed of Oriental spruce *(Picea orientalis),* Nordmann Fir *(Abies nordmanniana)* and pine *(Pinus sosnowskyi).* In subalpine belt the subalpine forests and bushes, subalpine high grasses and meadows are spread.

Following Georgia's Red Data Book rare and endemic species are found in the park: chestnut *(Castanea sativa),* Colchic oak *(Quercus hartwissiana)*, yew *(Taxus baccata),* Steven's peony *(Paeonia steveniana)* and Vinogradov's iris *(Iridodictyum winogradowii)*.

The fauna of Borjomi-Kharagauli is diverse. Among large carnivores one can find Gray wolf (Canis lupus), lynx *(Lynx lynx)* and Brown bear *(Ursus arctos).* Among the hoofed animals Roe deer *(Capreolus capreolus)* and Wild boar *(Sus scrofa)* can be found. Borjomi gorge was always famous for its population of Caucasian Red deer *(Cervus elaphus)*. The number of deers reached to 140 in the Borjomi-Kharagauli National Park. Bezoar goats *(Capra aegagrus)* lived on local rocks since the ancient times, though nowadays only the reintroduced Bezoar goats live there, which were brought from neighboring Armenia by support of Borjomi-Kharagauli Administration and World Wild Foundation (WWF). Most of the large mammals of the Park are included in the Red List of Georgia. Among small mammals several species of mice, dormouse, weasel, Pine marten, Stone marten, and Caucasian squirrel are met. Red fox *(Vulpes vulpes)*and hare *(Lepus europaeus)* are widely spread in the part. Among reptiles several species of lizards and snakes cen be found in the National Park. Among them the Caucasian agama (*Laudakia caucasica*) andGreek Tortoise (*Testudo graeca*) are distinguished. Among native birds of Borjomi-Kharagauli National Park the following rare species are distinguished: Golden eagle *(Aquila chrysaetos)*, Griffon vulture *(Gyps fulvus),*Black vulture *(Aegypius monachus)* andCaucasian Black grouse *(Tetrao mlokosiewiczi).*

Ajameti Managed Nature Reserve is located at 265 km distance from Tbilisi and at 15 km distance from Kutaisi, on the Rioni plain and consists of three borrows: Ajameti, Vartsikhe and Sviri. Total area of the Managed Nature Reserve is 4,848 ha, out of which 4,738 ha is covered with forest. The Managed Nature Reserve is located at a distance of one and a half km from a Vartsikhe borough. The terrirory of the Managed Nature Reserve is stretched for about 13 km from the east to the west. Its average width is 3 km and in the widest area the width reaches 5 km. The terrirory of the Managed Nature Reserve is constructed with the sediments of the Miocene, Oligocene and Eocene age. Here the solid and glutinous clay of Quaternary age of lacustrine-alluvial origin can be found. The reserve was founded in 1946 with an aim to preserve the rare relicts – Imeretian oak (*Quercus imeretina*) and Zelkova tree *(Zelkova carpinifolia)*. The unique feature of the Ajameti is that in the Kolkheti lowland it is almost the only place, where the subtropic mixed forests have been preserved in their primary conditions. Old Imeretian oak and Zelkova groves are well-preserved in their primary conditions. Some of the trees are more than 250 years old, and the century-old oaks are very frequent. Oak forest covers 4,723 ha, hornbeam *(Carpinus)* – 93 ha, oriental hornbeam *(Carpinus orientalis)* – 23 ha. The reserve flora is presented by 60 species. Here the oriental hornbeam and maple *(Acer)* are found. The sub-forest is thin and presented by Pontic rhododendron *(Rhododendron ponticum)*, common medlar*(Mespilus germanica)*, Dog rose *(Rosa canina)* and hawthorn *(Crataegus)*. Following species of the Red List of Georgia can be found in the Ajameti Protected Areas: Pastuchov's Ivy *(Hedera pastuchowii)*, Bearnut-tree *(Corylus iberica)*, Wych elm *(Ulmus foliacea)*, elm *(Ulmus elliptica)*,Caucasian wingnut *(Pterocarya pterocarpa)*, walnuts *(Juglans), et al.* Imeretian oak (*Quercus imeretina*) and Zelkova tree *(Zelkova carpinifolia)* are the rare species of Tertiary period.

Ajameti is poor in animal and bird species. Among mammals one can meet a hare, Red fox, jackals, squirrel, weasel, dormouse and badger here. The largest animal of Ajameti is a roe-deer. The following animals of the Red List of Georgia can be found in the Managed Nature Reserve: Leisler's bat *(**Nyctalus leisleri**),*Caucasian squirrel*(Sciurus anomalus),*common dormouse *(Muscardinus avellanarius)*, Forest dormouse*(Dryomys nitedula)* and Caucasian otter(*Lutra lutra* ***meridionalis***). More than 60 species of birds are registered in the Ajameti Managed Nature Reserve. Out of them only twenty-one nest in the oak forest, the others appear in Ajameti while migrating or spending winter there. Among amphibians Eurasian marsh frog *(Pelophylax ridibundus)*, Caucasian toad*(Bufo verrucosissimus)*and Green toad *(Bufo viridis)* can be found here, and among reptiles –Dice snake *(Natrix tessellata)*and Grass snake *(Natrix natrix)*.

Complex of Imereti caves is located at a distance of 10 km from the town of Kutaisi in the sub-tropical zone. The area of the complex of Imereti caves is about 354 hectares. The Sataplia itself is located at 500 m above sea level. Karst caves can be found in this territory. Climate of Sataplia is subtropical. Amount of annual precipitation reaches 1900 mm. Average air temperature in January is $+4^0$C and in August – $+25^0$C.

98 % of its territory is covered with subtropical young forest of Colchic type ***in Sataplia Strict Nature Reserve***. In the forest beech groves with box-tree underbrush and hornbeam groves with Oriental hornbeam underbrush are prevalent. Among coniferous plants natural yew trees (*Taxus baccata*) can be found here. 67 species of wood plants are described in the territory of the Strict Nature Reserve, out of which 30 are tree species and 37 – bush species; among them 59 species are deciduous and 8 – evergreen. Nearly half of wood plants are relict. There are relicts of the Tertiary period among them, such as: Caucasian hornbeam (*Carpinus caucasica*), Georgian oak (*Quercus iberica*), Oriental beech (*Fagus orientalis*), Sweet Chestnut (*Castanea sativa*), Imeretian buckthorn (*Rhamnus imeretina*), alder (*Alnus barbata*), European bladdernut (*Staphylea pinnata*), Colchic box-tree (*Buxus colchica*), *et al.* Among the elements of Colchic forests, 8 species are widespread in the Strict Nature reserve, such as: Colchic oak, Imeretian buckthorn, rhododendron, Butcher's broom, Southern Butcher's broom, European bladdernut, Caucasian Whortleberry and Colchic box-tree and among the elements of Poltava flora – box-tree, Colchic climber, rhododendron, *et al.* 9 wood plants species of Georgia's Red List are also widespread in the Strict Nature Reserve, of which 3 are endemic to Caucasus and one – to Georgia.

Sataplia Strict Nature Reserve is inhabited by 12 species of mammals, 5 species of reptiles, 4 species of amphibians and 30 species of birds. Among large mammals the following can be found here: jackal (*Canis aureus*), badger (*Meles meles*), Pine marten (*Martes martes*), Caucasian squirrel (*Sciurus vulgaris*), hare (*Lepus europeus*) and Red fox (*Vulpes vulpes*) and rarely, Grey wolf (*Canis lupus*) and Roe deer (*Capreolus capreolus*). Multicolored birds complete the beautiful view of Colchic forest. The Strict Nature reserve is a kingdom of swallows, Chiffchaffs, Blackbirds and Jays. Hoopoe, quail and woodcock often visit the Strict Nature Reserve.

Katsoburi Managed Nature Reserve was established in 1996 and its total area is 295 hectares. It is located at a distance of 300 km from Tbilisi, in the southwestern part of Abasha Municipality. The territory of the Managed Nature Reserve is mainly flat – its maximum height does not exceed 40 m above sea level. Alluvial clay-sands are widespread here, while the humus clay-sand soils can be found in small areas.The Rioni River flows through the territory of Katsoburi Managed Nature Reserve. Besides, the underground waters are an important part of hydrographic network of the Managed Nature Reserve, the levels of which in some places come near to the ground surface and create marshes. The climate of Kolkheti lowland is characteristic for the Katsoburi Managed Nature Reserve –the mean annual minimum temperature of January is - 4^{o}C, and maximum – is +22^{o}C. The Total amount of annual precipitation is 1757mm.

In the past there were real Kolchis forests in the protected areas. Only the modified remainders of the forests are preserved nowadays. At present the flora in Katsoburi Managed Nature Reserve mainly consists of alder groves, were among the forest-making species there can be found wingnut *(Pterocarya pterocarpa),* ash tree *(Fraxinus excelsior), et al*. On the areas of the Managed Nature Reserve covered with forest one can also find Mimosa *(Acacia dealbata)*, alder tree *(Alnus barbata)*, Goat willow *(Salix caprea),* pear(*Pyrus caucasica)*, wild plum *(Prunus divaricata)*, oleaster *(Elaeagnus angustifolia)* and Indigo bush *(Amorpha fruticosa)*.

The Katsoburi Managed Nature Reserve is poor in species of fauna. Among hoofed animals herre can be found the Wild boar *(Sus scrofa)* and Roe deer *(Capreolus capreolus)*, and among beasts of prey – wolf *(Canis lupus)*, hare *(Lepus europiacus)*, jackal *(Canis aureus)*, badger *(Meles meles)*, Wild cat *(Felis silvestris)* and otter *(Lutra lutra)*. Among birds only several species can be found in the Managed Reserve, such as: Wood pigeon *(Columba palumbus)*, Grey heron *(Ardea cinerea)*, Chaffinch *(Fringilla coelebs)*, Mallard *(Anas plathyrynchos)*, Ferruginous duck (*Aythya nyroca)*, Sparrowhawk *(Accipiter nisus),* Goshawk *(Accipiter gentilis), et al*. Existence of population of Colchis pheasant *(Phasianus colchicus)* can be noted as well.

Kolkheti National Park covers the eastern zone of the Black Sea coast and the basin of the Paliastomi Lake. The Park is established with the purpose of protecting wetland ecosystems. The Kolkheti lowland became the subject of international interest in 1996, when Georgia became a party of the Ramsar Convention on "Wetlands of International Importance Especially as Waterfowl Habitat". Since 2000 the Kolkheti national park has began full-scale operations. The park is not a monolith formation and consists of separate territories – the municipalitiess. The Park is divided into the following natural geographical municipalitiess: Anaklia-Churia (between the coastline sections of gorges of the Churia River and the Khobistskali River. This part does not belong to the Rioni river basin), Nabada (between the western sections of the gorges of the Khobistskali River and the Rioni River) and Imnati (between the western sections of the gorges of the Rioni River and the Supsa River). At some places of the park wetlands are very well preserved. Apart from this, the national park includes the sea water area located between the estuaries of the rivers of Rioni and Churia. The area of Anaklia-Churia is 13,713 ha; Nabada part occupies 10,697 ha, and the Imnati part – 19,903 ha. In total, the terrestrial area of the National Park is 28,571 ha, and the aquatic area – 15,742 ha. The sections of the National Park are located in the territories of five administration territories - Zugdidi, Khobi, Senaki, Abasha and Lanchkhuti municipalities and are a part of two historical regions of Georgia – Samegrelo and Guria (for more details please refer the map of the Kolkheti national park, figure 10, annex 2).

The Paliastomi Lake was a gulf of the Black Sea several thousand years ago. The sand dunes displaced along the coast by the sea waves over the centuries isolated the lagoon from the saline water of the sea, and the pure water flowing into the lake from the Pichora River made the water fresh and created the ideal vital environment for many species of fish in the m3 deep natural reservoir abundant in water invertebrates and plankton.

Kolkheti mires are important for their relic origin. This lowland is a remainder of the tropical and subtropical landscapes preserved till today (Colchic refugium), which were stretched along entire Eurasian continent as continuous belt in Cenozoic age about 10 million years ago. In Kolkheti such plants are preserved that are nowadays specific only to swampy ecosystems of tundra and taiga of the far North.

Boreal species alien to Kolkheti grow also in the marsh – sphagnum mosses *(Spagnum imbricatum, Sp. palustre, Sp. acutiflium)*, round-leaved sundew *(Drosera rotundiflora)*, woollyfruit sedge *(Carex lasiocarpa)* and other plants of alpine zone, such as sedge and Pontic rhododendron *(Rhododendron ponticum)*. Swampy and humid forests include: alder trees, Caucasian wingnut, Imeretian oak and Colchis oak with well-developed evergreen underbrush, Colchis ivy, *et al.* In the sandy zone of dunes grow Sea-buckthorn and Jerusalem thorn. Composition of species of algae is diverse.

Kolkheti national park, first of all, is interesting for its plant diversity and richness in endemic and relic species. Different plant communities of the mires, swampy forests and sand dunes located along the coastline, such as: spurge *(Euphorbia)*, eringo *(Eringium coeruleum)*, Colchis sedge *(Carex colchica),* Imeretian cogongrass *(Imperata cylindrica)*, astragalus *(Astragalus caucasicus),* Marsh woundwort *(Stachys palustris)*, catchfly *(Silene)*, Jerusalem thorn *(Paliurus spina-christi)*, hawthorn *(Crataegus)*, Sea-buckthorn *(Hippophae rhamnoides)*, *etc. are* preserved there. Two species: Yellow poppy and Water lily included in the

Red Data Book of Georgia with a status of threaten species are also found here. Following plants: Colchis water-lily *(Nymphaea colchica)* and Yellow water-lily *(Nuphar lutea)*, Colchis water chestnut *(Trapa colchica)* and Lesser duckweed *(Lemna minor)* and, in the peaty mires are spread along the lakes and the marshy rivers in the wetlands. Together with the north tundra species one can find Royal fern *(Osmunda regalis*) and Imeretian sedge *(Molionia litoralis*). Some of the plant species are included in the Red List of Georgia as rare and threatened species, including: Colchis oak *(Quercus hartwissiana)*, Caucasian wingnut *(Pterocarya pterocarpa)*, Colchis box-tree *(Buxus colchica)*, and among other species the following are injured: maple *(Fraxinus exscelsior)*, Georgian oak *(Quercus iberica)* and Alder *(Alnus barbata)*.

In the marsh forests along the peripheral belt of peaty mires and the valleys of the marshy rivers about 9-10 m tall Colchis-Hyrcanic alder groves, rarely mixed with wingnut, Imeretian oak or maple, beech, ash-trees and hornbeam are found. Till present the following species have been preserved there: Box tree, Yellow azalea, Pontic rhododendron, Butcher's broom, ilex, *et al.*

In total, 194 bird species inhabit the Kolkheti National Park. The route of the annual migration of the birds crosses the area. For millions of birds that migrate from the north to the south in fall and from warm countries to their nesting places in spring, uninhabited swamps and marshes are ideal places for having a rest during a long distance migration, and for birds of different species Kolkheti is the place where they spend winter. Among the birds following species can be found: Small water cocks, herons and bright blue kingfisher. Bird watching is possible in October, when the birds of prey fly along the Black Sea coast migrating to the south. Common Buzzards, Black Kites, Common and Lesser Kestrels, Eurasian Hobbies, other falcons, European Honey-Buzzards, White-tailed Eagles, Steppe Eagles and Imperial Eagles soaring in the air at different heights are flying to the south along the coastline. In winter, the groups of ducks, geese, and swans fly here from the north. Besides, following species can be found here: Woodcock, Eurasian curlews with long and hooked beaks, common coots, grebes, White-fronted geese, Mute and Whooper swans, Dalmatian Pelican, Greater Spotted Eagle, *et al.* One can rarely find the pride and beauty of the fauna of Georgia, the beautiful bird – pheasant, about existence of which the world learned from the Greek seamen visiting Colchida long ago.

Among large mammals, inhabiting swampy floodplains, forests and shrubs of Kolkheti following species are found: jackal *(Canis aureus)* and Wild boar *(Sus scrofa)*, Roe deer *(Capreolus capreolus)* and otter *(Lutra lutra).* It is remarkable, that 6 species of the Red List of Georgia can be found here. The marine mammals are presented by 3 species of dolphins, such as: Aphalina – the Bottle-nose Dolphin *(Tursiops truncatus),* White-sided Dolphin *(Lagenorhynchus acutus*) and Herring hog *(Phocoena phocoena).*

Among amphibians inhabitin the Kolkheti National Park, the Common Tree frog and Marsh frog are interesting. Among reptiles the following species are found here: Common Newt *(Triturus vulgaris)* and Banded Newt *(Triturus. vittatus)*, Dice Snake *(Natrix tesselata)*, Aesculapian Snake *(Elaphe longissima)* and pond turtle *(Emys orbicularis)*. Ichtyofauna of the National Park is presented by 88 species, out of which 23 species are transiting, 21 species are freshwater fish and 44 species Black Sea fish. Among the cartilaginous fish the Atlantic sturgeon and beluga can be distinguished, and among the bony fish – the Black Sea salmon, herring, striped mullet, pike, bonito, *et al.* 6 species of fish of the Red List of Georgia is widespread in the water ecosystems of the Kolkheti National Park, such as: beluga *(Huso huso)*, sea sturgeon *(Acipenser sturio)*, Sevruga sturgeon *(Acipenser stelatus),* sea trout *(Salmo fario (truta) morpha)*, Sand goby *(Gobius (Neogobius) fluvatilis)*, roach *(Rutilus frisii)*.

2.1.5. Forest Resources

Alazani-Iori Rver Basins

General. Comprehensive, consistent and current data on forest resources of Georgia per river basins are unavailable. Relatively old data exists per administrative regions and municipalitiess. The latest inventories of some sections of Georgian forests (e.g. Racha-Leckhumi) for individual administrative regions or municipalitiess were conducted in 1995-1996. No national-wide inventory has been carried out in the country since late 80s. Therefore, data on forest resources are outdated. The description of forests according to regions and municipalities are given in the present study. Information for some municipalities is comprehensive, while for others is scarce due to absence of relevant informational and data.

Overall, in Alazani-Iori river basins, forests occupy slopes and foothills of the Greater Caucasus (Tianeti, Akmeta, Telavi, Kvareli and Lagodekhi municipalities), Tsivgombori range (Sagarejo, Telavi, etc) and the banks of the Alazani and Iori Basins (Telavi, Gurjaani, Dedoplistskaro, Sagarejo, etc.) (for more details enclosed see the map of the forest cover of Georgia, figure 12, annex 2, the map of the forest cover of the Alazani river basin, figure 13, annex 2 and the map of the forest cover of the Iori River Basin, figure 15, annex 2).

Akmeta municipality. ***Akhmeta municipality***, is very rich in forest resources. State forest fund makes up 101,386 ha. Of this, strict natural reserve forests make up 14,706 ha, Tuhseti national park forests – 7,886 ha, managed natural reserve forests – 6,771 ha, protected landscape forests – 4,076 ha, green zone – 1,006 ha and, soil protection and water regulation forests – 66,941 ha. Total forested area of the State Forest Fund is 95,046 ha, of which 44,671 ha are mature and old forest groves. Forested area amounts to 43.2%. Total timber resources are estimated at 14,256,900 m3, of which 6,700,700 m3 is mature and old tree timber resources. Latest forest inventories were carried out in 1991-1992 and 1998 years. There are following timber resources in the forests of the municipality: coniferous trees – pine (Pinus hamate), common yew (Taxus baccata), broad-leafed trees – oriental beech (Fagus orientalis), mountain oak (Quercus macranthera), European hornbeam (Carpinus caucasica), sweet chestnut (Castanea sativa), Red-bud maple (Acer trautvettri), Common ash tree (Fraxinus exselior), Smoothleaf Elm (Ulmus carpinifolia), Wild cherry (Cerasus avium), wild pear (Pirus caucasica), Common elder (Alnus barbata), Common Aspen (Populus tremula), Caucasian Linden (Tilia Caucasica), *Ulmus minor*, Ulmus glabra, Juglans regia, Pterocarya pterocarpa, etc. There are also varios shubs spread in Alkmeta forests, including: *Dog rose (Rosa canina)*, Georgian Snow Rose *(Rhododendron caucasicum)*, parmagranat (Punica granatum), Elderberry *(Sambucus nigra),* Common Medlar (*Mespilus germanica)*, Common Hazel *(Corylus avellana),* European barberry *(Berberis vulgaris), Caucasian blackberry (Rubus caucasicus),* European dewberry *(Rubus caesius),* Caucasian Whortleberry (*Vaccinium arctostaphylos),* Hawthorn *or* thornapple *(Crataegus microphylla),* Yellow Azalea (*Rhododendron luteum),* bilberry *(Vaccinium myrtillus),* Bieberstein's currant *(Ribes biebersteinii),* Raspberry *(Rubus idaeus), Ruscus colchicus,* common juniper *(Juniperus depressa), Juniperus pigmala,* golden mock orange *(Philadelphus caucasicus)*, *etc. Among the lianas, following species are spread:* prickly-ivys *(Smilax excelsa),* wild vine *(Vitis silvestris*), Old man's beard *(Clematis vitalba),* Common hop *(Humulus lupulus),* Common Ivy *(Hedera helix),* Silk Vine *(Peripcola graeca). Among grasses* common ladyfern (Athyrium filix femina), ostrich fern (Matteuccia struthiopteris), wood bluegrass (Poa nemoralis), Common Wood-sorrel Oxalis acetosella, wood sanicle (Sanicula evropaea), Common Male Fern (*Dryopteris filix-mas), Sweet* Woodruff (Asperula Odorata), Northern Fescue**,** Festuca montana.

As it was mentioned above in the landscape and biodiversity part 2.1.4, some of the forests of the Akhmeta municipality are represented by pretty large tertiary yew and Zelkova groves, preservation of which became a reason for establishing Batsara-babaneuli protected areas. It is also worth to mention sacred or holly forests present in Tusheti. These are virgin forests with high cultural and biological value (for more details please see the map of the distribution of holly forests in Tusheti, figure 14, annex 2).

Among the fauna species, chamois (Rupicarpa rupicarpa), brown bear (Ursus arctos), The least weasel (Mustela nivalis), rat (Rattus), Southern White-breasted Hedgehog (Erinaceus concolor), steppe field mouse (Apodemus fulvipectus), Caucasus mole (*Talpa caucasia)*, wildcat (Felis silwesteis), *Maries maries, hare (Leporida curopaous),* European Badger (*Meles meles*), wolf (Canis lupus), fox (Vulpes vulpes), medow mole (Microtinae), Golden jackal (Canis aureus), Eurasian lynx (Lynx lynx), wild boar (Sus scrofa), European Roe Deer (*Capreolus capreolus*), Caucasian squirrel (*Sciurus anomalus*), European Otter (*Lutra lutra*), West Caucasian Tur (*Carpa caucasia*) found in Tusheti and Bezoar or wild goat (Capra aegagrus). Among the birds: eagle (Aquila crifaetas), Eurasian tawny owl (Strix aluco), European Turtle Dove (Streptopelia turtur), Great spotted woodpecker (Desndrocaposmajer), rock pigeon (Columba livia), Golden Oriole (Oriolus oriolus), Common Quail (*Coturnix coturnix*), Griffon Vulture (*Gyps fulvus*), hoopoe (*Upupidea*), Caucasian black groose (Tetrao mlokosiewiczi), black vulture (*Aegypius monachus*), common wood pigeon (*Columba palumbus*), Northern Goshawk (*Accipiter gentilis*), coomon black bird (Turdus merula), *Turdus silvestris*, Eurasian Jay (*Garrulus glandarius*), black kite (*Milivus migrans)*, borea owl (*Aegolius funereus)*, common pheasant (*Phasianus colchicus)* and Caucasian snowcock (*Tetraogallus caucsasicus).* Fresh waters are rich in: *black trout (*Salmo fario), *Barbus mursa,* Kutum (Rutilus frisii), mountain carp (Xondrostoma cyri), Sander lucioperca (*Lucioperca lucioperca)*, Kura Gobio (*Gobio perca*) and *Barbus capito.*

Telavi municipality***. In Telavi municipality***, state forest fund, in accordance with the latest forest inventory data (1992) amounts to 59,738 ha. Of this, 7,767 ha is a green zone and, 51,969 ha – soil protection and water regulation forest zone. Total forest cover of the State Forest Fund makes up 55,785 ha (51%), of which 30,315 ha is mature and old forest grove. Total wood resources are estimated at 9,400,400 m3, with 5,569,700m3 mature and old forest wood resources. Mostly, on the Alazani valley and the foothills natural landscapes are transformed into cultural landscapes, where steppe, forest-steppe and secondary forest vegetation is met. On the flood plain areas there is a poplar, floodplain oak, white willow, etc. On the low to medium elevation slopes of the Gombori range oak – common hornbeam and sometimes beech groves are met. At the higher elevations (1800-2000 m) beech forests prevail, from place to place mixed with hornbeam, etc. As a result of human intervention, the forest zone is reduced by altitude and secondary sub-alpine meadows are found in place of former forested areas. Natural sub-alpine meadows are met as small islands in the areas of Tsivi, Manavi Tsivi, Tsiv-Gombori and other mountainous areas. On East or Kakheti Caucasus slopes at an altitude of 800-1000 m oak – common hornbeam forests mixed with beech and sweet chestnut are spread. Between the altitude of 800-1000m and 2000-2200 m beech forests sometimes mixed with oak, hornbeam, chestnut and maple are met. Sub-alpine meadows are found at the elevation of 2,500-2,600 m and alpine meadows – at the elevation of 3200-3400 m.

Among fauna species, chamois (goat antelope), brown bear, red deer, wolf, fox, jackal, wild pig, rabbit, squirrel, mise, *Talpa caucasia,* wild cat*, (*Felis silwesteis), *Meles meles, Mustela nivalis*, *Maries maries* and rets are met. In the high mountains Caucasus grouse, *Gyps fulvus, Tetraogalus* are met. In the fresh waters following fish is found: varicorhinus (ray-finned fishe), Barbus mursa, barbel (Barbus barbus), Barbus capito, wels catfish (Silurus glanis), common carp (Cyprinus carpio) and others are met.

Lagodekhi municipality. ***In Lagodekhi municipality,*** forested areas amount to 35,500 ha, of which 3,200 ha is shrubbery. Following main types of vegetation are found in the municipality: riparian forests, formed by oak (Quercus pedunculiflora), black poplar (Populus nigra), white poplar (Populus canescens), willow (Salix excelsa), wing nut (Pterocarya pterocarpa) and alder (Alnus barbata); lianas also are widely spread there including: sarsaparilla (Smilax excelsa), clematis (Clematis vitalba), silk vine (Periploca graeca) and ivy (Hedera helix). Riparian forests are spread along the left bank of the river Alazani from the village Chabukiani to Georgia-Azerbaijan border. They are bogged here and there. It should be mentioned that along the riverbed of the river Kabali (left tributary of Alazani), due to artificial disturbance of natural-hydrological regime of this river (which caused intense silting of its riverbed), significant part of riparian forest got flooded bogged for a quite a long time, which resulted in its almost complete drying. The piedmont (foothill) forests are developed on slightly sloped accumulative piedmont plain. They are mainly represented by the formations of secondary oaks and hornbeams (Quercus iberica+Carpinus betulus). Natural vegetation practically is no more present here or is presented in the strongly degraded form. The vegetation on the debris cones and terraces of the rivers (Kabali, Ninos Khevi, Shromis Khevi, etc.) are represented by the thickets of mesophile deciduous forests, created by: alder (Alnus barbata), bare elm (Ulmus glabra), hornbeam (Carpinus betulus), chestnut (Castanea sativa), wild cherry (Cerasus sylvestris), maple (Acer trautvettri), lime-tree (Tilia cordata), etc. Undergrowth consists of black elder (Sambucus nigra) and sarsaparilla (Smilax excelsa), which create impassible thorny thickets. Forests of this type are substantially degraded due to uncontrolled logging and irregular cattle grazing, as well as by mudflow and landslide impacts. Lower and middle mountain zone forests are spread on the slopes, inclined at various degrees, where leading role belongs to: oriental hornbeam-chestnut-oak (Quercus iberica-Castanea sativa-Carpinus orientalis), hornbeam-oak (Quercus iberica+Carpinus betulus) and hornbeam-beech (Carpinus betulus+Fagus orientalis). Forests of this type are spread up to the height of 1,400 – 1,600 m above sea level. Forests of upper mountain and sub-alpine zones are spread on the relief, striped by multiple gorges and ravines at the height of 1,700 – 2,400 m above sea level. Together with forest, sub-alpine bushes and high-mountain grasses are developed in this zone. Following species are predominant here: beech (Fagus orientalis), high-mountain maple (Acer trautvetteri), birch (Betula litwinowii), high-mountain oak (Quercus macranthela), rowan (Sorbus aucuparia), etc. The following also participate in the formation of forests on the slopes of the south exposition: maple (Acer laetum), ash (Fraxinu excelsior), lime-tree (Tilia cordata), chestnut (Castanea sativa), etc., sub-alpine shrubbery on forest zone valleys and lower border of forest, where primarily Caucasian rhododendron (Rhododendron caucasicum) monodominant cenoses and sub-alpine forest and rhododendron complexes are to be mentioned. Bilberry (Vaccinium myrtillus), yellow azalea (Rhododendron luteum), juniper (Juniperus depressa), etc. are also spread here. Sub-alpine high-mountain herbs are spread in places cleared from forests and together with subalpine crooked and light forests. The following participate in the formation of high-mountain herbs: Aconitum nasutum, A. orientalis, Gadellia lactiflora, C. latifolia, Chaerophyllum maculatum, Senecio rhombifolius, Telekia speciosa, etc. Alpine meadows are spread at the height of 2,600 – 3,100 m above sea level and are represented by multiple modifications, among which, firstly, mat grass (Nardus stricta), fescues (Festuca varia), and mixed grassy meadows should be mentioned. Subniveal zone. The subniveal zone of Caucasian Range within the boundaries of the municipality is located above 3,100 m above sea level and is represented by separate individuals of vegetation (rarely – microcenoses), mainly by sedges (Carex) and other mixed grasses.

Kvareli municipality. ***In Kvareli municipality***, in accordance with the latest national forest inventory data (1989) forests occupy 57,050 ha, which is more than half of the total area of the municipalities (100,080 ha). The State forest fund is divided into 5 quarters (municipalitiess) of 182 ha average size. Kvareli forests belong to the East Trans-Caucasus Kakheti-Zakatala Forest-Vegetation group. Here relic species of Tertiary Hyrcanic and Colchic refugiums are found. The forests occupy south-west and south east slopes of the Greater Caucasus and one can distinguish three vertical zones: 1. Georgian oak forests mixed with other broad-leafed trees, e.g. beech (500-1000 m above the sea level); 2. Beech forest (1,000-2,000 m) from place to place mixed with elm, Caucasian Linden and hornbeam. At the high altitudes the forest grove becomes light and represents sub-alpine groves. 3. Sub-Alpine light forests (2,000-2,200 m) represented by red bud maple, various types of birch and Common Aspen low density groves. From place to place they are mixed with light beech groves mixed with shrubs of Georgian Snow Rose (*Rhododendron Caucasicum*). After this zone sub-alpine and alpine meadows are spread. Many of plant species of Kvareli forests are relic, endemic and rare and are listed in the Red Book of Georgia. These includes: Velvet Maple (Acer velutinum), sweet chestnut (Castanea sativa), the field Elm (Ulmus foliacea), Corilus iberika, Caucasian wingnut (Pterocarya pterocarpa) met in floodplain forests, Bladdernut (Staphylea pinnata), Downy Oak (Quercus pedunculiflora) met in floodplain forests, Georgian Hazel (Corylus iberca), common yew (Taxus baccata), Azalea Pontica (Rhododendron flavum), Caucasian Whortleberry (Vaccinium arctostaphilos), Woronow Ivy (Hedera pastuchowii). From endemic grasses, Primula juliae, Caucasian or Golden Peony (Paeonia mlocosewitschii) and Crested Gentian (Gentiana lagodechiana) are found. Most of the forests occupy steep slopes, which are striped with various mountainous rivers of mudflow basin. They belong to water and soil regulating mountainous forest category.

<u>Gurjaani municipality</u>. ***In Gurjaani municipality***, total state forest fund amounts to 31,000 ha. Here broadleaved forest prevails. As it was mentioned above in floodplain areas riparian forests with specific to them wood species are found. The majority of tree groves are 40-130 years old. The municipality is pretty limited with forest resources. Most of lands here are occupied by cultural landscapes of agricultural lands and settlements. The Alazani valley is almost entirely transformed to the cultural landscapes. Natural landscapes and ecosystems are found as small fragments in floodplains of the Alazani River as riparian forests. In areas free of arable and perennial crop lands, forest-steppe vegetation is spread, where shrubberies and grassy biomes are sequencing each other. Floodplain forests are represented here by black poplar (populus nigra), willow, balsam poplar, floodplain oak, alnus (Alnus barbata), and elm. From place to place wingnut – the relic species is found as well. From the shrubs following species are met: dog rose, common sea-buckthorn, hawthorn or thornapple, swida (from dogwood family) and salt cedar. There are also lots of climbers, including: Caucasus ivy, smilax, clematis or 'Nelly Moser', common hop, wild grape, blackberry, silkvine, etc. Foothills of Gombori range are covered by Jerusalem thorn, Oriental hornbeam, hawthorn, dog rose, buckthorn (Ramnus). On the north-east slopes of the ridge broad-leafed forests are spread with oak, hornbeam and beech trees. On the plateau steppe vegetation is met.

Among fauna, deer, brown bear, wolf, fox, jackal, hare and other large mammals are met. From raptors, common mouse, gray rat, bank vole, etc. are found. In the Alazani river there are following fish species: catfish, Barbus mursa, Barbus capito , Sevan khramulya, etc. are met.

<u>Signagi Municipality.</u> ***In Signagi municipalities***, mostly low mountainous and foothill forests (Gombori ridge), light wood forests and floodplain forests (Iori river banks) are met. Slopes of the Gombori ridge are covered predominantly with oak and common hornbeam. The light woods are composed of maple, *Savin Juniper* as well as of xerophyte vegetation of rocky areas. On the banks of the river Ioni small patches of floodplains forests are spread composed of willow, poplar, etc.. On the Alazani valley steppes of shrubberies are met.

Steppes are also spread on the Iori Plateau, on the south of which the semi-desert vegetation cover composed of artemisia, salsola and other semi-desert species is met.

Dedoplistskaro Municipality. ***In Dedoplistskaro municipality,*** forested area amounts to 19,107 hectares. Here mostly arid forests are prevalent and, are found on the Iori Plateau, as well as on the Eldar lowland plain (Tchatchuna, Kotsakhuri, Burdos Mta, Vashlovani, Karadari, Kumroi, Bucha-Moedani, etc.). In certain locations, e.g. along the Alazani and the Iori rivers, beech forests are widespread. Specifically, beech forests dominate along the r. Alazani – in Mijnis Bay, in areas of the Sabatlo village, at the adjunction of the Arpadari and Mijniskuri valleys; and in the Riv. Iori valley – in certain areas of Tchatchuna.

The area of deciduous forests of lower zone of mountains and foothills is relatively limited. Fragments of such forests are met in the north-west, central and east parts of the municipality, up to the height of 400 – 800 m above sea level. Georgian oak (Quercus iberica) and ash-tree (Fraxinus excelsion) are the prevalent species of these forests; undergrowth is formed by oriental hornbeam (Carpinus orientalis), hawthorn (Crataegus curvisepla, C. monogina), meadow-sweet (Spiraea hypericifolia), jasmine (Jasminum frutcans), etc. Riparian forests are spread along the banks of Alazani and Iori. In particular, along Alazani – in Mijnis Kure, village Sabatlo, at the junction of Arfadar and Mijniskure gorges; and in the gorge of the river Iori – in Tchatchuna area. Riparian forests are represented by aspens (Populus canescens, P. nigra) and oaks (Quercus pedunculiflora). Meadow-steppes are mainly of secondary origin and spread in the north-west, central and east parts of the municipality. It is represented by poly-dominant grain-mixed grass types (Graminetovarioherbetum). Salinated meadows are met on Alazani plain, along the banks of the river Iori and the south part of Eldari plain-hollow. The vegetation of the mentioned meadows is mainly represented by couch grass (Elytrigia repenus), swamp sea lavender (Limonium meyeri), etc. co-societies. Salinated meadows on Alazani plain and partly along the river Iori are replaced by cultural landscapes (mainly hayfields) on quite large area. Light arid forests are quite widely spread on Iori elevation and Eldari plain depression (in the areas of Tchatchuna, Kotsakhuri, Burdo Mountain, Vashlovani, Kaladari, Kumroi, Bigha-moedani, etc.). Wild pistachio (Pistacia mutica) and junipers (Juniperus polycarpos, J. foetidissima) participate in the formation of the mentioned forests. Besides, Georgian maple (Hacer ibericum), nettle tree (Celtis caucasica), Georgian pear (Pyrus salicifalia), etc are found here. Phryganoid vegetation is spread in the south-east part of Iori elevation (Chachuna, Kotsakhuri, Eldari Mountain slopes, on the territory of Vashlovani preserve, etc.). The basic importance in the formation of vegetation of this type belongs to: reamuria (Reamuria alternifolia), Siberian pea shrub (Caragana grandiflora), goat's wheat (Atraphaxis spinosa), Caucasian astragalus (Astracantha microcephala, A. caucasuca), prickly thrift (Acantholimon fominii), etc. Steppe vegetation on the territory of the municipality is mainly of secondary origin. Its main area covers Didi Shiraki, Patara Shiraki, Naomari, Ole and Jeirani valleys, slopes of Nagomari, Shavi Mta, Kashebi, steppes of Iori, Chachuna, Natbeuri, etc. Remaining areas of the municipality are represented by semi-deserts and steppes. Here we also meet inter-zonal types of vegetation: phryganoid vegetation, semi-deserts, hemixerophilous shibliak-type shrubs secondary meadow steppes, salinated meadows, etc. Semi-desert vegetation is mainly spread on Eldari loawland plain, Taribana Valley, plains, located in the middle and lower stream of Lekistskali gorge and slopes of hill-hillock zone. Its main phytocenosis is absinthe (Artemisia fragrans), heather-like saltwort (Salsola ericoides), glasswort (Salsola dendroides), nodulous saltwort (Salsola nodulosa), nitre bush (Nitraria schoberi), etc. Steppe vegetation is represented by two formations: bluestem (Bothriochloa ischaemum) and feather grass (Stipa lessingiana, S. capillata) steppes. Shibliak-type vegetation is spread in the north-west, central, east, and south parts of the municipality. It is mainly represented by Jerusalem thorns (Paliurus spina-christi), most part of which are formed at the expense of forest logging; oriental hornbeam (Carpinus orientalis) as well as groupings of polydominant shrubs. Significant part of Dedoplistskaro municipality is occupied by the preserved territories. Among them, primarily, Vashlovani National Park – 25,114 hectares, Vashlovani Preserve – 8,480 hectares, Chachuna Reserve – 5,200 hectares, natural monument of Artsivis Khevi should be mentioned. The existence of preserved territories on the territory of Dedoplistskaro municipality evidences its biodiversity in regard to ecosystems, as well as multiplicity of etalon and rare taxons of plants and animals.

Sagarejo Municipality***. In Sagarejo municipality,*** forest-covered area amounts to 41,860, which is 28.1% of the total area (149,313 ha). Mostly hornbeam-oak forests in the municipality are spread on the slopes of the Gombori range at over 700 meters above sea level. On the Iori plateau, woodland vegetation is presented in small fragments of tugay forest, where beech forests have been retained in separate localities along the riverbanks, within the erosive gorges and, on the slopes of the Gombori ridge. Riparian oak (Quercus pedunculiflora), together with lianas: sarsaparilla (Smilax excelsa), wild vine (Vitis sylvestris), clematis (Clematis vitalba) and silk vine (Periploca graeca) form floodplains forests. Riparian oaks as well as lianas found here are the relics of the tertiary period. Oak forest on the territory of Sagarejo municipality is spread up to 1,200 m above the sea level, which is highly degraded. These forests are characterized by average productivity. Oriental hornbeam-oak forest (Quercus iberica + Carpinus betulus) dominates within 1,200 – 1,400 m above the sea level. Its ecological condition is relatively better and from place to place maintains its natural state. In addition to the basic cenotypes, the following associates participate in the formation of hornbeam-oak forest: Norway maple (Acer platanoides), Japanese maple (Acer laetum), smooth-leaved elm (Ulmus glabra), seldom - common yew (Taxus baccata); in the undergrowth – gaiter-tree (Swida australis), elderberry (Sambucus nigra), privet (Ligustrum vulgare), etc. Beech forest is well defined on the slopes of north exposition of Gombori range, above 1,400 m above the sea level. In the lower part of the mentioned strip mainly hornbeam-beeches (Fagus orientalis – Carpinus betulus) are represented, in the upper part – pure beeches. Sub-alpine meadows and meadow-shrubs are spread in the top strip of Gombori range and slopes, directly adjacent to it. They are formed at the expense of the shrinking of the upper boundary of the forest as a result of the anthropogenic impact. Sporadic spreading of high-mountain oak (Quercus macranthera) is also remarkable near the upper limit of the forest. The rest of the territory of the municipality is represented by bush, grass or bush-grassy steppe and small segment of semi-desert vegetation cover found in the south part of Iori Elevation located within the boundaries of the municipality. Thorn-bush steppe is spread in the north part of Iori elevation up to 1,000 m above the sea level (in the area of the villages Patardzeuli, Tskarostavi, Krasnogorsk, etc., where various modifications of thorn- bush steppe is represented – bluestem- Jerusalem thorn (Paliurus spina – Christi – Bothriochloa ischaemum), feather grass-bluestem-Jerusalem thorn (P. spina – christi – B. ischaemum – Stipa pulcherrima), grains- mixed bushes (Mixtofruticeta – graminosa), etc. On the hillock relief one can meet forest-bush groupings and arid light forest elements in the form of fragments. On Kachreti and Tsitsmatiani plains (up to 750 m above the sea level) the unities of oriental hornbeam steppes are represented. Meadow vegetation is spread in fragments on the north slopes of mountains and intermountain depressions, where humidity is higher, and soil salinization is less. Meadow fragments are mainly represented by broad-leaved cereals and motley grass: Brachypodium pinnatum, Dactylis glomerata, Phleum phleoides, Koeleria cristata, Bromus inermis, Salvia nemorosa, Onobrychis iberica, Phlomis pungens, Vicia veriabilis, Achillea setacea, Zathyrus aphaca and etc. Semi-desert flora is mainly is represented in combination with steppe flora formations. These two ecosystems often alternate according to the soil type. The dominant edificator of semi-desert flora is absinthe - Artemisia fragrans and, together with it, Poa bulbosa, Bothriochloa ischaemum, Medicago minima, M. lupulina, Teucrium polium, Elyrtigia repens, Allium rubelum, Podospermum laciniatum etc.

participate in creation of cenosis. Halophilous flora (i.e. flora of salinated areas). This type of vegetation is spread mainly in the south and north-west part of Iori Plateau, where it occupies significant area on plain – hollows and hollow relief forms. Special composition of Halophilous flora depends upon the degree of soil salinization, humidity and relief. The basic species creating halophilous flora are: Crypsis schoenoides, Puccinellia gigantean, Polygonum argirocoleum, Gamanthus pilosus, Petrosimonia brachiata, Salicornia europaea, Salsda ericoides, Kochia prostrata, Artiplex hitens, Suaeda sp. etc. Forest flora is spread in the forms of single fragments at the bottom of intensely fragmented relief of Iori elevation, narrow gorges and gullies here and there, in more or less humid habitats. Here forest flora is represented by low-productive forests-bushed, in formation of which participate: Juniperus hemisphaerica, J. oxycedrus, Ulmus minor, Celtis caucasica, Pistacea mutica, Lonicera iberica, Cerasus microcarpa, Cotinus coggygria, Elaeagnus angustifolia, Spiraea hypericifolia etc. In the south-west hill-hillock piedmont and low foothill zone, at the height of 900 – 950 m above sea level, secondary oriental hornbeam-oak (Quercus iberica – Carpinus orientalis) forest and hemixerophilous shrubbery is developed. It is spread on the place cleared from former oak (Quercus ibérica) forest. Here and there we meet the fragments of light forest, expresses against the background of steppe and secondary shrubbery (Pyreta fruticosa; P. stepposa).

<u>Tianeti municipality</u>. ***In Tianeti Municipality,*** total state forest fund makes up 53,483 ha, of which 52,082 is a forest cover (56% of total area) with 8,489.0 ha mature and old tree groves. The absolute majority of forests are of ecologically high value with soil protection and water regulation functions. More specifically, about 5,003 ha belong to Tbilisi national park, 5820 ha – to the green zone and, 42,660 ha – to the soil protection and water regulation forests. Total timber resources are estimated at 8,489,000 m3, with 4,149 m3 mature and over mature tree wood resources. The last inventory of forests was conducted in 1991-1992.

In the alpine and sub-alpine zone, alpine and sub-alpine meadows are met. At the sub-alpine zone from place to place Georgian and high-mountain oak, beech and hornbeam light forests are found. At the middle mountain forests beech and beech-hornbeam forests with Colkhic sub-forest elements are met. Apart from the major phytocenosis, the biome is created by maple, ash tree, etc. Below middle-mountain zone, low-mountain and foot hill oak dominating forests mixed with hornbeam are spread. Intermountainous synclines (depressions) are covered by hornbeam forests mixed with oak. The most of the dense forest groves are spread at an elevation of 1,000-2,000 m. Overall, following wood and bush and grass species are spread in the municipalities: tree of heaven (Ailantus altissima), Black Locust (Robinia pseudoacacia), birch (Betula litwinowii), Wild cherry (Cerasus avium), common aspen (Populus tremula), black poplar (Populus nigra), white poplar (Populus alba), smooth-leaved elm (Ulmus carpinifiolia), field elm (Ulmus minor), Wych Elm (Ulmus glabra), white mulberry (Morus alba), Grey Alder (Alnus incana), Black or common Alder (Alnus barbata), European ash (Fraxinus excelsior), Presian wallnut (Juglans regia), Caucasian wingnut (Pterocarya pterocarpa), common fig (Ficus carica), Oriental wild apple (Malus orientalis), Caucasian oak (Quercus macrantera), Georgian oak (Quercus iberica), Sycamore maple (Acer psevdoplatanus),Norway maple (Acer platanoides), Greek maple (Acer trautvetteri), field maple (Acer campestre), Cappadocian Maple (Acer laetum), wild or Gewone peer (Pyrus caucasica), Coomon hornbeam (Carpinus caucasica), goat willow (Salix caprea), while willow (Salix alba), cherry plum (Prunus divaricata), European yew (Taxus baccata), Scots pines (Pinus hamata), Austrian pine (Pinus nigra), Caucasian Linden (Tilia caucasica), Small-leaved Linden or lime (Tilia cordata), rowan (Sorbus graeca), mountain ash (Sorbus caucasica), sweet chestnut (Castanea sativa), Oriental beech (Fagus orientalis), Oriental hornbeam (Carpinus orientalis), Caucasian persimon or date-plum (Diospipyrus lotus), Caucasian Zelkova (Dzelkova carpinifolia). Among bushes, following species are met: pomegranat (Punica granatum), dog rose (Rosa canina), Georgian snow rose (Rhododendron caucasicum), European Black Elderberry (Sambucus nigra), Common Medlar (Mespilus germanica), ruscus (Ruscus ponticus), Cotinus coggigria, yellow azalea (Rhododendron luteum), common hazel (Corylus avellana), common barberry (Berberis vulgaris), red hawthorn (Crataegus microphylla), Pontic hawthorn (Crataegus pontica), small-flowered black hawthorn (Crataegus pentagina), Caucasian backberry (Rubus caucasicus), European dewberry (Rubus caesius), Daphne caesius, Caucasian Whortleberry (Vaccinium arctostaphylos), Alpine Currant (Ribes alpinum), Bilberry or whortleberry (Vaccinium myrtillus), Bieberstein's currant (Ribes biebersteinii), European or red Raspberry (Rubus idaeus), Cytissus caucasisus, Golden mock Ornage (Phyladelphus caucasicus), Common Mistletoe (Viscum album), sea-buckthorn (Hypopphae pseudonivea), golden juniper (Juniperus depresa), Juniperus pigmala, Svida australis, Corneliancherry or European cornel (Cornus mas), Honeysuckle (Lonicera iberica), Lonicera caucasica, European Cranberrybush or Water Elder (Viburnum opulus), Oriental Cranberrybush (Viburnum orientalis), Wayfaring Tree (Viburnum lantana), Ruscus hypopyllum, Ruscus colchicus, Evonymus verrucosa, Common Buckthorn (Rhamnus cathartica), Rhamnus pallasii, Alder Buckthorn (Frangula alnus), bladdernut (Staphylea pinnata)/ Among climbers, following species are met: Smilax excelsa, wild grape (Vitis silvestris), Old man's beard (Clematis vitalba), Common hop (Humulus lupulus), Common Ivy (Hedere helix), silver vine (Peripcola graeca). Among grasses following species are met: common ladyfern (Athyrium filix femina), ostrich fern (Matteuccia struthiopteris), Wood bluegrass (Poa nemoralis), Common Wood-sorrel (*Oxalis acetosella),* wood sanicle (Sanicula evropaea), Common Male Fern (Driopteris filix mas), Sweet Woodruff (Asperula oborata), mountain fescue (Festuca montana).

Among fauna, following species are met in the Tianeti forests: chamois (goat antelope) met in Alpine zone, dear, wolf, fox, jackal, wild pig, rabbit, Caucasus squirrel, mise, *Talpa caucasia,* wild cat*, (*Felis silwesteis), *Meles meles, Mustela nivalis*, *Maries maries* and rets are met. In the high mountains Caucasus grouse, *Gyps fulvus, Tetraogalus* are met. In the fresh waters following fish is found: trout, Barbus mursa, barbus barbus, Chondrostoma cyri, etc.

Rioni River Basin

<u>Racha-Lechkumi and Lower Svaneti region</u>. The upper course of the Rioni River Basin, where Racha-Lechkhumi and the Kveda (Lower) Svaneti region is located, is very rich in forests, making up about 263,093 ha or 53% of the total area (495,400ha) of ther region. Almost all types of forests specific to the ecosystems of Georgia are met there, varying from Caucasus high, middle, low mountainous, foothill and Kolkheti foothill and plain forests. All the coniferous trees are found here, including pine, spruce, fir, yew and common juniper. Spruce and Norman fir are met on the Central Caucasus at an altitude of 1,100-1,600 m as intact, dense forest groves. At the altitude of 1,000-1,100m broad-leafed beech forests from place to place mixed with oak, sweet chestnut, maple, ash, Caucasian Linden, wild peer, etc are found. Monodominant beech forests sometimes in combination with coniferous trees are met at the altitude above 1,100 m. Sub-alpine forests are represented by birch, maple and Caucasian and mountain ash (for more details please refer to the map of the forest cover of Georgia, figure 12, annex 2 and the map of the forest cover of the Rioni Basin, figure 16, annex 2).

Racha-Lechkhumi forests belong to the first category forests with water regulating and erosion control as well as recreation functions. Since 1950s there has been an intensive cutting of trees and per 1 ha about 300-400m3 high quality tree has been cut. Following Georgian red list trees are met in the region: yew, sweet chestnuts, Georgian hazel, etc.

Foothill and low mountainous forests are met at an altitude of 600-900 m in Racha-Lechkhumi syncline (depression). On the right side of the R. Rioni at the altitude of 700 m on limestone substrates of the southern slopes (Ambrolauri municipalities) relatively young forest groves of pine-oak trees are met with dominant smoketree (Cotinus coggygria) forest understory community. Today these forests are almost entirely degraded or transformed into secondary forests or cultural landscapes and are met only as small fragments in the villages Skhvava, Tbeti, Gogoleti, Tkhmori, Tchrebali and Khimshi. Middle-mountain forests with monodominant beech tree groves are met at the altitude of 800-1,550 m above sea level. Below this height beech forests are mixed with other trees, including spruce and fir. Between 1,550 m and 2,000 m above sea level fir and spruce groves and beech-fir or beech-spruce groves are met. On the Northern slope of the Racha range the forests with evergreen understory communities are founds on contrary to the Lechkhumi range, where the forests with grassy understory communities or without any understory vegetation cover are met. In the karst depressions (hollows) Pontic rhododendron creates dense thickets of shubberies called in Georgian "Shkeriani". On the Satsiliki mount chestnut and yew make up yew-chestnut forests at the altitude of 1,600 m. On the carbonate substrates one of the common species is pine as well. Kolkhic plants are rarely met and xerophyte species are more widely represented here. High mountain forests are met at an altitude of 1,800-1,900 m and are represented by beech forests. In sub-alpine zones light forests represented by silver birch, white birch, goat willow, red-bud willow and beech are met. In the understory community Georgian white rose or rhododendron, common bilberry, red bilberry, etc are met. Rocky vegetation is met almost every altitude zone and in the low and middle mountain areas are represented by Caucasus pine, Savine juniper, carnation, viola, thousand-leaf, etc.

In Lower Svaneti virgin or well-preserved forests are only met on inaccessible tops of the mountains and steep rocky slopes. In the majority of the territory the state of the forests is good to medium. Forested areas are represented by broad-leafed forests of hornbeam, chestnut, oak, mixed with fir and pine at the altitude from 450 m to 1200-1300/1500m. Colchic understory community is very poor here. Monodominant large groves of oriental beech are met on the northern slope of the Lechkhumi ridge and the slopes of the Lower Svaneti ridge. Here pine and fir forests are of relatively wide distribution. In the west of the Svaneti, at an altitude of 1,000-1,200 m mixed broadleaved forests are met with beech, sweet chestnut and European hornbeam dominating trees from place to place mixed with Caucasian linden, Cappadocian maple, Norway maple, (Acer platanoides), etc. Forest understory is represented by Kolkhic communities. In the middle of the r. Tskenistskali at an altitude of 1,000-1,600m beech forests dominate and oak groves are only met at very sunny slopes. In the rest of the Lower Svaneti at the same altitude mostly spruce and fir forests are met from place to place mixed with broad-leafed trees. With the increase in altitude monodominant fir and spruce are met.

Forests in Lower Svaneti similar to the forests of Racha-Lechkumi have the function of soil protection, erosion and avalanche control, water regulation and recreation. These forests occupied very large areas in the past. Now pretty sizable areas are covered with secondary meadows especially, at the altitude higher than 1,500m above sea level. Initially, there were fir and spruce forests there by due to human intervention boundaries of these forests have been reduced and the former forests have been replaced with secondary meadows.

Sub-alpine zones in Svaneti are complex are represented by sub-alpine forests, shruberries and meadows within the range of 1,750-1800 m and 2,600 m. In the west of this zone, there are light sub-alpine forests of beech, spruce, fir, birch and Red-bud Maple. In the bushy understory community Georgian white rose, Pontic rhododendron, common rhododendron, etc. are met. In the east Caucasian birch, Caucasian mountain ash-birch and pine-birch groves are spread with fragments of high mountain oak and Caucasus pine. Sub-alpine forests have high ecological value, since they protect middle mountain forests from avalanches. Unfortunately, these forests are severely degraded or cleared.

Alpine polidomonant grassy meadows are widely represented in the source of the r. Tskenistskali and as fragmented areas – in the high altitudes of Lechkumi and Egrisi ridges. On the Main Caucasus range upper limit of such meadows is at the altitude of 3,250 m above sea level.

In Ambrolauri municipality, the total area of the State Forest Fund is 76,859 ha, of which 60,030 ha is State Forest Fund and 16,829 – Central Caucasus State Forest Fund Protected Areas. Although, the PA area is only planned one. Most of the forest areas here belong to the III category (medium danger) in accordance with the forest fires. About 4.7% of Ambrolauri forests are represented by young tree groves, 51.5% - by middle age trees, 13.8% - by near mature trees and 30% - by mature and old trees. Commerical wood reserves are distributed in a following way:young tree grove make up 1.5%, middle-age tree groves - 40,2%; near mature tree groves – 14.9% and mature and overmature tree groves 43.4%. The largest areas of forest groves are found on the 21-30% slopes (32.2%), followed by the forest groves spread on the $11\text{-}20^0$ slopes. Over 77% of the forests are located up to the altitude of 1,100-2000 m above sea level. Following species are met here: Abies Nordmaniana, Picea Orientalis, Pinus pithyusa, Quercus iberica, Fagus Orientalic, Caprinus Caucasica, Populus glatinosa, Alnus glutinosa, Betula litvinvii, Pirus caucasica, Bubus caesius, corilus colchica, Rubus Buschii, Ribes Bieberateinii, Berberis vulgaris, Chelidnium majus, Lconurus cardiaca, Mentha avensis, Polygonatum, Urtica dioica, Origanum vulgare, Plantago, Crataegus-pentagina, Sambucus ebulus, Vacinium arctostaphilos, Mesnilus germanica, Achillea millefalium.

In Oni Municipality, about 70% (~ 95,100 ha) of the total area (135,940 ha) is covered by forests. Here very unique species of white fir (Abies Concolor Lowiana) is found.

In Tsageri Municipality about 50% (~ 67,900 ha) of total area (75,540 ha) is covered with predominantly broad-leafed forests.

In Lentekhi municipality, forests occupy about 58.1% of total area (134,400 ha). State Forest fund consists of 82,989 ha in accordance with 1996 forest inventory data and is divided into 5 units. The forests are of high productivity. Following wood and non-wood species are found in Lentekhi forests: *1. Abies Nordmaniana; 2. Picea orientalis; 3. Quercus iberica; 4. Fagus orientalis; 5. Carpinus Caucasica; 6. Populus nigra; 7. Alnus glutinosa; 8. Betula Medvedevi; 9. Pirus Caucasica; 10. Ilex; 11. Rododendron Caucasica; 12. vacinium arctostaphilos; 13. Rododendron luteum; 14. Ribes biebersteinii; 15. Rubus casius; 16. Corylus colchica; 17. Rubus Buschil; 18. Berberis vulgaris; 19. Rosa canina; 20. Asparagus; 21. Chelidnium cardiaca; 22. Lconurus cardiaca; 23. Poliganatum; 24. Urtica dioica; 25. Plantago; 27. Crataigus pentagina; 28. Sambucus ebulus*

<u>Imereti region</u>. Imereti is rich in forests, but less than Racha-lechkumi. Woody areas are mostly represented as middle to low mountains, foothills and lowland forests of Kolkhic type that occupy about 286,331 ha, making-up nearly 44% of the total area of the region (655,200 ha). More specifically, lowlands of Imereti are mostly covered with Kolkhic (same as Colchic) low brush, forests, oaks, groves and meadows. The mountainous parts of Imereti are mainly Colchis deciduous forests. Mostly broad-leafed forests are met in the region. But, coniferous and mixed forests are not rare as well. The forests of Imereti are rich in animals

and birds. Zekari, Ajameti and Kharagauli forests are inhabited with bears, wolves, martens, foxes, jackals, badgers, deer, rabbits, squirrels and bobcats. Some of the most common birds are: jay, cuckoo, nightingale, woodcock, hoopoe as well as some rare birds.

In Tkibuli municipality, forests are mostly composed of beech, hornbeam, sweet chestnut, oak, maple, ash tree. There are also fir (abis) and spruce groves and as well, common yew tree groves, e.g. in Gelati surroundings. As a result of human intervention, large areas of natural landscapes are transformed into the cultural landscapes. Forest understories are represented by oriental hornbeam, cornus mas, European cornel, hawthorn, yellow azalea as well as by evergreen shrubs including Pontic Rhododendron, Black Sea Ilex (Ilex colchica), common box, etc. On limestone uplands xerophite vegetation is met and humid river banks – alder. Following climbers (lianas) are met in the municipalities: blackberry, prickly-ivys, Old man's beard (clematis), Kolkhic ivy, etc.

In terms of fauna, following animals are met: wolf, jackal, fox, Caucasus marten, badger, hare, forest mouse, least weasel and rarely – Caucasus otter. From bird species crows, Eurasian Jay, hoopoe, woodpecker, golden Oriole, common Quail, cuckoo, European turtle dove, mistle thrush, common buzzard, duck, etc. In the lowlands pheasants are also met. In the rivers there are: Caucasus barbel, Caucasus chub, Caucasian goby (*Ponticola constructor*), Colchic khramulya, Colchic nase, etc.

In Sachkhere municipality, total state forest fund makes up 64,780 ha, of which 62,001 ha is occupied by forests. This is about 79.9% of the total area of the municipality. In the region, the latest forest inventory was conducted in 1996.

Sweet chestnut forest belt is met at an altitude of 500-1000 m above sea level. In such forest groves one can also find European hornbeam, elm, Caucasian Linden, field maple, oak and yew trees. In the forest understory is represented Pontic (or Black Sea) rhododendron, Cherry laurel, bilberry, etc. Oriental beech forests, from place to place mixed with European hornbeam, Caucasus linden, Sycamore maple, ash trees, is met at the altitude from 1,000-1,1000 m to 1,500-1,600 m. Forest understory is composed of Black Sea rhododendron, Caucasian bilberry, cherry laurel, etc. Fir and spruce forests are spread at the altitude between 1,600m and 2,000-2,200 m and are represented along with Oriental spruce and fir by Oriental Beech, Caucasus linden, birch, elm, poplar, etc. Forest understory community is composed of Caucasus bilberry, cherry laurel, rhododendron, etc. Sub-alpine light forests found at the altitude of 2,000-2,000 m are represented by mountain maple, birch, Georgian white rose, mountain ash, etc. Above this height alpine pastures are met. Frequently at such altitudes Oriental spruce, Caucasus fir and beech light forests are found.

Among animal species fox, wolf, brown bear, jackal, hare, wild boar, European badger, European pine marten, etc. In the rivers trout, Cobitis aurata, barbell, ginger goby, etc.

In Terjola municipality, only 21% or 3,800 ha is covered with forests of protection, water protection and recreation functions. Relatively large massifs of forests predominantly, broad-leafed ones are spread on the northern slopes of the Adjara-Imereti ridge. The region belongs to the eastern part of the Kolkheti geographic (geo-morphological) region, namely to the Imereti lowland, where plain-hilly and, alluvial gray-ash soils with Colchic vegetation are met here. Natural forests that where in the past represented by oak-hornbeam forests are entirely cleared and the areas transformed into cultural landscapes. Relatively significant forest area is found in the east part of the Imereti lowland on the left banks of the Rioni and

Kvirila rivers. Here the part of Ajameti forest is spread, which has a protected areas status. The forest is represented by very old oak and Zelkova trees. Considerably smaller area of the Oak forest is spread on the Sagoria terrace.

On the Imereti lowland following fauna species, specific to the Caucasus region are met: wolf, fox, marten, squirrel, etc. Avia fauna is pretty rich represented by sparrowhawk, falcon, and milvus (kite). On the lowlands, a little egret is found and on the river banks – albatross. The area is rich in reptiles, including frogs, tritons, salamander, and water snake. In the fresh waters, Danube bleak, fat chub, catfish are found.

In Chiatura municipality, natural forests are cleared on the Chiatura depression and the plateau and only secondary vegation cover is found there. The majority of the territory is occupied by arable and perennial crop lands. Forest groves are only met on the slopes of Racha and Likhi (Surami) ridges. Dominant species of forests here are: oak, beech, hornbeam, chestnut, maple, Caucasus lindend, ash tree, etc. Vary rarely coniferous trees are also met. Forest understories are represented by evergreen shrubs of rhododendron, Kolkhic ruscusm, etc. as well as by wild peer, bilberry, etc.

Oriental beech forests are mostly spread on Surami ridge. The forests of the plateau (namely, Chiatura plateau) are a mixture of *C. caucasica* with *Cytisus hirsutissimus* with *Hypericum orientale* understories and *Q. iberica* with some *Q. imeretina* (Red List of Georgia, **RDB**). On limestone substrates, yellow azalea (*Rhododendron luteum)* makes up a forest understory. Furthermore, on the Chiatura plateau, in the Nigozeti limestone canyons, the rare Imeretian calciphytes and endemics: *Delphinium colchicum*, *Potentilla imerethica* and *Symphyandra pendula* are found. On the left bank of the river Budja there is a forest area consisting of *C. caucasica* with chestnut *Castanea sativa* (Red List of Georgia, **RDB** Georgia) and *R. luteum*. There are also areas of red-soil oakwood with *Q. imeretina* (Red List of Georgia, **RDB** Georgia and the former USSR), *Dorycnium graecum*, *D. herbaceum*, *Ruscus ponticus* and *Pteridium tauricum*. The main understory plants of dry ecotopes in the area are *Corylus avellana*, *R. luteum*, *Crataegus* spp. and *Staphylea* spp. In humid areas these are replaced by *Laurocerasus officinalis*, *Ilex colchica* and *Frangula alnus.*

On the southern slope of the Racha ridge, where relatively large groves of forests are met following animal species are spread: Caucasus deer, roe deer, chamois, bear, wolf, fox, jackal, Caucasus marten, wild cat, hare, linx, squirrel. Among birds crow, raven, Jackdaw, golden oriole, Eurasian Jay, luscinia, hoopoe, woodpecker. In the upstream sections of the rivers trout is found and in the middle reaches and downstream – barbel, Caucasian goby, European or fat chub (pollard).

In Vani municipality, in accordance with the latest forest inventories (1995) total state forest fund occupies 30,434 ha, of which 1,700 ha is recreational-resort zone, 628 ha – green zone and 28,106 the zone of mountainous forests with water regulation and soil protection functions. Out of total forest land fund, 29,885 ha is forested area, of which about 33% (9,819 ha) are the mature and old tree forest groves. Overall, the forest cover of the municipality is 53.6%. Total wood resources are estimated at 3,733,400 m3, of which 1,820,300 m3, or about 49% is the mature and old tree forest resources

There are more than 1,000 plant species in the municipality and vertical zonality is pretty evident there. In the past, the lowland was covered by Colchic forests, where Colchic and Imeretian oak, hornbeam, poplar, willow, alder, etc. were found. However, these forests have been cut and the area used as agriculture land. On the foothills of the hilly landscapes insignificant groves of Colchic forest are met with the dominant trees of beech, chestnut, Georgian oak, Caucasus hornbeam, etc. Forest understories are represented evergreen shrubs of rhododendron, cherry laurel, Colchic ruscus, etc. as well as by lianas. From 600-700 m to 1,500-1,600 m there is a beech forest belt. In these forests dominating beech trees are mixed with oak, chestnut, Caucasus linden, Caucasus hornbeam, etc. The forest is rich in evergreen forest understory communities. Above this zone coniferous forests are met with dominating fir and spruce trees and rarely found pine trees. Among broad-leafed trees beech is met. From the border of this belt light sub-alpine forests are met composed of maple, birch, mountain ash, etc. They are found at the altitude of 1,900-2,300. Mostly, three types of vegetation cover are met here: sub-alpine grassy meadows represented by: purple betony, greanium or cranesbill, pulsatilla, etc; meadows represented by hogweed, *Agasyllis caucasica, inula,* Larkspur (delphinium), wild lilies, etc. and; sub-alpine shrubs of rhdodendron, yellow azalea, juniper, etc. From the altitude of 2,300 m above sea level, alpine meadows, with various grasses sre spread and they are used as pastures.

Among animal species, black bear, mutsela nivalis, rat, hedgehog, mouse, Caucasian mole, wild cat, marten, hare, European badger, wolf, bear, lynx, roe deer and Caucasu squirrel are met. Among bird species mount eagle, boreal owl, European turtle dove, woodpecker, wild dove, lesser kestrel, hoopoe, common wood pigeon, Northern Goshawk, black kite are met. Fresh waters are inhabited by river trout. Among amphibians two varieties of lizards are met.

In Kharagauli municipality, forests occupy about 68.2% of the total territory. As it was mentioned in previous parts of the report, the absolute majority of forests of the municipalities have protected areas status and they are part of the Borjomi-Kharagauli protected areas. The PAs in accordance with its management plan is divided into following zones: strict nature protection zone, wilderness zone, traditional use zone, recuperation zone and the support zone. Initially the park occupied 50,400 ha and in 2000 it was extended towards Akhaltsikhe-Adigeni municipalitiess by 10,846 ha. The support zone of the national park covers 150,000 hectares and consists of various land uses including agriculture, industry, infra-structure and areas of natural and semi-natural habitat. The National Park makes up about 1% of total area of Georgia. It is situated on the northern and southern slopes of the eastern part of Meskheti mountain range. The extreme northern end of the Park geographically coincides with the point, where Meskheti mountain range merges with the Likhi ridge. The northern border of the park runs along the left bank of the Chkhirimela River at an altitudes of 1000-1600 meters. The western border of the Park crosses the upper parts of the rivers Khanistskali, Lashuri and Sakraula and goes up to the Sakondria Mountain. The highest peaks are more than 2000 meters above sea level (Sametskhvario Mountain – 2642.6 m, Tskaltsitela – 2496.1 m etc).

The national park encompasses forests and sub-alpine meadows of the central part of the Lesser Caucasus. The north-western section of the Park is lying within the influence zone of a humid subtropical climatic area. The central part of the Park is in the impact zone of the Caucasian climatic region. The southern part is under the greater influence of the dry climate of the Middle East. Throughout the municipalities, subalpine meadows and mountain steppes are dominating landscapes, although small patches of light forest also exist. The territory of the Park almost entirely falls within the Colchic morpho-geographic and biological regions. Typical Colchic landscapes are represented by foothill and lowland subtropical forests with high content of evergreen plants in the understory. High mountains in the Park (at the altitude of 2000m and more) have typical to the Caucasus Municipalities landscapes and vegetation cover. Mountain and subalpine forests, subalpine and alpine meadows, and subnival landscapes are prevailing here. In the western part communities include many Colchic elements. Caucasian Municipalities is characterized with the presence of species' more typical for Central Europe.

Overall, the fauna of the Protected Areas is typical to the Colchic and Caucasian biogeographical areas. Availability of large plots of the virgin forest, together with mountain relief, provides shelter for animals rare in other parts of Georgia. The fauna is represented by relatively stable populations of brown bear (Ursus arctos) and wolf (Canis lupus). In addition, lynx (Lynx lynx), jackal (Canis aureus), roe deer (Capreolus capreolus), chamois (Rupicapra rupicapra) are found there. Birds are represented by the endemic Caucasian Black Grouse (Tetrao mlokosiewiczi), a few species of raptors and a large number of forest passerines. Some species' have wintering place on the territory of the Park, for example, the Great Grey Shrike (*Lanius excubitor*) and Woodcock (*Scolopax rusticola*). There is also Tertiary animal refugium in the park, represented by relic species of red-bellied lizard (*Darevskia parvula*) and Adjarian lizard (*D. mixta*), Caucasian salamander (*Mertensiella caucasica*), the Caucasian parsley frog (*Pelodytes caucasicus*) and Caucasian toad (*Bufo verrucosissimus*) as well as many other species' exist here in isolated refuges. Also as endemic Caucasian species' of small mammals *Sorex raddei*, *S. caucasica*, *S. volnuchini*, *Talpa caucasica*, *Terricola daghestanicus*, *Apodemus (Sylvaemus) ponticus.*

Data and information on forests and other ***biological resources of the Khoni municipality*** are practically absent. What is know that in Overall, Khoni municipality is plain, hilly low to middle mountains and, broad-leafed forests specific to these landscapes of Colchic type are spread here.

Bagdati municipality is rich in forests that cover over 67.5% of the total territory of the municipalities. Here mostly Colchic broad-leafed forests are spread. The lower altitude belt is represented by oak, Caucasus of European hornbeam and chestnut tree forests and the upper altitude belt – by beech forests. Spruce and Fir are also met at high altitudes. Forest understory is well-developed and is composed of evergreen shrubbery vegetation. In settled areas the natural forests are transformed into secondary meadows, agriculture crop lands and cultural plant species.

The part of the Ajameti Managed Nature Reserve is located in the Bagdati municipality. The reserve is situated in the extreme east part of the Kolkheti lowland, on the left bank of the river Rioni, in the basins of Kvirila and Khanistskali. It covers three different forest regions: Ajameti, Vartsikhe and Sviri. The Vartsikhe part is entirely within the boundaries of the municipality, on the left bank of the r. Khanistskali and occupies 1,105 ha. Ajameti part with total area of 3,531 ha is located between two left tributaries of the r. Rioni and is shared by Zestaphoni and Bagdati municipalitiess. Approximately 97% (4,700 ha) of the total reserve territory (4,848 ha) is covered by forests, out of which 4,609 ha is occupied by natural forests. Imeretian oak forests cover about 95% (4,454 ha) of the territory occupied by forests. 140 years old oak forests are developed on the territory of about 1,700 ha, in some places there are 220 – 230-year old trees and even - 250-270 years old oaks.

Ajameti reserve was established for protection and preservation of tertiary period rare relict species of Imeretian oak (*Quercus imeretina)* and water-elm (*Zelkova carpinifolia)*. They are included in the Georgian Red Book and the Red List. Besides, on the reserve territory there are (*Pterocarya pterocarpa)* and caucasian persimmon (*Diospyros lotus)*, Colchic (Hartvisi) oak (*Quercus hartwissiana)* and nut-tree (*Juglans regia)* included in the Georgian Red Data Books and the Red List. The following types of vegetation are developed on the territory of Ajameti Managed Reserve: - forests formed by Imeretian oak; mixed oak-hornbeam and hornbeam forests; alder thickets occupying minimum territory; shrubbery vegetation; weed vegetation; vegetation of the river Kvirila flood-plain; water-elm forest; postforest meadows. The territory of reserve is surrounded by Vartsikhe agricultural lands and arable lands of villages Dimi, Fersati, Bagdati, Rodinouli and other arable lands. Forests are partially thinned due to the closeness of settlements, average density of tree distribution is 0.56. About 1,561 ha of the territory is occupied by forests with density 0.6, in some places (of 268 ha total area) density equals 0.8-0.9.

In Zestaphoni municipality, 12,700 ha is occupied with forests that make up about 30% of the total territory of the municipalty. Here humid subtropical plain, foothill, and mountain landscapes are found that consist of: humid subtropical floodplains with meadow-forest vegetation (alder tree); sloped terraced low-plain and foothills with polydominant Colchic forests of hornbeam, oak, beech, zelkova, chestnut, alder-tree and with evergreen and deciduous substorey (ilex, nut, hawthorn, lianas); humid subtropical hilly plateau with oak-hornbeam forests and; humid low mountains with beech forests.

In Imereti lowland former oak-hornbeam forest landscapes are almost entirely transformed into cultural landscapes. Significant massif of forest is only maintained in the eastern part of Imereti lowland on the banks of the rivers Rioni and Kvirila. In the remaining lowland and hilly, and foothill areas only small fragments of relic Colchic forests composed of oak, hornbeam, chestnut, beech and alder are met. In the past large areas were covered by polidominan broad-leafed forests of Colchic and Imeretian oak, hornbeam, beech, chestnut. On the limestone substrates these forests were represented by oak and oak-hornbeam forests with evergreen common box forest understories. Fragments of such forests still exist in the municipality.

In addition to lowland, foothill and hill forests some forest groves are met on the ridge of the rivers Kvirila and Sakrauli and are represented by beech, hornbeam, maple, linden, Imeretian oak. Forest understory is composed of common or Balck Sea rhododendron, Colchic ilex, yellow azalea, etc. On the former forested areas secondary meadows are formed. Among deciduopus bushes, hazel, hawthorn, European Cranberrybush, wild peer, bilberry, etc. are met and, among liana blackberry, prickly-ivys, valerian, Colchic ivy are met. On the lowlands forest understories are more rich in lianas, while on the limestone substrate xerophite bushes dominate. From place to place relic Caucasian Zelkova tree forest fragments are met.

There are Ajameti (3,531 ha) and Sviri massifs (211 ha) of the Ajameti natural reserve in Zestaphoni municipality. Sviri sestion is located at a distance of several meters from Ajameti forest, is separated from it by agricultural lands of the village Sviri.

In densely populated areas and their surroundings secondary vegetation cover is met. Significant areas are covered by Black Locust (*Robinia pseudoacacia)* that initially was plant as windshield. Lateron, areas covered by these trees have expanded.

Imereti lowland and its surroundings, including foothills and hills are populated by: wolf, jackal, fox, squirel, etc. Birds are represented by mountain **sparrowhawk, falcon, kite, Eurasian jay.** In the lowlands and marshes little egret (**Egretta garzetta)** is met on the riverbanks – albatross. Reptiles are represented by water snake, lizard, salamander, triton, frog. **In the fresh waters, Danube bleak, fat chub, catfish are found.**

In Tskaltubo municipality, in accordance with 2008 data, total forest fund amounted to 24,685 ha, of which 23,706 ha was wooded area. This makes up about 34.9% of the total area. Forests here belong to the first category with soil protection, water regulation and recreation functions.

There is well-know Sataplia caves reserve in Tskaltubo municipalities that is located on the Sataplia mount at altitude of 500 m above sea level. It covers 345 ha, of which 95% is covered with relic Colkhic forests of beech, hornbeam, chestnuts, box tree, Zelkova, oal, wild peer, etc. Forest understory is very dense is thickets of bushes. Among mammals jackal, fox, squirrel, hare and roe deer are found.

The majority of lowland area in the municipality is transformed into cultural landscapes. Only relatively large massif of virgin forests is kept in the eastern part of the Imereti lowland on the banks of the rivers Kvirila and Rioni and is a part of the Ajameti forests of relic oak and zelkova trees.

In Samtredia municipality, forest resources are relatively limited and the majority of natural landscapes in densely populated areas are transformed into cultural landscapes. Forest types specific to the region are Colkhic broad-leafed forests, which in the lower zone are represented by oak, hornbeam and chestnut and on the the upper zone by beech. Forest substory is well-developed here and is composed of evergreen trees and shrubs as well as thickets of deciduous bushes.

The southern part of the vegetation cover of the municipality is distinct from that of its neigbouring Guria foothills. This area is almost entirely cleared of forests. Secondary forest fragments are represented by a mixture of oak and hornbeam with pine, maple, presudoacacia, etc. Rarely Zelkova trees are also met.

In the surroundings of the city of Kutaisi, forested area is only found in its northern part and is represented by Colkhic broad-leafed forests. Southern parts and lowlands are almost entirely free of forests due to human impacts.

Samegrelo region. Total forest cover of the Samegrelo-Zemo Svaneti is 301,000 ha, which is 40.7% of the total area of the region. The Samegrelo is very rich in vegetation cover and counts about 1,200 plant species, of which 175 are endemic plants. The unique ecosystems represented in the region are: turf marshes, Colchic forests with evergreen under stories, oak, hornbeam and coniferous forests, sub-alpine light forests and sub-alpine and alpine meadows.

In the 19th and 20th centuries natural vegetation cover in the Kolkheti plain became significantly degraded due to the anthropogenic pressures. In particular, this was a case for lowland-plain and foothill-hilly areas. Current alder and mixed Colchic broad-leafed forest fragments are the remnants of the virgin forests of oak, chestnut and hornbeam that occupied entire territory of the Kolkheti plain.

In swamps and marshes various shrubberies and lianans are spread, which then are replaced by grassy marshes of scirpus or club grass and rushes. In the Rioni delta and Poti swamps water lilly is found. In addition, near Paliasomi Lake an antient royal fern (Osmunda regalis) is met.

Colchic alder forests are widely spread in Kolkheti plain and represent inaccessible marsh forests. They are composed of alder, mixed with wingnuts, which are listed in the Red List of Georgia.

Colchic forests are composed of relic species of black alder, wingnut, ash tree (fraxinus), Imeretian oak, chestnut, Caucasus linden, etc. On the river banks, forests understories are represented by Pontic or Black Sea rhododendron, box tree groves, etc.

At the altitude higher than 1000-1200m above seal level beech and coniferous tree (Caucasus spruce, fir and pine) forests are met. Caucasus spruce dence groves are the most dominant here. At the upper borders of these forests, birch, beech and spruce-fir light groves are met.

Sub-alpine light forests are spread at the altitude of 1,800-2000 m above sea level and are represented by light forests composed of birch, sycamore maple and mountain ash, black birch, high mountain oak trees are found. The density of these groves is very low and between trees hogweeds, *Agasyllis latifolia,* forking larkspur, vernal whitlow-wort, wild lilies, bellflowers, Fleabane (Inula magnifica), etc. grow. This belt is used as summer pastures. Shrubs and bushes are represented by Georgian snow white rose, yellow azalea, blubbery and on the southern slopes – by junipers.

At the border with sub-alpine and alpine meadows rhododendron shrubberies are distributed. Sub-alpine and alpine meadows are spread up to the 3,000-3,010 m above sea level.

It should be noted that in the gorge of the r. Tskenistskali, forest belt is expanded and reaches one of the highest villages of Tsana in Lentekhi municipality.

In Martvili municipality, total state forest fund land makes up 33,924 ha. In 2006, 18,320 has been concessioner out the Georgian Forestry, LLC for long-term use to produce timber. Forest massifs from north to south are spread at 63 km and from east to west at 24 km. The latest comprehensive forest inventory and arrangement activities were conducted in 1989. In accordance with 1989 forest arrangement, total state fund has been divided into 5 forestry municipalities and 259 lots. Average area of the lots amounted to 130 ha, minimum area – 24 ha and maximum area – 229 ha.

In accordance with geo-botanical classification, forestry of Martvili municipality belongs to Colchic botanical zone of the Western Transcaucasia region. The region from the north is encircled by the Main Caucasus range, from the south – by the Adjara-Imereti ridges and from the west – by the Likhi or Surami ridge. Here tertiary Colchic refugium of relic plants species is found, including groves of box trees. Landscapes and vegetation cover are characterized with well-defined vertical zonality. More specifically, 5 vertical zones (belts) are found in the municipalities. The lowland belt of vegetation and landscapes is spread at an altitude up to 500 m and is represented by mixed broad-leafed forests of Imeretian oak, Georgian oak, chestnut, hornbeam. Highly humid areas of the Kolkheti plain are covered by alder and ash tree forest groves. The low-mountain forest belt is spread at an altitude of 600-1000 m and is represented by chestnut tree forests with rhododendron and cherry laurel forest understory. The middle-mountain forest belt is spread at an altitude of 1000-1,600 m and is represented by Oriental beech mixed with hornbeam, Caucasian linden, and maple and ash trees. Forest understory is composed of rhododendron, blueberry, Georgian snow white rose, etc. The high mountain forest belt is spread at an altitude of 1,500-2,200 m and is represented by Caucasus fir and Oriental spruce mixed with beech, birch, maple and other high-mountainous tree species. The forest understory is composed of thickets of rhododendron, blueberry, etc. The sub-alpine light forest belt is spread at an altitude of 2000-2,200 m consisting of mountain maple, birch and rhododendron thickets. Above this zone, sub-alpine and alpine meadows are found.

Among animals following mammals are met: brown bear, roe deer, wild cat, hare, chamois, jackal, fox, wolf, European badger, otter, pine marten, squirrel, etc. Among birds falcon, Sparrowhawk, hawk, duck, wild dove, woodpecker, owl, Eurasian eagle-owl (Bubo bubo), mistle thrush (Turdus viscivorus), Eurasian jay, common quail, dipper, Eurasian woodcock, etc. In the fresh waters trout, Caucasian goby (Ponticola constructor), roach, barbell, common nase, gobii, blue bream (or zope), European chub, etc

In Senaki municipality, natural landscapes on Kolkheti lowland-plain and partly on foothills, are almost entirely transformed into cultural landscapes due to anthropogenic pressures. Tertian Colchic relics are only maintained deep in the river gorges, in particular, on terraces and slopes at the altitude of up to 1000 m. Here about 50 trees and up to 80 grasses are relics. Nearly 2/3th of the adventive 450 plant species are spread in the Tertiary Colchic refugium. On the plain the most aggressively expanding non-aborigine species are pseudoacacia *(Robinia pseudoacacia),* honey locust *(Gleditsia triacanthos),* Japanese Cedar (*Cryptomeria japonica),* indigo bush *(Amorpha fruticosa),* Eastern Baccharis or cotton-seed tree *(Baccharis halimifolia),* milkweed or wild cotton *(Gomphocarpus fruticosus),* Rose of Sharon or Rose Althea *(Hibiscus syriacus),* Japanese honey suckle *(Lonicera japonica).*

Forest vegetation fragments in the Kolkheti plain are represented by secondary derivatives of alder. Average height of trees is 4-5 m and the most of tree is of 10-15 mm diameter. The density of the bonitet is 60-70%. In the open areas in addition to alder tree groves, one can meet gum trees ((Eucalyptus). Under-story communities of the elder forests are not well-developed and are represented by blackberry (Rubus anatolicus), Pontic tween flowered Daphne (Daphne pontica), privet (Ligustrum vulgare), etc. Among lianas smilax (Smilax excelsa) and silkvine (Periploca graeca) are found. Adventive grass species as *Truellum thunbergii, Oplismenus undulatifolius, Persicaria hydropiper, Arthraxon hispidus* are widely spread in the region*.*

Marshy and mezophilic meadows found in the municipality are used as pastures and are completely degraded. Dominant species of these meadows are *Juncus effuses, Alysma plantago-aquatica, Lythrum salicaria, Carex vesicaria, Persicaria maculate, Kyllinga gracillima, Poa pratensis, P. palustris, Setaria viridis, Mentha aquatica*. Widespread are also alien species such as: *Erigeron Canadensis, Solidago neglecta, Ambrosia artemisiifolia, Xsanthium strumarium,* etc.

In forests, meadow understory communities are represented by monodominant fern biocenosis (Pteridium tauricum).

Marsh vegetation is found along the drainage canals and as small fragments on inclined reliefs. Here following species are found: *Typha latifolia, Juncus effuses, J. bufonius, Sparganium neglectum, Carex vesicaria, C. acutiformis, C. pseudocyperus, Iris pseudocorus, Alysma plantagoaquatica.* In standing, still waters of drainage canals and ditches water vegetation creates sizable spots is represented by *Lemna trisulca, Lemna minor, Ceratophyllum submersum, Hydrocharis morsus-ranae* and *Salvinia natans*.

In Senaki municipality, very small part of the Kolkheti National Park is located.

In Abasha municipality, mostly lowland-plain vegetation cover of Colchic type and flood plain forests with meadow forest understories are found. Forests are composed of alder, floodplain oak, hornbeam, elm, etc. In the municipality, small section of the Kolkheti national park is located.

In Khobi municipality, climate is Kolkhic lowland humid sub-tropical and the vegetation cover is typical to such climate zone. More specifically, Colchic forests are spread represented by broad-leafed trees. Forests occupy about 22% of the total territory. However, very small section of the municipality located in the Rioni delta is included in the Rioni Basin and this area is mostly marshy, with marshy forests and meadows. The majority of natural landscapes in the lowland is transformed into cultural landscapes as a result of human intervention.

In the territory of v. Patara Poti there is a secondary forest grove near Nabada settlement represented by gum trees, alder, blueberry thickets and ferns. Small swampy lakes and canals are also met here. There area is rich in avia and ichtiofauna.

In the delta area and river mouth there are following fish species, both frashwater and migrating: northern pike (Esox lucius), Oriental chub (uciscus cephalus orientalis), Black Sea chub (euciscus borystenicus), roach (Rutilus rutilus), common rudd (Scardinius erytroptalmus), Colchic rhodeous (Rhodeous colchicus), tench (Tinca tinca), Shamaia or Danube bleak (Chalcalburnus chalcoides dejugini), AlburnusA(lbarnus albarnus), white breamB(licca bjoerkna), vimba (Vimba vimba tenella), common carp (Cyprinus carpio), wels catfish European perch (Silurus glanis), Colchic Nase (Chondrostoma colchicum), Colchic khramulya (Capoeta sieboldii), Crimean barbel (arbus tauricus escherich), Alburnoides bipunctatus fasciatus, Gudgeon or gobio (Gobio gobio), bull-runner (eogobius gumnotrachelus), spined loach (cobitus taenia), monkey goby (neogobius fluviatelis), Ginger goby (neogobius cephalages constructor), sturgeon or beluga (Huso huso), ship sturgeon (Acipenser nudiventris), Colchic or Persian sturgeon (Acipenser persicus colchicus), Atlantic or Baltic or common sturgeon (Acipenser sturio), Starry sturgeon (Acipenser stellatus), European Eel (Anguilla anguilla), Black Sea roach or Kutum (Rutilus fris), Lake Paliastomi shed (Alosa caspia paliostomi), Pontic shad (Alosa pontica), common kilka or sprat (Clupeonella cultriventris cultriventris), frash water bream (Abramis brama), three-spined stickleback (Gasterosteus aculeatus), Black Sea Big-scale sand smelt (Atherina boyeri pontica), flathead mullet (Mugil cephalus), golden grey mullet (Lisa aurata), Leaping mullet (Liza saliens), zander (*Stizostedion lucioperca*), black-striped pipefish (Syngnathus nigrolineatus), River Flounder (Platichthys flesus luscus), round goby (Neogobius melanotrachelus), tubenose Goby (Proterorhinus marmaratus), asp (Aspius aspius).

Guria region. Guria region, similar to most parts of the Samegrelo region, belong to the Kolkhic climate zone and therefore, vegetation cover is represented by flora specific to this humid sub-tropical climate zone. Sections of Chokhatauri and Lanchkhuti municipalitiess of Guria region, located within the Rioni basin are mostly represented by natural landscapes mixed with small areas of cultural landscapes of settled areas (Chokhatauri municipalities). Overall, forest covered area is high in Chokhatauri and amounts to 66.4%. Here mostly foothill and low to middle mountainous forests are spread.

Overall, Guria mountainous landscapes and vegetation cover are characterised by well-defined vertical zonality with three distinctive belts of forest, sub-alpine and alpine landscapes and vegetation cover. More specifically, on the foothills and low mountains at an altitude of up to 1000-1,100 m Kolkhic polidominant mixed forests of chestnut, hornbeam, beech, Colkhic oak, Caucasus linden, elm, et are found. From place to place they are mixed with pine and spruce. Monodominant forests are also met at such altitudes, including chestnut, hornbeam, oak, hornbeam-beech and hornbeam-shestnut forest groves. Dark coniferous forests are met at an altitude of 1,500-1,550 m to 1,800 m and are represented by spruce, fir, fir-spruce mixture, beech-fir mixture, beech-spruce-fir mixture forest formations (e.g. v. Chkhakaura in Chokhatauri municipalities located at 1,500 above sea level). In sub-alpine zones mixed light forests and sub-alpine shrubbery understories and grassy meadows are met.

2.1.6 Land Resources

General Information

In general, Georgian land resources are limited. Out of the total area of 69,700 km^2, according to 2005 data, agricultural lands occupied 30,200 km^2, of which cultivated lands (arable lands and land under perennial crops) accounted for only 10,700 km^2. Georgian lands can be divided into three categories in accordance with the main land use types: cultivated lands, natural economic areas (forests, brush woods, hay lands/pastures), and areas unusable for agriculture and forestry. Five climatic belts and eight soil zones can be identified in the country. There are 49 soil types concentrated on 10 different soil-forming rocks (for more details please refer to the map of soil types in Georgia, figure 1, annex 3). About two-thirds (65-70%) of Georgian soils are not rich in humus and mineral nutrients, and have poor physical structure. They also suffer from a too high groundwater table. The main agricultural lands suitable for cultivation are cinnamonic, grey-cinnamonic, black, raw-humus calcareous, subtropical podzol, red, yellow, silty-bog and, Soddy-peat soils. Quite a large proportion of agricultural land (6.7%, or 205,000 ha) has less productive and saline soils. Besides that, 8% (300,000 ha) of land is covered by acid soils and 7.3% (210,000 ha) – by boggy soils. In terms of suitability for crop cultivation Georgian soils can be characterized as ‘good’ and ‘medium’. There is practically no land area containing soils considered the ‘best’ for agricultural use.

Alazani-Iori River Basins

General. Due to the complex oro-climatic and biological conditions of the Alazani-Iori river basins, soils in the targeted areas are diverse and are represented by the following types of various soil bio-ecologic groups, in accordance with FAO soil classification system: Primitive soils – Leptosols (1); Mountain-meadow soils – Leptosols, Cambisols and Cryosols (2); Mountain-forest-meadow soils – Humic cambisols (3); Grey soils – Eutric cambisols (4); Mountain black earth - Chernozems (5); Humus-carbonate soils - Rendzic Leptosols (6); Brown soils - Eutric cambisols and Calcic kastanozems (7); Meadow brown soils - Calcaric Cambisols and calcic kastanozems (8); Grey-brown soil- Calcic kastanozems (9); Meadow grey-brown soils – Calcic vertisols (10); Alluvial soils – Fluvisols (11); Chernozem-like – Chernozems (12) Black earth soils – Chernozems (13); Marsh – Histosols (14); Saline soils – Solonchaks and solonetz (15).

Tianeti municipality. Complex oro-climatic conditions of the Tianeti municipality predetermine the diversity of the soils there that vary in accordance with vertical zonality of the landscapes.

In plain, foothill, slopes and depressions of low mountain areas, mountain black earth soils – chernozems are found, characterized by high humus content and fertility and cultivated for fruit growing. In the lower parts of the forest zone these soils are poorly developed and have low thickness. In the mountain-forest zone, mountain-forest meadow soils are met that above broad-leafed forest belts transform into primitive soils, characterized by very low fertility. In the lower zones of the forests on the limestone substrates humus-carbonate soils are met at an altitude of about 1,000 m. They are cultivated for fruit and serial crop production. On the river banks alluvial soils are met that are highly cultivated. In the high mountain zones, on the slopes of the mountains, mountain-meadow soils are found, which are used primarily as pastures and hey fields. In the Ertso plain (depression) chernozem-like soils characterized by very high fertility are met.

Akhmeta municipality. In Akhmeta municipality, on the tops and the slopes of the northern parts of the ridges low thickness primitive soils are met. In the high-mountain areas mountain-meadow soils are found and in the lower parts – brown soils. At some places steep slopes are free of topsoil, due to erosion. In the forests zones typical forest soils are met and, on the limestone deposits - humus-carbonate soils.

Telavi municipality. On the right bank of the Alazani River, alluvial-carbonate-clay soils are met, while on the right bank – meadow-forest alluvial clay soils. This type of soils as fragments are met on the foothills. In the denudative substrates of conglomerates and sand-stones brown soils are spread. On the lower parts of the slopes of Kakheti Caucasus and the Gombori range, under the broad-leafed forest cover on the substrates of clay and sand-stone deposits dark-grey soils are met. Above forest zone, under the sub-alpine grassy meadows mountain-meadow soils are found that in the alpine zones transform into primitive soils.

In terms of the soil types of various landscapes, they are as follows: alluvial soils are characteristic to the floodplain forests; meadow-grey-brown soils – to the valley with meadow-steppe vegetation; alluvial, prolluvial and humus-carbonate soils – to the valley with alluvial fans and forest-shrub understory vegetation; meadow brown soils – to the foothills with alluvial fans and hornbeam-oak forest vegetation; forest dark grey and brown soils – to the hills and the lower parts of the their slopes with hornbeam-oak vegetation; dark grey and brown soils – to low mountain zones with nornbeam-oak forest cover; grey-brown cqastanozems – to steepy middle mountain zones with beech, oak and chestnut forest cover; grey-brown calcic soils – to middle mountain hornbeam-oak and pine forests; mountain-forest-meadow and soils - to sub-alpine forests soils – to sub-alpine forests and meadow and; mountain-meadow soils – to alpine meadow.

Gurjaani municipality. In Gurjaani municipaluity, on the alluvial fans and slopes of the Gombori range forest brown soils are developed and in upper parts of the range – medium to low thickness dark-grey soils. On the Iori or Gare Kakheti Plateau low to medium thickness chernozems are most widely spread and on the Alazani valley alluvial non-carbonate soils dominate. Alluvial-carbonate soils are specific to meadows with steppe vegetation; saline soils – to the lanscapes with halophyte vegetation cover; chernozem soils - to the landscapes with feather grass-beard grass drought resistant vegetation cover; forest brown soils – to the low mountainous landscapes with oak-hornbeam forest cover.

Sagarejo municipality. Within the boundaries of Sagarejo municipality – slopes of Gombori Range – dark-grey and mountain-forest-meadow soils are developed, and on Iori elevation – grey-brown, chernozem-like and black soils; in the piedmont strip passing from Iori elevation towards Gombori Range – brown and meadowbrown soils. Mountain-forest-meadow soils (Humic cambisols) are developed in the highest hypsometric strip –1,700 – 1,800 m above sea level and higher. Due to intense development of erosion processes, here we mainly meet mountain-forest-meadow shallow (seldom – medium-thick) soils, scavenged at various degrees. In the places where soils experiences less erosion, its profile is differentiated, highly humified, and humus in the whole profile is distributed evenly. Soil is mainly skeletal. Mountain pastures are developed on the soils of this type. Dark-grey soils (Eutric cambisols) are spread on the territories of Gombori Range slopes, covered with broad-leaved forest. This type of soils is characterized by weakly differentiated profile, heavy clay composition and egg-cloddy structure. Dark-grey soil on the territories covered with forest is less impacted by erosion, and in the places cleared from forest, they are intensely scavenged. Brown soils (Eutric cambisols and calcic kastanozems). Brown soils within the boundaries of Sagarejo municipality are spread mainly on the slopes of Gombori Range. Part of these soils is developed under oriental hornbeam-oak forest-bushes of secondary origin, and at the height of 1,200 – 1,400 m and above carbonate rocks covered with oak-hornbeam forest. The soil is carbonate, skeletal, well-formed profile, egg-cloddy structure, rich with humus and consequently, highly fertile. Places, cleared from forest are easily eroded; brown soils on the territory of Sagarejo municipality are degraded at separate degrees due to improper cultivation, irregular application mineral fertilizers and pesticides, etc. Grey-brown soils (Clcic kastanozems) on the territory of the municipality are mainly met on plains and hollows. These soils have differentiated profile, heavy clay composition, are characterized by salinization, the soil is carbonate, contains 3 – 4 % humus. Content of nutritional substances for plants – potassium, phosphorus and nitrogen in grey-brown soils is average and above, although, due to more or less salinization of the most part of these soils, their use as agricultural grounds requires implementation of special land treatment measures. Natural swamps, as well as the signs of bogging caused by excessive irrigation along irrigational channels, are met in the place of spreading of these soils. Chernozem-like (Vertisols) soils are mainly spread on plains and hollows of Iori elevation and slightly sloped relief features. Soils of this type are formed in the result of degradation of black earth soils under the impact of human economic impact. Humus content in chernozem-like soils reach 6 %. The soils has heavy clay mechanical composition, are characterized by normal physical properties. Soils of this type are widely used under agricultural crops. Black earth soils (Vertisols) with average humus content are met within the boundaries of the municipality. More widely these soils are spread on Iori elevation – mainly on plains and slightly sloped relief. These soils are characterized by clay composition, contain 5- 6 % humus and high content of elements, required for plant nutrition. The soil profile is characterized by high porosity and good filtration ability. Black earth soils are widely used under agricultural crops.

Signagi municipality. Soils of the following types are spread on the territory of the municipality: Grey soils (Eutric cambisols). Soils of this type are developed to the west of Signagi – slopes of Gombori Range, under broad-leaved forest. Due to low density of forest, grey soils experience erosion. Its profile if weakly differentiated, having medium, and some places – big depth. The soil is skeletal, having heavy clay composition and egg-cloddy structure. Humus content makes 2.5 – 3.5%. Brown soils (Eutric cambisos and calcio kastanozems). Brown soils are developed in the top part of Gombori Range, under light forest, on carbonate rocks. In the places, cleared from forests, these soils are totally used in agricultural land farming. Brown soils have well-formed profile, depth – up to 20 cm; they are characterized by egg-cloddy structure, good drainage, have clay composition, are rich with humus, which is provided with elements, required for plant nutrition. Formation of meadow brown soils (Calcaric cambisols and calcic kastanozems) proceeds in the places of development of brown soils in the result of excessive irrigation and flooding. The profile of meadow brown soils is homogenous. Brown soils are rich with clay fraction, characterized by bad drainage conditions, weakly carbonated, often claying; are used under annual and perennial crops. Grey-brown soils (Calcic kastanozems) were formed on the next step of evolution of brown soils. Grey-brown soil is spread in the piedmont strip of the south part of Iori elevation, and represents stagnant soil. It is characterized by sulphate and partly chloride salinization, have heavy clay composition, contains humus up to 3 – 4 %; experiences bogging in the result of excessive irrigation. Use of these soils for agricultural grounds requires implementation of certain land treatment measures. Chernozem-like soils (Vertisols) are spread on the plain-hollows of Iori elevation and partly on Alazani plain. Chernozem-like soils are formed in the result of improper use of black earth soils, due to which bogging, salinization, sludging, etc. of the latter. In the result of above mentioned, black soils changed typical form and turned into chernozem-like soil. Humus content in chernozem-like soils is high (up to 6 %) and, these soils are characterized by normal physical properties, are used under agricultural crops on the most part of spreading. Black earth soils (Vertisols) are spread on the plains and hollows of the central part of Iori elevation, partly – on Alazani plain. According to mechanical composition it's clay, rich with humus (5 – 6%) and elements, required for plant nutrition; characterized with high porosity, good filtration ability. Majorpart of these soils are used under agricultural crops.

Kvareli Municipality. Part of the Kvareli municipality is located in the Eastern Georgia soil group region, specifically, in mountain-forest soil, Kakheti Caucasus middle-mountain forest dark-grey soil and mountain-meadow soil group zones. The other part of the municipalities is located in the Eastern Gerogia plain, transitional forest-plain and forest soil and, the Alazani Valley left bank forest-meadow alluvial non-carbonate soil group zones. The most dominant soil type is alluvial meadow-forest non-carbonate clay soils. On the foot-hills of the municipality, including areas of the city of Kvareli and villages Akhalsopheli and Eniseli alluvial-prolluvial soils are spread. In the gorges of the river Chelti and Intsoba alluvial meadow non-carbonate clay soils are spread. In the basin of the river Duruji there are several types of soils: forest brown soils, dark-grey soils, mountain-forest-meadow soils, primitive soils, and calcic kashtanozems and prolluvial-delluvial soils. On the left bank of the Alazani valley, non-carbonate alluvial soils dominate. However, from place to place on the Jurassic limestone substrates alluvial meadow carbonate clay soils are found. To the south of Gavazi humid meadow heavy clayey soils are spread.

In terms of soil types, specific to the various landscapes, they are as follows: alluvial soils are speicific to the accumulative plains with meadow-forest vegetation cover and to the alluvial fans with forest-shrubbery cover; forest-meadow-mountain soils – to the sub-alpine forest-meadow cover landscapes and; mountain-meadow soils – to alpine meadow landscapes.

Lagodekhi municipality. Primitive soils (Leptsols) are fragmentally spread on steep slopes of Caucasus, between the bare rock, above the height of 3,000 m. Due to strict climatic conditions, the soils of these types are on the initial stage of development. The thickness of their horizon doesn't exceed 5 cm on average. Mountain-meadow soils (Leptosols and Cambisols) are represented within the boundaries of Lagodekhi municipality by the sub-type of mountain-meadow turf-carbonated soils, which is spread above the height of 2,000 – 2,300 m above sea level. These soils are characterized by high humus content, high nitrogen content, high skeletality, light and medium-clay structure, quite high resistance against erosion; they facilitate the formation of the best summer pastures due to having highly nutritional vegetation cover. Mountain-forest-meadow soils (Humic Cambisols) are spread in sub-alpine zone; they are distinguished by relatively big thickness, heavy clay composition, skeletality and high humus content. Pastures are represented on the major part of spreading of these soils, and forest – of the part thereof. Grey soils (Eutric cambisols) are mainly developed under deciduous forest, and also occur in piedmont areas cleared from forests, where they are use in agricultural land farming. The soils have medium and average thickness, they are podzolised, skeletal, characterized by cloddy-egg structure, heavy clay composition; contain average amount of humus, are less resistant against erosion, experience the impact of erosion processes with more or less intensity in the areas, cleared from forests. Great part of brown soils is covered with the forest on the territory of the municipality. In the places, cleared from forest, they are used as agricultural grounds. They are characterized by well-formed profile (with the depth of 20 – 30 cm); they are skeletal, with egg-cloddy structure; the soils are carbonate and, are characterized by good agronomical properties, due to which is used in agriculture on the significant area of spreading. On some plots of irrigated areas, meadow brown soils are developed. Genesis of these soils relate to irrigation and impact of ground waters. The soil is carbonate, here and there, within its spreading; we meet the signs of sulphate salination. Highly fertile alluvial soils are spread on the territory of the municipality, with good structure, light mechanical composition, good drainage conditions and abundance of nutritional elements, required for plants. They are mainly used for melons and grounds, fruit orchards and vineyard plots. In some places alluvial soils are covered with riparian forest tracts. During intense high waters of the river Alazani and its tributaries, the areas, covered with alluvial soils, become flooded, which causes their erosion, and here and there – bogging.

Dedoplistskaro municipality. Soils of the following types are met within the Dedoplistskaro municipality: brown soils (Eutric cambisols and calcic kastanozems), developed on carbonate rocks and characterized by positive physical-mechanical properties and quite high fertility. Brown soils have heavy clay composition, well-formed profile (20 – 30 cm), egg-cloddy structure and good drainage conditions. Grey-brown soils (Calcic Kastanozems) are widely spread are transitional from brown to black soils. Grey-brown soils are rich in clay, are of carbonate type and are characterized by salinization, have differentiated profile, positive physical and mechanical properties, average content of nitrogen, phosphorus and potassium. Chernozem-like soils (Vertisols) are quite widely spread on the territory of the municipality; they are distinguished by high humus content (5 – 6 %), heavy mechanic composition, and good physical properties. From place to place chernozem-like soils are salinated. They are used for growing of various agricultural crops. Black earth soils (Vertisols) are also common to the municipality; they are distinguished by positive agronomical properties and, consequently, are used mainly under grain crops. These soils have well-developed profile, clay mechanic composition, contain 4 – 6 % humus, are rich with basic plant nutrition elements (nitrogen, phosphorus and potassium). Alluvial soils (Fluvisols) are spread along the riparian forests of the rivers Alazani and Iori. Most of them are used for growing melons and grounds. Alluvial soils are characterized by high agronomical properties, light mechanical composition, good structure. The soil is carbonate and quite rich in micro elements, required for plants. From place to place they suffer from high salinity, and at some places one can meet waterlogged plots.

Gardabani section located in the Iori River Basin. Landscapes and soils of Sartichala and Muganlo settlements and their surroudings are representes by moderately dry sub-tropical plains plateau landscapes with semi-desert, dry steppe, shibliak and light wook, mountain forest and mountain meadow vegetation cover. These landscapes are mostly degraded due to anthropogenic pressures of industrial and urban development type. These landscapes are characterized by dark brown, boggy, salinized and mountain meadow soils.

Rioni River Basin

General Information. In general, soils of the Rioni River basin belong to the West Georgia soil group region, which are represented by lowland-plain mursh and podzol, foothill-hill, mountain-forest and mountain-meadow soils.

On the Kolkheti plain, the majority of the land is covered with marsh and sub-tropical podzol and grey podzol soils. The largest areas among marsh soils are covered by siltybog and peatbog soils. On the elevated areas of the plain, sub-tropical grey podsolized soils dominate and on the first level terraces of the rivers – alluvial soils. Hills and foothills of the Basin are covered with red and yellow soils, with red soils dominating between given two types. Red soils are most widely spread on low slopes and tops of the hills and claly marls and comglomerate substrated in Okriba (Tkibuli and Vani municipalitiess). In mountain-forest zones on the limestone conglomerate, mergels and carbonate substrates row-humus calcareous soils (redzins) are met. Middle mountain-forest zone is most widely represented brown forest acid soils (dystic Cambrisols). In the higher zones of coniferous forests brown podsolized soils are met, which are chracterized by low humus content (fulvic acids) and thickness of the topsoil. They are mostly met in monodominant spruce and beech forests. In the upper Imereti, Svaneti and Samegrelo very large areas are covered by mountain-meadow soils. The smaller areas are covered by these soils on Meskheti ridge and Likhi ridge. In sub-alpine and apline grassy meadows meadow-mountain soils are found. Al the lower altitiude transitional to the forest zone, secondary mountain-meadow non-fertiles soils are spread. Al the high altitides where alpine meadows are met, mountain-meadow soddy peat soils are found. Such turfy soils are widely spread on the sub-alpine zones of the Caucasus, where rhododendron thickets are met. Upper parts of the Caucasus alpine zones mountain-meadow primitive soils are spread (for more details please refer to the map of soil types, figure 1, annex 3).

Racha-Lechkhumi and Lower Svaneti. In Racha part of the Racha-Lechkumi and Lower Svaneti region, following soil types are met: yellow and red soils are specific to the foothill and low mountain forest landscapes with Colchic vegetation cover that are spread at an altitude of 600-900 m; brown forest soils prevail on middle mountain beech forest landscapes that are spread at the altitude of 800 -1,500 m; On the right bank of the r. Rioni raw humus calcareous soils are spread on limestone substrates; forest brown podzolized soils are specific to the middle mountainous dark-coniferous and mixed beech-dark-coniferous forest landscapeds that are spread at the altitude of 1,500-2,000 m above sea level; mountain-forest meadow soils are specific to the upper mountain beech-maple forest landscapes that are spread at the altitude of 1,800-1,900 m above sea level; mountain-meados soils are specific to the sub-alpine elfin (light) woody meadow and primitive soils – to the alpine meadows spread at the altitude of 2200-3300 m above sea level.

In Lower Svanety and Lechkhumi, low to middle-mountain broad-leafed forests mixed with fir and pine are represented by forest brown and forest brown podzolized soils (450 m to 1200-1300/1500m above sea level). The landscapes with monodominant beech and fir and spruce forests are represented by brown podzolized soils. Sub-alpine forest-meadow zone with rhododendron shrubbery understory is represented by mountain-forest boggy meadow soils (from 1,750-1,800 m to 2,600 m). Sub-alpine and alpine meadows are represented by mountain-meadow soils (up to the altitude of 3,250 m above sea level).

Ambrolauri municipality. In Ambrolauri municipality, mountain-forest-meadow soddy sub-alpine soils are spread at sub-alpine and alpine zones. Below this zone, forest brown acid, raw humus calcareous and raw humus padzolized soils are met. On the rivers banks and its terrates alluvial soils are spread. In terms of vertical zonality, the highest altitides (from 1,800-2,000 3,800-3,000 m) are represented by mountain-meadow soils, which are bordered with mountain-forest-meadow soils.

Oni Municipality. In Oni municipality similar to Ambrolauri municipality, foothills, hills and low mountainous areas are represented by yellow soils, foothill and hill areas as well as middle mountain forest areas – by forest brown and forest brown podzolized soils, middle mountain dark-coniferous forest landscapes – by forest brown podzolized forest, high-mountainous dark-coniferous and beech forests – forest brown podzolized soils; sub-alpine elf woody meadow landscapes – by mountain-forest-meadow soils; sub-alpine and alpine meadows – by mountain-meadow soils and upper parts of the alpine meadows and sub-nival landscapes – by primitive soils. On the younger terraces of the river banks alluvial soils are met, while on older and limestone substrates on the right bank of Rioni – raw humus calcareous soils.

Tsageri municipality. In Tsageri municipality, plains, foothills, hills and low mountain areas are covered with yellow soils. On limestone substrates raw humus calcareous soils are met, on the younger terraces of the floodplains – alluvial soils. Vertical zonality of soils is similar to the Oni and Ambrolauri municipalitiess are associated with spreading of various landscapes typical to the region.

Lentekhi Municipality. Lentekhi municipality similar to other municipalities of the region belongs to the West Georgia soil type region that encompasses South-west part of the Greater Caucasus range. Here mostly mountain-forest soils are spread. More specifically, here middle mountain forest brown and forest brown podzolized soils prevail. Hower, mountain-forest-meadow and mountain-meadow soils are also represented here at sub-alpine forest-meadow and meadow zones. On steepy and rocky areas primitive soils are met.

Imereti Region

General. Large areas of Imereti region are represented by yellow and red soils cultivated for the production of sub-tropical cultures. There are only two large massifs in the region represented by sub-tropical podzol and sub-tropical greish podzolized soils.

Tkibuli municipality. In Tkibuli municipality prevailing type of soils is raw humus calcareous soils. There are also yellow soils and forest brown acid soils. On the terraces of the r. Tkibuli alluvial soils are spread. Steep rocky surfaces are completely removed of topsoil. In terms of soil types of various landscapes, they are as follows: yellow, raw humus calcareous and forest brown soils are specific to foothill-hilly beech-oak-chestnut forest landscapes; forest brown soils are specific to low mountain beech-chestnut forest landscapes; raw humus calcareous soils are specific to karst low mountain hornbeam-oak forest landscapes and; forest brown soils are specific to middle mountain beech-dark coniferous forest landscapes.

Sachkhere Municipality. In Sachkhere municipality, forest brown and raw humus calcareous soils specific to foothill and hills and low mountain forests of the Imereti upland are spread.

Chiatura Municipality. In the municipality dominant types of soils are raw humus calcareous soils that are developed on the limestone and carbonate sandstone denudation substrates. At an altitude of 1,300-1,500 m forest brown and forest brown podzolized soils are spread. On the younger lower terraces of the river Kvirila and its tributaries alluvial soils are spread and on the old terraces – sub-tropical grey podzol (greysols) and sub-tropical podzol (stagnic acrisols) are spread. In terms of soil types of various landscapes, they are as follows: forest brown acid and raw humus calcareous soils are specific to hilly plateau with oak-hornbeam forest cover; raw humus calcareous and forest brown soils are specific to the flat plateau with oak and beech forest groves; raw humus calcareous soils are specific to low karst mountains with hornbeam-oak forest cover; forest brown soils are specific to middle mountains with beech forest cover; raw humus calcareous, yellow and sub-tropical podzol soils are specific to plain-hilly foothill (piedmont) landscapes with Colchic forests.

Terjola Municipality. In the Terjola municipality on the Imereti lowland (plain), major soil types are sub-tropical podzol and alluvial soils. While surfaces of old sediments are covered by podzol soils, young river terraces of Quaternary period are covered by alluvial soils.

Vani municipality. In Vani municipality, dominant soils are mountain-forest brown and mountain-forest brown podzolized soils. Mountain-forest-meadow as well as mountain-meadow soils are also met, but at smaller areas than forest brown and brown podzolized soils. In terms of soil types of various landscapes they are as follows: alluvial soils are specific to floodplain forest-meadow; sub-tropic podzolized soils are specific to the inclined lowland-plains with Colchic vegetation; yellow, red and raw humus calcareous soils are specific to hills and foothills with Colchic vegetation cover; forest brown soils are specific to the middle mountain landscapes with beech forest cover; forest brown and forest brown podzolized soils are specific to the humic sub-tropic middle mountain landscapes with beech-dark coniferous forest cover; mountain-forest meadow and mountain meadow soils are specific to the sub-alpine forests and meadows and; mountain meadow soils are specific to alpine meadows.

Kharagauli municipality. In Khragauli municipality, particularly in the Borjomi-Kharagauli national park mostly mountain-forest and mountain-meadow soils are met. The territory of the park almost entirely belongs to the Colchic morpho-geographic and biological regions. Typical Colchic landscapes represented by foothill and lowland subtropical forests with evergreen plants in the understory are characterized by yellow and red soils. Mountain and subalpine forests and meadows widely represented in the park are characterized by mountain forest brown, mountain forest brown podzol, mountain-forest meadow and mountain meadow soils.

Bagdati municipality. Baghdati municipality is stretched over high, middle and low mountainous areas, including the Meskheti Range. Following major landscapes are spread here: low plains with Colchic vegetation and oak forests; foothills and low mountains with Colchic vegetation; Colchic middle mountains with beech, beech-dark coniferous forests and evergreen understorey; Caucasian upper-mountain landscape with beech and pine forests; Caucasian sub-alpine landscapes with combination of meadows, high-herb communities, elfin woods and brush thickets and; alpine meadows. Each of these landscapes are characterized by certain types of soils. Namely, low plain landscapes with Cochic vegetation and oak forests are characterized by sub-tropical podzol and grey podzol soils; foothills with Colchic vegetation – by yellow and red soils or raw humic calcareous soils; middle mountain beech, beech-dark coniferos forests – by forest brown soils; Caucasian upper-mountain landscapes with beech and pine forests – by forest brown podzolized and mountain-forest-meadow soils; Caucasus sub-aline forest meadow landscapes – by mountain-forest-meadow soils and; alpine meadows – by mountain meadow soils.

Zestaphoni municipality. In Zestaphoni municipality, on the Imereti lowland, major soil types are sub-tropical grey podzol and alluvial soils. Relatively older sediment substrates are covered by podzol soils, while the younger (upper Quaternary) riverine alluvial terraces – by weakly developed top soil alluvial soils. Hills and foothills are covered by raw humus calcareous rendzic soils; Steepy slopes are covered by leached and eroded raw humus calcareous soils. On the east side of the r. Rioni forest brown podzolized soils and on the northern slope of the watershed ridge of the rivers Kvirila and Sakrauli forest brown soils are spread. Here humid low mountain beech forests are spread.

Tskaltubo municipality. In Tsaltubo municipality, on Imereti lowland similar to Zestaphoni municipalities sub-tropical podzol and alluvial soils dominate, with podzol soils spread on old (mature) deposit substrates and alluvial soils – on young terraces of the floodplains. On the foothills, yellow soils and raw humus calcareous soils on karst relief are spread. On the middle mountain deciduous forest landscapes – yellow and forest brown soils and on the karst substrates – raw humus calcareous soils.

Khoni municipality. In Khoni municipality, on Imereti lowland sub-tropical podzol, podzolized grey and alluvial soils are spread. On hilly, foot-hill and low mountainous areas yellow soils are spread. Middle and high mountain areas are characterized by forest brown, forest brown podzolized soils and sub-alpine areas – by mountain-forest meadow and mountain-meadow soils. Among thes mountain-forest soils the most dominant and widely spread are forest brown soils.

Samtredia municipality. In Samtredia municipality, on the Imereti lowland, yellow soils are spread on the old terraces of the floodplains and alluvial soils – on the young terraces of the floodplains. In the very small area in the extreme west of the municipality peat bog soils are also met. On the foothills and hills raw humus calcareous, yellow and yellow podzolized soils are spread and on the slopes – clayly humus calcareous soils.

Samegrelo region. Samegrelo like other regions of the Rioni Basin belongs to the West Georgia humid soil type region. Here following types of soils specific to various landscapes are found: peat-bogs, silty-bogs (gleysols), red, yellow, raw-humus calcareous, alluvial, and gray podzolized soils are found on the Kolkheti plain lowland and its hilly areas at an altitude of 0-450 m above sea level; mountain forest, forest brown and raw-humus calcareous soils are specific to low to middle mountain landscapes with deciduous forests cover of beech, fir, oak at an altitude of 600-1,600 m; mountain forest brown podzol and mountain-forest meadow soils are specific to the middle to upper mountain forest landscapes with beech and fir cover and, to the sub-alpine forests at an altitude of 1,500-2,000 m; mountain-meadow boggy and mountain meadow soils are specific to the mountain plains, meadows, sub-alpine meadows at an altitude of 1,400-2,500 m and; mountain meadow and primitive alpine soils are specific to the high mountain meadows, sub-alpine forests, bushes, sub-alpine meadows at an altitude of 2,000-3,500 m.

More specifically, peat-bog soils with a width of 2-8 km are spread in the coastal zone. The average depth of the peat is 3-5 m and the maximum depth – 8-10 m. Along the river beds of the marshy rivers silt-bog soils are met. At the relatively elevated areas of the Kokheti plain, at an altitude of 100-200 m above sea level varieties of alluvial soils are found, developed on alluvial clay and loamy sand substrates. These soils are characterized by low humus content. At the marine and riverine upper terraces sub-tropical grey podzol soils are met covering the clay and clayey sediments. On the low height hills of the foothills and old terraces yellow soils are spread. On the hilly-foothill areas with a height of 170-200 m relatively smaller areas are covered by red and red podzolized soils, mostly in Zugdidi and Tchkhorotsku municipalities. On the foothills at an altitude of 200-500 m above sea level raw humus calcareous soils are met, which are used as arable lands and perennial (laurel) crop lands. At an altitude of 400-700 m, foothill and low mountain broad-leafed and mixed forests are spread, characterized by forest brown soils. At higher altitudes forest brown, forest brown podzol, mountain-forest-meadow and mountain-meadow soils are spread.

Martvili municipality. The dominant soil types in Martvili municipality are middle mountain forest brown and middle to high mountain forest brown podzolized soils. In some parts of the municipalities, raw humus calcareous soils are met and, in others – Samegrelo (Egrisi) ridge, mountain-meadow soils of the secondary meadows are found. These soils in areas of meadows with rhododendron thickets mountain meadow soddie peat soils are met. On the floodplains prolluvial-delluvial soils are found. In rocky, steep areas the surface is completely free of soil. In the lowland hilly and foothill areas yellow and red and on the plain area sub-tropical soils are found.

Abasha municipality. In Abasha municipality alluvial and sub-tropical gray podzol soils are most widely spread. Both alluvial and podzol soils are specific to the lowland-plain areas with Colchic vegetation cover. While old (mature) substrates are covered by podzol soils, younger sediment substrates are covered by alluvial soils. Floodplain forests and meadows are characterized by alluvial soils.

Khobi Municipality. In the Rioni basin, only the section of the Rioni delta is included covering several villages.

Senaki Municipality. Sub-tropical gray podzol and peat-bog, silt-bog, silt-gley soils dominate. In addition, alluvial calcareous soils are met on the floodplains of the rivers.

City of Poti. Surroundings of the city of Poti along the sea shore are covered by peat bog marshes an in bogged river beds by silt bogs.

Guria region. In the Guria section of the Rioni Basin mostly foothill landscapes are met with red and yellow soils. The latter occupies wider areas than red soils.

2.1.7 Mineral Resources

Alazani-Iori River Basins

Kakheti region. Kakheti region is rich in mineral resources. Limestone is extracted in Sagarejo, Signagi and in large quantities, in Dedoplistskaro municipalities, and shale marble - in Akhmeta and Telavi municipalitiess. Brick clays are extracted in Sagarejo, Signagi, Lagodekhi and Gurjaani municipalitiess. Oil and gas deposits exists in Sagarejo, Guraani, Dedoplistskaro and Signagi, the majority of which is extracted. Preliminary estimates suggest oil reserves at 2-7 million tons in Sagarejo. At present, 260 tons of oil is extracted per day. Experts think that the Taribana valley (78 km^2) in Dedoplistskaro municipalitiess may contain billion of tons of oil reserves. Copper deposit is discovered in Telavi municipalities, which gives a possibility to attract solid investments to produce a blue vitriol. In addition, there is a diabase (dolerite equivalent to volcanc bazalt or puttonic gabro) deposit that was extracted in the past in Akhmeta municipality, murble-like limestone deposit not extracted now – in Akhmeta and Signagi municipalities and lime deposits in Signagi and Dedoplistskaro municipalities. Mineral water is extracted in Ujarma, Sagarejo municipalities (for more details please see the maps of the mineral deposits of Georgia, figures 2,3, annex 3 and the table of licenced mining operations, annex 3).

In Akhmeta Municipality, there is an unexplored oil deposit near the village Vedzebi, in the surroundings of the Kvetera Fortress. In addition, various kinds of marble deposits in the valleys of the rivers Alazani and Ilto are present. Diabase deposit exists in the municipality as well. Akhmeta Municipalty is also rich of healing waters (the Baths of Torghva, the sulpher springs at Khevischala, the Bakana Mud).

In Telavi Municipality, following mineral resources are found: high-quality white marble deposit at the administrative boarder of Kvareli and Telavi in the river Lopota gorge (left tributary of the river Alazani); copper deposit – in Intsoba gorge; copper, lead and zinc deposit in Girgali; copper deposit in Kvatakhevi area; copper deposit in Gonjatkhevi area; copper deposit in Supura area; copper deposit in Avaniskhevi area; copper, lead and zinc deposit in Loduani area; copper deposit in Mtsare - Diki area; copper, lead and zinc deposit in Adalaskhevi; copper deposit in Shorokhevi-Goloiani area; copper deposit in Kresha area; marble deposit in village Tivi; clay-shale deposit in village Sabue; clay deposit in village Zinobiani; construction materials (gravel, pebble, etc.) in river Duruji; sulphur thermal waters of Gonjakhevi, with temperature of +4-20^{0}C (mineralization level is 30-150 g/l).

In Gurjaani municipality, there is an Akhtala pseudovolcanic mud deposit. It is the only medical mud resort in Georgia 412 meters above the sea level. It is located in Gurjaani, 120 km away from Tbilisi. There are seven main craters in the city. The Akhtala mud consists of three main components: the mud fluid, the crystal part and the colloidal admixtures. The mud fluid is rich in iodine, bromide, chlorine and sodium. The crystal part of the mud is rich in calcium and has a pure clay complexion. The colloidal complex consists of boric acid, iodine and bromide. The volcanic gases of the erupted mud have argon and helium in it. The Akhtala Mud has several different healing features and based on those features Medical Cottages were built around the spot in 1924. Lateron, in 1931-1932 the Medical sanatorium was constructed. Already in 1935 the big two-story medical clinic was added to the complex. Daily discharge (debit) of the source is from 5,000 to 12,000l of mud. In accordance with many scientists, there are oil and gas deposits of the north and southern slopes of the Kakheti range at a depth of 2,000 m. They are covered with pliocene sedimentary rocks of clays, conglomerates and sandstones. From the depth the gas coming to the surface encounters infiltrates of surface waters in clay layers. So that from the deep earth, clays mixed with water and gas (forming the mud), from hollow places through forcing by gas streams are erupted to the surface.

In Kvareli municipality, limestone deposits are found all across the entire municipality and were in the past extracted for producing the construction materials. In addition, extraction of brick and ceramics clay was very intensive within the municipality. The reserves of the deposit are practically unlimited. The territory in the north of the village Sabue is well-known with the high-quality flat stone, so-called "Pikali". High quality marble deposits are found in the east of the municipality. The inert materials in the bed of river Duruji the high quality sand is characterized by the high degree of stickiness and is a superb material for producing the cement, bricks and other construction materials. The resources are huge to be used in the construction sector. There are also many resort zones with the healing mineral waters that are currently unutilized.

Lagodekhi municipality is not rich in mineral resources. Only small deposits of brick clay exist there.

In Dedoplistskaro municipality, there are significant oil and gas reserves and large deposits of limestone. The JSC "Arcivis Kheoba" produces approximately half a million tons of limestone a year. The limestone is also produced by the "Rustavcementi" LTD and "Kalciti" LTD. Frontera Resources Corp conducts oil and gas exploration and drilling operations as a part of the block 12 license in Georgia in Mtsare Khevi, Mirzaani, Patara Shiraki, Tarribana valley, etc (for more details please refer to the map of oil deposits and drilling operations in Georgia, figure 4, annex 3). The largest approved deposit is Tarribana valley. In the Mtsare Gorge Frontera extracts heavy oil, in Taribana – light oil, in Nazarli – medium. Extractions of the company do not exceed several thousand tons a year. Currently, the company is focused on identifying the geology of the potential deposits. The company invested 100 million USD in exploration works, which has enabled it to determine the borders of the two potentially promising oil deposits. According to some estimates, these deposits, located on the upper and lower parts of the Kura Basin, may be commercially viable.

As per estimates of prospective resources of shallow fields of Mirzaani, Mstsare Khevi, Nazarbeli and Patara Shiraki made by Netherland Sewell and Associates (NSA), the "Best Estimate" for gross (100 percent) original oil-in-place is 626.2 million barrels, with a "low"-to-"high" range of 397.4-991.9 million barrels; and "Best Estimate" for associated recoverable gross contingent and low-risk prospective oil resources is 52.1 million barrels, with a "low"-to-"high" range of 24.9-101.3 million barrels (Includes Mirzaani Northwest Extension and Mtsare Khevi Prospects.) As for gas reserves, for Mtsare Khevi Field the "Best Estimate" for gross (100 percent) original gas-in-place is 2.6 billion cubic feet, with a "low"-to-"high" range of 2.1-3.1 billion cubic feet; and the "Best Estimate" for associated gross contingent and low-risk (safe yield) prospective resources is 1.5 billion cubic feet, with "low"-to-"high" range of 1.2-1.9 billion cubic feet (Includes Mtsare Khevi Prospect) Mirzaani, Mtsare Khevi, Nazarlebi and, Patara Shiraki Fields, represent explored but yet undeveloped or underdeveloped fields with additional associated exploitation potential. In addition, this unit contains prospects similar to Kakabeti, Lambalo, Mkralihevi, Mlashiskhevi-Oleskhevi and Tsitsmatiani prospects (Sagarejo). Each of these prospects contains Soviet-era wells that demonstrated hydrocarbon shows while drilling but were never placed on production or adequately appraised. Objectives are considered to be traditional, well-known reservoirs of Pliocene and Miocene age that are situated at depths from 10 meters to 1,500 meters. Discovered in 1932, the Mirzaani Field has historically produced approximately 7 million barrels of oil, but contains extensive undeveloped and underdeveloped areas. The Mirzaani #1, #2 and #5 wells are the newest wells to be drilled in the field since the Soviet-era. In 2006, Frontera acquired approximately 100 kilometers of new 2D seismic data over the field area as part of an effort to re-map and identify new potential associated with the field. The new independent assessment by NSA places a "Best Estimate" for gross original oil-in-place for the Mirzaani Field and Mirzaani Northwest Extension of 541.7 million barrels, with a "low"-to-"high" range of 343.8-857.3 million barrels; and a "Best Estimate" for associated recoverable gross contingent and low-risk prospective oil resources of 43.8 million barrels, with a "low"-to-"high" range of 20.5-86.1 million barrels. This assessment is consistent with Frontera's internal estimates. The Mtsare Khevi Field is located in the western portion of Block 12 with multiple objective reservoirs situated at depths between 200 meters and 1,100 meters. The field was discovered, nominally produced and partially delineated with multiple exploration wells from 1989 to 1994, but never developed. After completing a field study in 2007, Frontera designed a plan to bring the shallow reservoirs from the Akchagil formation into production. The new independent assessment by NSA places a "Best Estimate" for gross original oil-in-place for the Mtsare Khevi Field of 14.9 million barrels, with a "low"-to-"high" range of 11.3-19.7 million barrels; and a "Best Estimate" for associated recoverable gross contingent and low-risk prospective oil resources of 2.1 million barrels, with a "low"-to-"high" range of 1.4-3.2 million barrels. This assessment is generally consistent with Frontera's internal estimates for the Akchagil formation. For gas, NSA places a "Best Estimate" for gross original gas-in-place for the Mtsare Khevi Field of 2.6 billion cubic feet, with a "low"-to-"high" range of 2.1-3.1 billion cubic feet; and a "Best Estimate" for associated gross contingent and low-risk prospective resources of 1.5 billion cubic feet, with "low"-to-"high" range of 1.2-1.9 billion cubic feet. Frontera's internal estimates reflect additional resource potential along the northwest trend of the fault block, which NSA was not asked to evaluate.

In Sagarejo municipality, major mineral resources are oil and gas and, brick clay. Limestone in small quanitities is also extracted. Sagarejo oil and gas fields include Ninotminda, Patardzeuli and Manavi fields. While oil and gas fields are already exploited for oil and gas production in Ninotsminda and Patardzeuli fields, exploration works are on-going on Manavi field. Ninotsminda and Manavi oilf fields are operated by Canargo, US and Georgian government joint stock gas and oil producing company. It entered Georgia in 1997 and has been working on the deposits of Ninotsminda, Nazvrevi, Norio, Rustavi, and the XIII block. All of these deposits were discovered during the Soviet era. The main producing deposit of the company – Ninotsminda located at a depth of 2,600 meters – was discovered in 1979. The deposit has yielded 11.5 million barrels of oil and 331 million cubic meters of gas. In 2008, Canargo extracted 21,000 tons of oil. The company extracted the greatest amount in 2003 (92,000 tons). Subsequently, the extraction has been substantially decreased. On the Ninotsminda deposit the gas cap still exists. It amounts to approximately 430 million cubic meters. Canargo is also engaged in extracting gas (70-80 thousand cubic meters annually). This gas is supplied to the population of Sagarejo through the pipeline. Canargo has not completed exploration works on the Manavi block so far. According to the existing assumption, the Manavi block could be described as a medium size deposit.

Patardzeli oil and gas field is operated by Iori Valley - Oil and Gas Ltd, one of the major Georgian oil companies, with 100 % of its shares fully owned by the State. The total licensed territory of 367.395 square kilometers out of which 133.27 square kilometers already developed and – 234.125 yet unexplored. The licence of the company is valid until 2021.

In addition to above oil and gas deposits, there are Kakabeti, Lambalo, Mkralihevi, Mlashiskhevi-Oleskhevi and Tsitsmatiani prospective sites, which are thought to have the following prospects: "Best Estimate" for gross (100 percent) original oil-in-place of 91.9 million barrels, with a "low"-to-"high" range of 57.7-147.7 million barrels; and "Best Estimate" for associated recoverable low-risk prospective oil resources of 8.7 million barrels, with a "low"-to-"high" range of 4.8-16.2 million barrels.

In Signagi municipality, there are limestone, marble-like limestone, brick clay and, silica clay deposits. Some of them are extracted, some of them not. There are also oil and gas deposits in the municipality.

Tianeti Mtskheta-Mtianeti region. In Tianeti municipality is relatively poor in mineral resources. Deposits of limestone and brick clay are found here. There is also an extraction of sand and gravel for construction materials as well as extraction of peat.

Kvemo Karli Region. In Iori section of the Gardabani municipality, oil and gas deposits are found on the Iori Plateau, which are extracted by company Ioris Valley in Samgori and Teleti settlements. There are also limestone and clay deposits in Sartichala.

Rioni River Basin

Racha-Lechkhumu Kvemo Svaneti Region. Racha-Leckhumi region is very rich in non-ferrous metal and non-metal mineral deposits. At a lesser extent, ferrous mineral resources are also found in the region. Among existing mineral deposits, arsenic and associated metal (gold, molybdenum, antimony, etc.) ores found in Ambrolauri and Lentekhi municipalities are the most important ones. There is also smaller deposit of gold in Oni municipality. In terms of other metals, there are small to medium-size deposits of copper and associated metals (zinc, lead, cobalt, etc) in Lentekhi, Oni and Tsageri with the largest deposits found in Lentekhi, deposits of lead and tungsten and associated metals in Oni and Lentekhi municipalities and, lead and zinc enriched with gold and silver in Oni, Lentekhi and Tsageri. With regards to ferrous metals, Chiatura deposit-like manganese is found in Oni and Ambrolauri, which are currently not extracted. In addition, ore deposits are found in Oni and Ambrolauri. Mercury deposits are found in Oni and Lentekhi municipalities. In terms of non-metal minerals, gabbro, diabase, limestone, brick clays, gravel, quartz, calcites, barites, pyrites, etc. exist in every municipality of the region. Finally, the region is extremely rich in mineral waters. In terms of precious stones, striped agate deposits are found in Tsageri municipality (for more details please see the maps of the mineral deposits of Georgia, figures 2,3, annex 3 and the table of licenses mining operations, annex 3).

In Ambrolauri municipality, as it was mentioned above, there are significant arsenic (As) deposit, associated with antimony (Sb) and gold (Au) found in the gorge of the river Lukhuni. The resource amount is 123,000 tons of ore reserves, 9,600 tons of arsenic reserves and, 1,300 tons of gold reserve. The amount of prospective resource is not known. Lead deposits associated with zinc and copper are found in Sokhortuli Tskali gorge and Sapertsvali and, lead associated with zinc – in Uravi and Tkhshori areas. In terms of ferrous metal deposits, these are as follow: Tkibuli-Shaori siderite ($FeCO_3$) deposit with 72,000,000 tons of prospective reserve; Gvardi-Baji, Baji and Zeda Savri manganese deposits with unknown reserves. Furthermore, there are antimony (St, Sl, Au) and associates metals unexplored reserves in Kajiani and and Chaduani. In terms of non-metal minerals, there are diabase (Lataskhuri: 107,000m3 approved reserve), murble-like (ornamental, facing stone) limestone (Ambrolauri: 3,174,000 m3 of approved reserve; Znakva:

6,045,000m3 of approved reserve; Khotevi: 4,116,000 m3 of approved reserves); limestone gravel and sand (Djoshkha: 3,730,000 m3 of approved reserve; Nakerala: 70,200 m3 of approved reserve), lime (Zeda Gvardia: 1,000,000m3 of approved reserve; Tsakhi: 400,000m3 of prospective reserve), brick clay (Ambrolauri: 221,000 m3 of approved reserve; Ambrolauri: 339,000 of approved reserve), gypsum (Tchrebalo: 3,479,000m3 of approved reserve; Mukhlitsesi: 12,080,700 m3 approved reserves; Tchrebalo with unknown quantity of reserves), barites and calcites (two deposits in Ambrolauri with unknown amount of resources).

In Oni municipality, there are ferrous and non-ferrous metal and various non-metal deposits, including: manganese (Shkmeri: 4,218,000t of approved and 2,180,000t of prospective reserve); copper and zinc with associate metals of lead, gold and silver (Edeni with unknown amount of resource, Oni with unknown amount of resources, Notsaruli with unknown amount of resources, Chukhtuni with unknown amount of reserve, Phasis Mta (mount) with unknown amount of reserve, Sagebisgele with unknown amount of reserve, Khvrelieto with unknown amount of reserve, Chkhornali with unknown amount of reserve, Tskharosphari with unknown amount of reserve, Mziuri with unknown amount of reserve, Kodnarua with unknown reserve, Didveli with unknown reserve, Khvarguli with unknown reserve, and, Tbilisi with unknown amount of resource); molybdenum and its associated metals: Cu, Au, (Karobi and Nunistskali with unknown reserve); lead and zinc with their associate metals (Telnari: 6,565,000t of approved ore reserves, 24,000t of approved and 92,000t of prospective lead reserves, 36,000t of approved and 135,000t prospective zinc reserves; Kiritosho: 572,600t approved, and 1,058,000t of prospective ore reserves, 5,260t of approved and 8,200t prospective antimony reserves; 15,200t approved and 28,800t prospective lead reserves; 7,300t of approved and 13,200t of prospective zinc reserves, 1,530t of approved and 2,900t of prospective gold reserves and, 117,700t of approved and 225,000t of prospective silver reserves; Kveda Tsveri with unknown reserves, Kvaishuri with unknown reserves, Grdjami with unknown reserve, Didveli with unknown reserve, Kvakatsi with unknown reserve, Tsedisi with unknown reserve and Sakhare with unknown reserve; Madjieti, Sakauri, Phitsris Khuli, Rubodzali, Mushuani, Pharavnishi and Khideshlebi with unknown reserves); antimony and its associate metals (Kvarzakheti: 1,071,100t of approved and 3,673,000t of prospective ore reserves; 7,500t of approved and 15,000t of prospective antimony reserves, 2,100t of unapproved and 7,200t of prospective gold reserves; Zophkhito: 197,300t of approved ore reserves, 24,300t of approved, and 30,000t of prospectve untimony reserves, 3,552t approved and 30,000t of prospective gold reserves and, 15,891t of approved and 100,000t of prospective silver reserves, Edenis surma: 1950t of approved antimony reserves; Kodianis Khruma: 900t of approved antimony reserves and, 5,700t of prospective gold reserves; Domba: 3,380t of approved untimony reserves; Sanartskhia: 2,220t of approved and antimony reserves; Neshkhu, Chrdili-edena; Chasaskhtomi, Nemali and Bosela with unknown amount of reserves; Kverelieto: unknown amount of antimony and wolfame reserves and 6,600t of prospective gold reserves; Usakhelo: unknown amount of antimony reserve; Sagebi: unknown amount of antimony reserves and 5,830t of prospective wolfram reserves; Shtali wolfram and mercury deposits with unknown amount of reservers; Usakhelo with unknown amount of wolfram and antimony reserves; Usakhelo with unknown amount of antimony reserves; Modrekili with unknown amount of antimony and wolfram reserves; Notsara-motsantara with unknown amount of antimony and wolfram reserves; Kvrelieto with unknown amount of wolfram reserves); mercury and its associate metals of antimony, arsenic, lead and zinc (Kodisdziri: 82,000t of prospective reserve of mercury associated with arsenic and antimony; Talakhiani: 95,300t of prospective reserve of mercury associated with arsenic, antimony, lead and zinc; Porkhishuli, Madnistskali, Kvaishuri, Mitseris Tskali, Lisgori, Khalatiphari, Shtali, Kodnarula, Kankleti, Satsikvile, Chiora, Chichkhva-Molisi, Moko, Bubis Tskali, Chichkhivi, Khvatsi and Mamisoni unknown amount of mercury reserves; Khideshlebi and Verdzis Ru unknown amount of reserve of mecury associated with arsenic; Gomi with unknown amount of reserve of mercury associated with arsenic and antimony); volcanic facing stones (Rekhebi, Kvakatsi and Tsitelimta unknown amounts of andesite reserves; Kvaishuri: 1,050,000m^3 of gabrodiabase approved reserves; Rekhebi with unknown amount of albitophyre reserves; Kirtisho unknown amount of diabase reserve); limestone gravel and sand (Tsedisi with 2,822,000 m^3 of approved reserve; Chiora with 6,060,000m3 of approved reserve, Phorkhishula, Dombra with unknown amount of reserves, Kvedrouli with 4,028,000 m^3 approved reserve, Oni with unknown amount of reserve and Badjiskhevi with 326,000 m^3 of approved reserve); gypsum (Bajiskhevi: 734,300 m^3 of approved reserves; Korti with unknown amount of reserve); crystal and mineral (soda-lime) glass (Shoda with unknown amount of reserve, Tsikhia with 110t of unapproved reserve, Sabrole with 150t of unapproved reserve, Geske with unknown amount of reserve, Domburula with unknown amount of reserve); calcites and barites (Chordi: 2,507,000t of approved barite reserve and 179,000t of approved calcite reserve, Vatri and Ontchevi demosits with unknown amount of reserves); mineral waters (Utsera: hydrocarbonate soda water with 633 m3/24h discharge rate; Shovi: Hydrocarbonate sodium ground water with 277m3/24h water discharge rate, Sortauni: unknown amount of reserve of hydrocarbonate choride sodium groundwater); crystalline pyrites (Mamisoni deposit with unknown amount of reserve); quartz (Sabrole and Shoda deposits with unknown amount of reserve).

In Tsageri municipality, significant reserves of arsenic are found in Tsana and, other non-ferous metals and non-metal mineral resources all over the municipalities. More specifically, following mineral resources are met in the targeted area: copper with associated cobalt and zinc metals (Dzuguri copper and cobalt deposits with unknown amount of reserve, Mokvaulis Gele deposits of copper and zinc with unknown amount of reserves); lead and zinc and associated metals (Nargvevi, Muris Gele and Chero lead zinc deposits with unknown amount of resource, Janauli and Karis Qvabi lead deposit with unknown amount of reserve); limestone gravel and sand (Zogishi deposit with 719,000m3 of approved reserve); gravel, pebble, cobble (Tsageri deposit with 9,237,000 m3 of approved reserve and Lashitchala deposit with 1,001,000m3 of approved reserve); lime (Tsageri deposit with 914,300m3 of approved reserve, Orbeli deposit with 15,146,000m3 of approved reserve, Alpana deposit with unknown amount of reserve); brick clay (Tsageri deposit with 150,000m3 of approved reserve; Orbeli deposit with 30,000 m3 of prospective reserve); barites and calcites (Lachepita, Khvamli and Zubi deposits with unknown amount of reserves); pyrite (FeS_2) (Zubi and Ophitari deposits with unknown amount of reserves), phosporites (Tsageri 2 deposits one with 800,000t of prospective reserve and another with unknown amount of reserve); mineral waters (Lashitchala and Dzugura deposits of hydrocarbonate calcareous ground waters with unknown amount of reserves); striped agate (2 Zubi deposits with unknown amount of reserves).

In Lentekhi Municipality, there are various mineral resources of non-ferous metals and non-metals. More specifically, these include: copper and zinc and their associated metals - gold, silver, etc. (Zeskho: 22,900,000t of approved reserves of ore, 414,000t approved reserve of copper, 64,100t of approved reserve of zinc and, 6.84t of approved reserves of cobalt, Skimeri: unknown amount of reserve; Laphuri: 10,000,000t of prospective reserve of ore, 200,000t of prospective reserve of copper and, 400,000t of prospective reserve of zinc, Laskaduri deposit of copper associated with lead and with unknown amount of reserve, 2 Laskaduri deposits of copper associated with zinc and with unknown amount of reserve, Laskaduri copper deposit with unknown amount of reserve, Laskaduri deposit of lead associated with copper and with unknown amount of reserve, Tvishdi deposit of copper associated with zinc and with unknown amount of reserve, Laskaduri deposit of copper associated with lead and zinc and with unknown amount of reserve, Geldashi deposit od copper associated with lead and zinc and with unknown amount of reserve, Tskvareshi copper deposit with unknown amount of reserve, Kheledi deposit of copper associated with zinc and with unknown amount of reserve, Khophuri deposit of copper associated with zinc and with unknown amount of reserve, Tkhvarsvildi deposit of copper associated with zinc and with unknoiwn amount of reserve, Dogurashi deposit of lead associated with copper and zinc and, with unknown amount of reserve, Hishkori deposit of copper associated with zinc and with unknown amount of reserve, Phasi Mta deposit of copper associated with zinc and with unknown amount of reserve, Mokhashi deposit of copper with unknown amount of reserve); lead and zinc and associated metals (Rtskhmeluri deposit with 1,418,500t of approved and 8,000,000t of prospective reserves of ore, 38,700t of approved and 200,000t of prospective reserves of lead and, 39,400t of approved and 200,000t of prospective reserves fo zinc, Kvabnari and Sareki deposits of copper associated with lead and zinc and with unknown amount of reserve, Jojokheti and Nagomari deposits of lead associated with zinc and with unknown amount of reserve; r. Tvibra inflow deposit of lead with unknown amount of reserve, Ptishkori deposit of zinc with unknown amount of reserve, Tvibrani deposit of lead and zinc with unknown amount of reserve; Babili deposit of lead and zinc with unknown amount of reserve; Natkviari "Morgouli" depost of lead and zinc with unknown amount of reserve; Istaphakari deposit of zinc and copper with unknown amount of reserve; Qvedreshi deposit of lead and zinc with unknown amount of reserve; Liashkuri deposit of zinc and copper with unknown amount of reserve; Pishkori deposit of zinc and copper with unknown amount of reserve; Sagebis Phekhi deposit of lead and zinc with unknown amount of reserve, Ashkhamuri deposit of zinc and copper with unknown amount of reserve, Makhashi deposit of zinc and copper with unknown amount of reserve, Jukhareshi deposit of lead and zinc with unknown amount of reserve, Dogurashi deposit of lead and zinc with unknown amount of reserve, Tskvareshi deposit of zinc and copper with unknown amount of reserve, Daberi deposit of lead and zinc with unknown amount of reserve, Mukhrini deposit of lead and zinc with unknown amount of reserve, Qemalaki deposit of lead with unknown amount of reserve, Sakeria deposit of lead with unknown amount of reserve, Rtskhmeuli deposit of lead with unknown amount of reserve); Arsenic and its associated metals (Tsana deposit of arsenic associated with gold and silver etc. with 293,000t of approved reserve of ore, 50,200t of approved reserve of arsenic, 480t of approved reserve of gold and, 4,600t of approved reserves of silver; Chorokhi deposit of arsenic ore with 38,000t of approved reserve of ore and 7,390t of approved reserve of arsenic; Shkhabani, Zeskho and Phishkori deposits of arsenic with unknown amount of reserves); antimony (Mokhasi deposit with unknown amount of reserve); mercury and its associated metals (mercury 2 deposits of Kheshkuri and 1 deposit of Shkedi with unknown amount of reserve); gold sands (2 deposits of Tskenistskali with unknown amount of reserves); murble-like facing limestone (Choluri deposit with 1,740,000 m3 of approved reserve); construction material of sand and gravel (Kheledi deposit with 2,115,000 m3 of approved reserve); lime (Muriskhidi deposit with 3,242,000m3 of approved reserve); mineral waters (Muashi and Laskaduri sources of hydrocarbonate calcareous and sodium water with unknown amount of reserves).

<u>Imereti region.</u> Imereti region is characterized by richness and diversity of mineral resources. There are more than 100 deposits registered in the region. Over 50% of these deposits are exploited for export purposes. Major mineral resources of the region are as follows: Chiatura manganes, the approved and unapproved reserves of which in total amounts to 212 mln tons. Prospective resources might exists in Zestaphoni municipality (.e.g Ajameti area, etc.), Chkhari area of Terjola municipalities and in Kutaisi and Terjola surroundings. Significant deposits of coal exist in Tkibuli and Gelati together with the deposits of barites, liatonites, clay, etc. Kutaisi surroundings are rich in bentonite clays, murble, limestone, teschenit, bazalt, etc. In addition, the region is rich in healing mineral waters based on which well-known resorts of Nunisi and Sairme have been developed.

In Tkibuli municipality, as it was mentioned above there are significant reserves of coal found in the city of Tkibuli, with 331,479,000t of approved reserves of bituminous coal, 8,316,000t of approved reserves of jet (compact form of lignite) and 1,725,000 tons of approved reserves of liptobiolites (phytogenic sediments). In addition, there is a lignite deposit in v. Gelati with unknown amount of reserves. Furthermore, natural gas in the amount of 12,000,000m3 reserve is found in Dzirovan area. Regarding the ferrous metals, there is Tkibuli siderite ($FeCO_3$) deposit with a 72,000,000t prospective reserves and Gelati analcite sandstone deposit with 176,000,000t of approved reserves. In terms of non-metal mineral resources, fire clay deposit with 5,800,000m3 approved reserves is found in Tkibuli, teshenite deposits with 1,495,000m3 and 1,633,000m3 approved reserves - found in v. Kursebi and Lolasheni respectively, lime deposit with 7,761,000t of approved reserve is found in v. Motsameta, gypsum deposit with 500,000t of approved reserve is found in v. Sochkheti, ceramic clay deposit with 1,298,000m3 of approved reserve is found in Jvarisa and barite deposit with 50,000t approved reserve is found in Rtskhilati. In terms of healing minerals and gems, agate is found in Gelati, Kursebi, Orpiri and Tsutskvati, Dzirovani villages and ozokerite is found in Dzmuisi.

In Sachkhere municipality, there are following mineral resources: a small deposit of coal with 500,000t of approved reserve found in v. Chala, a deposit of sand used for molding with 2,300,000m3 of approved reserve found in Sapharisgele, marble deposit with 1,115,000m3 of approved reserves found in v. Skhvitori, facing limestone deposit with 1,115,000m3 of approved reserve found in Skhvitori, construction sand and gravel mine with 1,001,000m3 of approved reserve found in Lashuri and with 2,383,000m3 of approved reserve found in Chruchuli; a lime deposit with 11,798,000m3 of approved reserve found in Sareki, brick clay deposits with 6,935,000m3 of approved reserve found in Lashuri and with 3,461,000m3 of approved deposit found in Perevi, ceramic clay deposit with 108,000m3 of approved reserve found in Perevi, quartz sand deposit with 9,078,000m3 of approved reserve found in Bajiti, pyrite deposit with 300,000t approved reserve found in Chala and with 200,000 approved reserve found in Qarzmani and, healing mineral water source with 153 m3/24h found in v. Kvereti.

In Chiatura municipality, there are following mineral resources: a small deposit of coal with 500,000t of approved reserve found in v. Mechkheturi; significant deposit of various kinds of manganese found in c. Chiatura with 50,717,000t of approved reserve of manganese ore, 5,327,096t of approved reserve of manganese dioxide, 605,000t of approved reserve of manganese ore to produce a burnt dead manganesite, 27,915,000t of approved reserve of mixed ore, 102,817,000t of approved reserve of manganese carbonate ore, 32,471,000t of approved reserve of oxidized manganese ore, 60,000t of approved reserves of manganese sandstones and unknown amount of reserves of mashed ore; molding basalt deposit to produce a basalt fiber and glass with 8,637,000m3 of approved reserve found in v. Perevisi; spongolite deposit with 2,300,000m3 of approved reserve found in v. Naphartshevi; marblelike limestone deposit with 25,485,000m3 of approved reserve found in v. Salieti; limestone sand and gravel deposit with 8,362,000t of approved reserve found in v. Beretisi, 3,300,000t of approved reserve found in v. Zeda Bereti, 8,754,000t of approved reserve found in v. Amashuketi, 8,469,000t of approved reserve found in v. Darkveti and, with unknown amount of reserve in v. Rgani; quartz sand deposits with 1,493,000m3 of approved reserve found in v. Mgvimevi, 4,550,000m3 of approved reserve found in v. Darkveti, 5,060,000m3 of approved reserve found in v. Perevisi, 1,200,000m3 of approved reserve found in v. Shuqreti, 26,027,000m3 of approved reserve found in v. Itkhvisi, 4,013,000m3 of approved reserve found in v. Qoreti, 13,140,000m3 of approved reserve found in v. Merevi and, 2,300,000m3 of approved reserve found in v. Naphartskhevi; limestone deposit to produce lime with 6,991,000m3 of approved reserve found in v. Navardzeti; healing agate deposit found in Speti-Nakhshirgele.

In Terjola municipality, there are following mineral resources: manganese deposits, with 2,600,000t of approved reserve of manganese oxides, 2,400,000t of approved reserve carbonate manganese found in Chkhari-Ajameti area and, 12,900,000m3 of approved reserve of oxides and 14,100,000t of carbonate ore found in r. Kvirila – Terjola-Zestaphoni section; limestone deposit with 16,601,000t of approved reserve found in r. Chishura gorge; chalcedony deposit with 3,477,000t of approved reserve found in Ajameti area; spongolite deposit with 16,098,000m3 of approved reserve found in Ajameti area; marblelike limestone deposit with 3,997,000m3 of approved reserve found in v. Alisubani; limestone sand and gravel deposit with 400,000t of approved reserve found in v. Qvashava and with unknown amount of reserves in v. Tsilkanin and Dedalauri; limestones to produce lime with 27,673,000t of approved reserve found in v. Navenakhevi and 5,406,000t of approved reserve found in v. Dzevri; brick clay deposit with 331,000m3 of approved reserve found in v. Chkhari and 168,000m3 of approved reserve found in v. Simoneti; clay deposit to produce the cement with 52,070,000t of approved reserve found in v. Nakhshirgele; limestone used for cement production with 152,000,000t of approved reserve found in r. Tchishura river gorge; ceramic clay deposit with 360,000m3 of approved deposit found in v. Chkhari; mineral waters with 415m3/24h discharge found in v. Qvemo Simoneti and 214m3/24h discharge found in v. Simoneti; agate deposit found v. Alisubani.

In Kharagauli municipality, there are following mineral resources: diorite deposit with 802,000m3 of approved reserve found in Tsiphi area; granite deposit with unknown amount of reserve found in v. Rkvia; marblelike limestone deposit with 377,000m3 of approved reserve found in v. Khoriti, 1,319,000m3 of approved reserve found in v. Sakasria, 709,000m3 of approved reserve found in v. Marelisi, 4,440,000m3 of approved reserve found in v. Moliti; facing (ornamental) limestone with 3000,000m3 found in Tsiphi area; limestone sand and gravel deposit with 1,737,000t of approved reserve found in v. Khandebi; Zvare mineral waters with 38m3/24h discharge found in v. Zvare and Nunisi source unknown amount of reserves; flint (rusty red chert) found in v. Legvani.

In Zestaphoni municipality, there are various mineral deposits of ferrous, non-ferrous and non-metal type. These are as follows: manganese carboante ore with 14,100,000t approved reserve found in Zestaphoni, gold ore found in metasomatic zones of the r. Dzirula gorge, fire resistant clays with 2,576,000m3 approved reserve found in v. Shrosha, marble-like limestone with 250,000m3 approved reserve found in Dzveli Shrosha, limestone sands and gravel with 1,882,000t of approved reserves found in v. Sakasria, construction sand and gravel (inert material) deposits with 2,607,000m3 of approved reserve of r. Kvirila and with unknown amount of reserve of r. Choloburi, brick clay deposit with 1,452,000 m3 of approved reserve found in v. Chalatke, 72,000m3 of approved reserve found in v. Chicharauli and 292,000m3 approved reserve found in v. Boslevi; ceramic clay deposit with 257,000m3 of approved reserve found in v. Zovreti and 2,232,000m3 of approved reserve of pegmatite found in v. Shrosha; barite and calcite deposits with 180,000t approved reserve found in Shrosha-Ubisa areas, quartz sandstone with 500m3 approved reserve found in v. Sakasria.

In Bagdati municipality, there are various non-ferrous and non-metal mineral resources, which are as follows: low sulfide gold-quartz vein found in v. Zekari; gabro deposit found in the city of Bagdati and; mineral water sources with 80m3/24h discharge found in v. Sairme and with 400m3/24h discharge found in Udabno section of v. Sairme.

In Vani municipality, following mineral resources are found: limestone sand and gravel deposits with 13,507,000t of approved reserve found in Dikhashkho area; construction sand and gravel (intert material) with 5,160,000m3 approved reserve found in v. Tskvishi; mineral water sources with 329m3/24h discharge found in v. Sulori and 3470m3/24h discharge found in Vani.

In Tskaltubo municipality, there are following non-metal mineral resources: moulding basalt to produce basalt fiber and glass with 3,345,000m3 approved reserve found in Sataplia area; dolomite deposit with 1000,000t of approved reserve found in v. Gumati; teshenite deposit with 3,037,000m3 of approved reserve found in v. Oferchkheti; tuff-breccia deposit with 5,974,000m3 of approved reserve found in v. Gvishtibi; facing limestone with 733,000m3 of approved reserve found in v. Osunela, 326,000m3 of approved reserve found v. Tskhunkuri, 716,000m3 of approved reserve found in v. Gelaveri and 3,338,000m3 of approved reserve found in v. Eklari; limestone sand and gravel deposit with 950,000t of approved reserve found in v. Kumistavi, 4,452,000t of approved reserve found in Tskaltubo and, 534,000t of approved reserve found in v. Sviri; construction sand and gravel (inert material) with 444,000m3 of approved reserve found in v. Vartsikhe, 2000,000m3 of approved reserve found in v. Gumati, 1000,000m3 of approved reserve found in v. Marani, 1000,000m3 of approved reserve found in v. Opshkviti and, 9,000,000m3 of approved reserve found in the Rioni reservoir; limestones to produce lime with 5,429,000t of approved reserve found in v. Banoja; brick clay deposits with 144,000m3 of approved reserves found in v. Banoja, 300,000m3 of approved reserves found in v. Ukaneti and, 160,000m3 of approved reserve found in v. Rokhi; gypsum deposit with 500,000t of approved reserve found in v. Pereti; barite deposit with 500,000t of approved reserve found in v. Mequeni; calcite deposit with 30,017,000t of approved reserve found in v. Mequeni; mineral pigments with 150,000t of approved reserve found in v. Kvilashori, 100,000t of approved reserve found in v. Gvishtibi and 100,000t of approved reserve found in v. Banoja; bentonie clays with 6,345,000t of approved reserve found in v. Gumbrini, 1,703,000t of approved reserve found in v. Kumistavi and, with unknown amount of reserve found in Kvakhchir-Nakhshirgele; pyrite deposits with 300,000t of approved reserve found in v. Meqveni and 300,000t of approved reserve found in v. Osuneli; phosphorites with 6,000,000t of approved reserve found in Tskaltubo; mineral water source with 19,000m3/24h discharge found in Tskaltubo; jaspis used as healing mineral and as a gem found in v. Semi and Gvedi.

In Samtredia municipality, there are following mineral resources: thermal hot water source with 2,765,000m3/24h discharge 62^{0}C temperature found in Samtredia; sand and gravel with 10,677,000m3 of approved reserves found in Chkhenishi, 1,176,000m3 of approved reserve found in Ilori, 2,131,000m3 of approved reserve found in Sajavakho-Qvishanchala area and, 3,000,000m3 of approved reserve found in Kolbani area; brick clay with 1,989,000m3 of approved reserve found in v. Buknari.

In Khoni municipality, there are following mineral resources: brick clays with 82,000m3 of approved reserves found in Khoni and 82,000m3 of approved reserves found in Khukhi area; barite deposit with 500,000t of approved reserve found in v. Gvedi; calcite deposit with 550,000t of approved reserve found in v. Gvedi; mineral pigments with 437,000t of approved reserve found in Matkhoki-Udzlouri area.

Samegrelo-Zemo Svaneti region. Samegrelo-Zemo Svaneti is very rich in hot thermal waters found in Khobi, Martvili, Senaki municipalities located within the Rioni River Basin. Total reserve of the resource is 35,000 m3/24h. There are also peat reserves in various municipalities including Otsantsaleshi deposit in Martvili municipality and Churia-Nabada in Khobi municipality. In Martvili municipality there is a facing stone deposit, including murble-like limestone deposit. Gravel and pebble deposits are abundant in Martvili and Senaki municipalities and construction sand and gravel deposits in Senaki and Abasha municipalities. Limestone for lime production is found in Senaki municipality. Brick clay deposits are found in Martvili, Khobi, Abasha and Senaki municipalities. Barite deposits are found in Martvili municipality. Apart from the there are healing mineral waters and minerals and gems in the region.

In Marvili municipality, major mineral resources are limestone and mineral waters (e.g. Lebarde, Chegola, Dviri, etc.). There is also a barite deposit with unknown amount of reserves.

In Senaki municipality, major mineral resources are thermal waters found in Sakharbedio, Ledzadzameshi, Zanashi, Noqalakevi, Potskho, Akhasopheli, etc. as well as inert materials, limestone and brick clay;

In Khobi municipality, there are abundant resources of thermal hot waters, but these sources are mostly located in Enguri river basin;

In Abasha municipality, the major mineral resources are sand and gravel for production of construction materials and brick clays.

Guria section located in the Rioni River Basin. In Kokhnari community of the Chokhatauri municipality located within the basin of r. Khevistskali, Rioni tributary there is a mineral water source. In addition, there are clay deposits in the targeted area.

2.1.8 Energy Resources

Alazani-Iori River Basins

Alazani River basin. In general, Alazani river basin is rich in renewable energy resources but is poorer, except for solar energy, than the Rioni River Basin, due to its oro-climatic and hydrological peculiarities.

In general, Georgia's hydropotential is very high. There are 26,000 rivers in Georgia. Their total theoretical hydropotential is estimated at 80 billion kWh per year. Out of all rivers, only 300 are considered to have the economically viable potential, which is estimated at 15,000 MW installed capacity and 40-50 billion kWh of annual power generation. This is 5-times more than current power consumption. However, it should be noted that above 300 rivers make only 26% of total hydropotential of the country. Most of rivers are of mountainous type with high height gradient that is considered one of the key parameters for assessing the hydropower technical potential.

Hydro-potential of the rivers of the Alazani basin vary from small to medium-size. According to estimates, total theoretical technical hydropotential of the basin equals to 414.2 MW of installed capacity and 2,420.2 mln Kwh electricity output. The highest potential exists in the Akmeta municipality (143.8 MW and 859mln kwh power output, with the river of Tushetis Alazani having the largest power potential of 25.7 MW installed capacity and 160.8 mln kwh electricity output), followed by the Kvareli municipality (112.4 MW and 649.7 mln kwh), Telavi municipality (98.8MW and 571.8 mln kwh), Lagodekhi municipality (56MW and 321.5mln kwh) and Gurjaani municipality (3.2MW and 18.4 mln kWh). There is practically zero potential in Dedoplistskaro and Signagi municipalities (for more details please refer to the table 1. technical hydropowtential of the rivers of the Alazani basin, annex 4).

In terms of the wind resources, in accordance with the wind atlas developed in 2004, Georgia's potential is over 1,700 MW that is completely unutilized. In the Alazani river basin, annual average wind velocity is not high varying from 2 to 4m/s for the majority of the area. On the slopes of the Greater Caucasus it is higher and varies from 4 to 6 m/s, while on the foothills it is lower amounting to less than 2 m/s. As for the power potential of the available wind resources, at the height of 50m above the ground level it is mostly less than 100 watt per square meter on the majority of the territory. Only the right bank of the basin shared by both Alazani and Iori basins has the potential between 100 and 250 w per square meter (for more details please see the maps of the wind velocity and the wind power potential, figures 1,2, annex 4).

With regards to the solar energy, overall Georgia is rich in these resources. Total annual solar energy potential is estimated at 108 MW. In all areas, except of Adjara, annual average duration of sunny periods exceeds 2,000 hours, with the highest values recorded for Shiraki plateau (2,556 hours), Telavi municipalities (2,465 hours), Akhmeta (2,392 hours) and Gardabani. The longest sunny periods occur in summer time amounting to over 340 hours in Kakheti. Total annual solar radiation, including direct and indirect radiation varies from 125 to 140 kcal/sm^2 in the Alazani river basin, reaching maximum values in upstream areas and, on the slopes of the Greater Caucasus. In terms of average annual radiation per square meter, it is very high in the middle to lower courses of the basin varying from 4.5 to 5.3 kWh/m^2 within 24 hours and from 1,643 to 1,935 kWh/m^2 annually. This is one of the highest values across the country (for more details please refer to the maps of the annual average solar radiation and solar thermal potential, figures 4,5, annex 4).

In terms of biomass resources, Georgia has significant reserves and the power potential. More specifically, it is estimated that the country's biomass power potential is 12.5 billion kWh, which is more than current power generation of Georgia (8 billion kWh). Biomass from livestock farms, which amount to 1,670,000 tons per year, has the largest potential of 6.9 billion kwh that can give the saving of $734*10^6$ m^3 of natural gas. Wood resources and their wastes amounting to 700,000 tons annually have the second largest potential of 2.7 billion kWh[2] that if utilized at a maximum level will save 200,000 tons of coal equivalents. Wastes from ceareal and legume crops amounting to 870,000 tons annually have the third largest potential of 1.3 billion kwh that is 112,000 tons of coal equivalent. Above biomass types are followed by sewage and municipal wastes, whose power potential amounts to 1.6 billion kWh.

In general, Georgia is very rich in wood resources, but they are unequally ditributed among the regions and the municipalitiess. Total reserve of wood resources is 451.7 mln m3. In accordance with 2009 official statistics, average annual production of wood material, including liquid wood, commercial timber and firewood amounted to 737,995.8 m^3 in 2005-2009. In addition, total illegal cuts amounted to 254,378m^3 from 2005 through 2009, with 50,875.6m^3 of average annual cuts. Unofficial estimates, however, suggest that illegal forest cutting may be far higher of offical statistics and the total amount of firewood utilized in the country may be around 1.5 million m^3, meaning that about two thirds of the total firewood is supplied illegally. With the current demand for firewood in Georgia estimated by MEPNR at 2.5 million m3, there is a significant supply-demand gap in firewood. Existing thermal energy supply gap could be filled partially by forestry and wood processing residues, and agricultural waste that are currently practically unutilized. Georgian experts think that the country could produce over 1.3 million m3 of firewood per year through

[2] This does not include energy tree and crop plantations

applying sustainable conservation measures. This, however, would still fall short of meeting a future heating energy demand.

In the forestry sector, significant amount of wood residues (estimated at 120,000 m^3 or 84,000 tons[3] as of 2008[4]) are generated in the logging sites and remain practically unutilized due to technological or economic constraints of collecting and transporting these wastes from the forests. Furthermore, almost none of the 540 wood processing entities existing in Georgia use the sawdust and other wood processing waste generated in the process. This sawdust (estimated at some 15,000 tons per year for the entire country) is usually dumped in the surrounding area or into the closest river. Agricultural biomass residues are also abundant across Georgia as it was mentioned above. For instance, only in the hazelnut production sector about 30,000 tons of hazelnut wastes are generated in Georgia annually of which over the half of the wastes are utilized to meet industries their own heating needs and about 20% of heating needs of the local population. It is also estimated that total of 870,000 tons of wastes are generated from cereal crop and legume harvesting. Thus, currently unutilized amount of plant wastes from forestry and agriculture sector is 80,000 tons of wood wastes, 15,000 tons of sawdust, 8,000 tons of hazelnut shells 1,500 tons of hazelnut prunings and 870,000 tons of cereal and legume crop wastes, making up 978,500 tons of plant wastes annually.

In the Alazani River Basin, forest resources are unequally distributed among geo-morphologic regions and various municipalities, e.g. while Akmeta, Kvareli, Lagodekhi and Telavi municipalities (southern slopes of the Greater Caucasus and the left bank of the r. Alazani) are rich in wood resources, Gurjaani, Signagi and Dedoplistskaro municipalities have limited forest resources. Only in Akhmeta and Telavi municipalities, for example, total wood resources are estimated at 23,657,300m^3. In accordance with official statistics, in 2005-2009, on average, 136,627.6 m^3 of wood material (about 19% of total wood material production) was produced in Kakheti region annually. In addition, there were illegal cuts, registered amounts of which equaled to 37,143 m^3 in total and 7,428.6 m3 on average.

In terms of geothermal resources, there are very few geothermal hot water sources in the Alazani river basin. These include: Torgvas Abano source in Akhmeta municipalities (1 well), Tsnori source in Signagi municipalities (1 well) and, Heretiskari sources (2 wells) with a total of 2.15 MW thermal capacities. Water temperature of these waters varies from 34 to 37^{0}C. Heretiskari is accounted for the largest thermal potential of 1.65 MW, followed by Tsnori and Torgvas Abano sources (for detailed information, please refer to the table 4. geothermal hot water resources of Georgia, annex 4).

Iori River Basin. Overall, the Iori river basin similar to the Alazani river basin is poorer in renewable energy resources, except for solar energy compared with the Rioni River Basin due to the oro-climatic and hydrological peculiarities of the region.

Hydropotential of the Iori river basin is lower than that of the Alazani river basin and equals to 41.5 MW of installed capacity and 237.3 mln kwh of power output. Iori River in the upstream area (Tianeti municipality) has the highest potential – 22.2 MW installed capacity and 127.2 mln kwh power output, followed by ther.

[3] Calculated based on the 0.7 ton/m^3 density
[4] FAOStat, 2008

Babkhiskhevi – 9.4 MW and 127.2 mln kwh (for more information please refer to the table 2. theoretical technical hydropotential of the rivers of the Iori River Basin, annex 4).

As for the wind power potential, on the left bank of the Iori River, it varies from 100 to 250 w/m^2, while on the right bank – between 100-250 w/m^2 to 500-800 w/m^2. On Shiraki plateau it reaches 800-1,200 w/m^2 at some small areas. In upstream areas the wind potential is less than 100 w/m^2 (for more details please refer to the maps of the wind potential and the average annual wind velocity, figures 1,2, annex 4).

In terms of solar energy, total annual radiation (direct and indirect) varies from 125 to 140 kcal/sm^2 and average annual radiation per square meter – from 4.5 to 5.3 kWh/m^2 within 24 hours and from 1,643 to 1,935 kWh/m^2 annually. This is one of the highest values across the country for more details please refer to the maps of the annual average solar radiation and the solar heat potential of Georgia, figures 4,5, annex 4).

In terms of biomass and in particular, wood resources potential, Overall it is lower than that of the Alazani basin, due to the lower wood reserves and wood production. The majority of wood resources is concentrated in the Tianeti municipalities (8,489,000 m^3) and other municipalities, including Sagarejo, Signagi, Dedoplistskaro dstricts are poor in forest resources.

The Iori river basin is very poor in geothermal resources. There is only 1 well in v. Ujarma, Sagarejo municipalities with 0.04 MW thermal capacity. Another source exists in the t. Tsnori that is shared by both Alazani and Iori river basins ((for detailed information please see the table 4. geothermal hot waters of Georgia, annex 4).

Rioni River Basin

General. In general, Rioni River basin is extremely rich in hydro resources as well as with biomass, in particular, with wood resources. Geothermal and wind resources are also significant. In terms of solar energy, its potential is far lower in the Rioni river basin than that in the Alazani-Iori river basins.

Racha-Lechgkumi region. Total theoretical technical hydropotential of the rivers of the Rioni basin within the Racha-lechkumi region is estimated at 428.8 MW of installed capacity and 2,390.0 mln kWh of power output. The Lentekhi municipalities has the largest potential (185.7 MW of installed capacity and 1,034.1 mln kwhs of annual power output) and, theOni municipalities –the second largest potential (144.1 MWs of installed capacity and 802.2 mln kwhs of annual power output) (for mor details please refer to the table 3. theoretical technical hydropowtential of the rivers of the Rioni Basin, annex 4).

In terms of wind power potential, it is mostly insignificant and is less than 100 watts per square meter. It is high only on the Mamisoni pass varying from 500-800 watts per square meter (for more details please see the maps of the wind velocity and wind power potential, figures 1,2, annex 4).

Regarding the solar power potential it varies from 4.2 to 4.5 kwh/m2 a day. The higher values are only recorded on the southern slopes of the West Caucasus (for more details please refer to the maps of the annual average solar radiation and the solar power potential of Georgia, figures 4,5, annex 4).

The Racha-Lechkumi region is very rich in wood resources. Forests cover over 275,817 ha of land, with 263,093 ha of forested areas. In 2005-2009, in accordance with official statistics, average annual production of wood material amounted to 41,215 m^3. In addition, there were illegal wood cuts, registered amount of which was 16,742m^3 in total, and 3348.4m^3 on average per year.

Regarding the geothermal resources, there are no hot water sources found in the region.

Imereti region. Total theoretical technical hydropower potential of the Rioni River Basin rivers flowing in Imereti region is estimated at 669.3 MW of installed capacity and 1,989 million kWh of power output. The river Tsablarastskali in Bagdati municipality has the highest power potential among the rivers flowing in the region (excludng transit rivers) with 37.1 MW installed capacity and 207.5 mln kwh annual power output and, the river Dzusa in Zestaphoni municipality – the lowest potential with 3.2 MW installed capacity and 6.6 million kwh annual power output (for more details please refer to the table 3. theoretical technical hydropower potential of the rivers of the Rioni Basin, annex 4).

With regard to wind resources, the majority of the region's territory has the 100-250 w/m^2 power potential density, with Kutaisi and its surrounding areas having from 500-800 w/m^2 to 800-1,200 w/m^2 values and the large areas on the Likhi range – more than 1,200 w/m^2 values. In accordance with calculations, it is possible to build 630 MW installed capacity and 2000 GWh annual power output plant on Likhi range and 150 MW installed capacity and 340 GWh annual power output plant near Kutaisi (for more details please see the maps of wind power potential distribution and perspective wind power plants of Georgia, figures 1,2,3, annex 4).

In terms of solar energy, solar power potential is 3.8 kwh/m^2 per 24 hours in the majority of the area of the Imereti region (for more details please refer to the maps of the annual solar radiation of Georgia, figures 4,5, annex 4).

In terms of biomass and in particular, wood resources, and the forest cover of the region makes up 286,332ha or nearly 44% of the region's total area (655,200ha). Average annual wood production in the region during the period from 2005 through 2009 amounted to 737,995.8m^3 that is about 13% total legal wood cuts. In addition, volumes of registered illegal wood cuttings amounted to 3,896 m3.

Imereti region is relatively rich in geotheram resources. Total thermal capacity of the existing groundwater sources are estimated at 28.3 MW. There are 24 geothermal hot water wells, 15 – in Tskaltubo municipality, 7 – in Vani municipality and 1 – in Samtredia municipality. Water temperature varies from 300C to 61^{0}C (for detailed information please refer to the table 4. geothermal hot water resources of Georgia, annex 4).

Samegrelo-Zemo Svaneti region. Total theoretical feasible hydropower potential of the Rioni Basin rivers flowing in Samegrelo region amounts to 64.9 MW of installed capacity and 363.7 mln kWh of annual power output. Among local rivers of the region, the r. Abasha has the highest potential of 64.9 MW installed capacity and 363.7 mln kWh annual power output. The river Nogela in Martvili municipality has the smallest power potential - 1.3 MW installed capacity and 7.6 mln kWh annual power output (for more details please refer to the table 3. theoretical technical hydropower potential of the rivers of the Rioni Basin, annex 4).

In terms of wind power potential, the wind power density is within the range of 100-250 w/m^2 in the absolute majority of the region, with Poti and its surrounding areas along the shore having the wind power capacity between 800 and 1,200 w/m^2. It is possible to build 90 MW installed capacity and 210 GWh power generation wind power plant in Poti area (for more details please see the maps of wind power potential distribution and perspective wind power plants of Georgia, figures 1,2,3, annex 4).

Regarding the solar energy potential, it is 3.8 kwh/m^2 a full day on the majority of the region's territory (for more details please refer to the maps of the annual solar radiation of Georgia, figures 4,5, annex 4).

With regards to the biomass, the region is rich in wood resources. The forest cover is over 40% of the total area of the region (744,100ha). Average annual volumes of wood material produced during 2005-2009 made up 80,972m^3, which is nearly 11% of total volumes of wood cuts. In addition, there were illegal cuts, the registered amount of which equaled to 5,784.2 m^3. In addition to forest wood resources, there are significant biomass resources in the form of agriculture wastes from hazelnut production. About 10,000 tons of hazelnut kernels are produced annually. Assuming the 40/60 kernel-to-waste ratio, about 15,000tons of wastes are generated annually in the region. At the same time, it is planned to increase the hazelnuts production in the short-term period thanks to the efforts of Ferrero Spa. And its subsidiary companies products.

There are 4 geothermal hot water wells in the segment of the Samegrelo-Zemo Svaneti region situated within the Rioni river basin. Of these, 2 wells are located in the v. Nokalakevi, 1 in v. Isula and 1 in v. Zana, Senaki municipality. Total thermal power potential of these wells is estimated at 4.1 MW (for detailed information, please see the table 4. geothermal hot waters of Georgia, annex 4).

2.1.9 Hydrology, Hydrogeology

Alazani River Basin

Surface Waters*.* Seasonal fluctuation of the river run-off is characteristic of the Alazani River Basin. Floods happen in spring, flash floods – in summer and fall and, low waters – in winter and summer. Most of the rivers of the basin are fed by multiple sources, e.g. ground water accounts for 40% of the water flow of the Alazani River, rain water – 31% and snow melting – 29%. Precipitation during the spring plays a key role in forming corresponding river runoff[5]. Intensity of snowmelt has also a significant influence on forming the maximum river runoff. Ground waters play a major part in forming river runoff (more than 60%) in the middle Alazani basin, explained by the intensive recharge of the left bank tributaries from aquifers (for more details please refer to the hydrological map of the Alazani River Basin, figure 1, annex 5).

Overall, the surface waters of the Alazani basin fall under the category of rivers with 25-50% spring runoff. The highest run off (about 35-40% of the annual runoff) occurs in spring. In summer 29-32% of the annual runoff is recorded, in fall – 20-23% and, in winter – 11%-12%. Spring floods begin in March (in lowlands by the end of February) and reach their maximums with peak discharges recorded in May-June. In summer, low water level is unstable, while in winter, on the contrary is. Daily amplitude of the water level fluctuation doesn't exceed 20 cm. In some cases, the water level remains invariable for 25-30 days. However, rarely due to the heavy rains and warm periods the water level significantly increases. Maximum alluvial run-off of the R. Alazani occurs during inundations. Mean monthly alluvial run-off reaches 100 kg/s in July at vil. Birkiani,

[5] Estimation of expected spring flood runoff is impossible without precipitation forecast. Hence, data of maximum water discharge mainly depend on meteorological conditions. Nowadays it is impossible to predict the precipitation with the lead-time exceeding a month.

400 kg/s at vil. Shakriani (June) and 2300 kg/s at inflow of R. Ayrichay (June). The annual discharge of the Alazani, measured at the confluence of the Alazani and the Mingechavir is about 2.5 billion cubic meters.

Total water resources of the Alazani River in Georgia are estimated at 3.10 km^3 (570mm). The flow module varies from 43 to 9 l/s per square kilometer. The long term average discharge recorded for the Shakriani Bridge is 45 m^3/sec and for the village of Chiauri – 71.4 m^3/sec. The maximum discharge of Alazani recorded at the Shakriani Bridge is 1,160 m^3/sec (5/6/1948). The Maximum value, recorded for the village of Chiauri - Lagodekhi municipalities amounts to 1 685 m^3/sec (21/5/1936). The low discharge for the village of Chiauri can be explained by the fact that large volumes of the river water are used for irrigation purposes through the Lower Alazani Irrigation canal that starts at the Shakriani bridge, thus considerably reducing water discharge beyond the canal's head structure. Multi-year average maximum discharge near the village Zemo Kedi is reordered at 479 m^3/s; discharge of 1% probability is 1,312 m^3/s, that of 2% probability – 1,107 m^3/s, that of 5% probability – 820 m^3/s and that of 10% probability – 697 m^3/s (For more details please refer to the Table 1. Main Hydrological Feature of the River Alazani, annex 5).Th Alazani has 1803 tributaries, with total length of 6,851km, from which 1,701 is shorter than 10. Below are the brief descriptions of the major tributaries of the Alazani river (for more details please refer to the Tables 6,7,8, annex 5).

The river Ilto takes origin from ground springs, located on the South slope of the Kakheti Range, at an elevation 2120 m, above sea level. The river flows to the river Alazani from right shore (in 324 km from its mouth). The length of the river is 43 km, total fall of the river surface is 1636 m, average slope 38 ‰. The watershed area covers 337 km^2, its average height is 1250 m. Tributaries of the river are very small, length do not exceeds 2-3-km. In total, the river has 115 tributaries, with total length 167 km., average density of the river network is 0.79km/km^2. The watershed has asymmetric form, main part of which is located on the South slope of the Greater Caucasus Range; the downstream of the river is located on the Alazani Lowland. From the Western side, the river basin from the watershed of the river Iori bounded by Kakheti range. From the Eastern side the basin bounded by nameless range, which has the following pikes: The Tbatani-mount (2262m), Sakanafo (1880m), Mtatsminda (1500.7m). The river basin is stretched from the North to the South, the length is 33km, and average width is 10.2m. In general, the territory of the basin (except downstream) is characterized by high mountain relief. 90% of the basin area is covered with forest. The bottom of the river bed is stony, straight and covered by gravel. In spring, in the beginning of March observed flooding events, rising of the water levels is caused by melting snow and reaches its maximum in May. There are no observed dangerous hydrological events in the river basin. The river used for irrigation purposes.

The river Stori takes origin from the south slope of the Greater Caucasus Range, at an elevation 2950 m above sea level, flows to the river Alazani from left shore (in 300 km from its mouth), 4 km far from the village Saniore. The length of the river is 38 km, total fall of the water surface is 2577m, average slope 67.8 ‰, The watershed covers 281 km^2, its average height is 16010 m. the rivers main tributaries are: the river Chechakbis Kheoba (20 km) and the nameless river (14 km). Total density of the tributary network is 0.71 km/km^2. The river basin is situated on the South slope of the Greater Caucasus Range, Khakheti part. From the North it is bounded by the watershed of the Greater Caucasus Range, from the West and East by Nakerala Range. The length of the river basin is 32 km, the widest part is 20km, and average width is 9 km. The basin is located in mountainous and lowland areas. The upper part of the basin, from the origin to the village Phshavela, is covered by mountains, height of some pikes are 3090-3334 m. The river bed is not branched, upstream is significantly meandering (in each 20-30m), variation of the width of the river is form

6 up to 22, mostly -11m, depth changes from 0.4 m to 1-1.5 m., mostly 0.6m., the speed of the river flow is 2-2.5m/sec, in downstream - 0.6m/sec-1.7m/sec. The bottom of river bed is uneven, stony and covered by large boulder. The river gets it charge from melting snow and rain waters. The river characterized by spring flooding, autumn flash floods and winter water scarcity. In spring rising of water level starts in March and lasts up to July, in this time maximum water level reaches 0.4-0.6m. Rising of water level has sudden and uneven character. In autumn observed flashfloods, caused by heavy rains. The river is mainly used for irrigation purposes.

One of the major tributaries of the Alazani River is the river Kabali that flows from high mountains characterized by heavy sedimentation and mudflow type gorges. The river originates from the mountain springs of the southern slopes of the Caucasus Range at the height of 2,720 m. It joins the Alazani River from the left side 3km northward of the Eriskari Village. The river's length is 48 km; total gradient – 2,500 m; average slope – 52.1%; catchment area – 391 km2. The mountainous part of the catchment is constituted by sandstone, limestone and clay shale. The soil is represented by forest brown soils. Presence of fresh water in alluvial soil is characteristic of hydro geological conditions of the area. The Kabali River regime is characterized by floods in spring, unstable low level of water in summer, stable low level of water in winter and high level of water in autumn. During summer and autumn floods caused by rainfalls, water sometimes rises higher than during spring floods. For instance, on August 18th, 1955, flood caused by a heavy rainfall damaged the Kabali HPP pressure pipeline and agricultural lands. The river is studied insufficiently in hydrological sense; it is estimated that its average run off is 3.18 m^3/s .

The river Avaniskhevi is formend by small springs located on the Greater Caucasus Range, at an elevation 1700m above sea level. The river flows to the Alazani River from left shore in 250km from its mouth. the length of the river is 25 km, total fall of the river surface is 1460m, average slope is 77.8 ‰ in the upstream and 6 ‰ in the downstream. The watershed covers 1185 km^2; its average height is 1590m. The main tributary of the river is Shorokhevi (24km), average density of the tributary network is 0.77 km/km^2. Upstream of the river located between the South slope of the Greater Caucasus Range and the Alazani Lowland. The watershed bounded by the rivers Kabala and Bursa at the Western side. The river basin has asymmetric form, the length is 29. km and average width is 6.4 km. The Avaniskhevi basin is divided into two parts: mountainous and lowland. The mountainous area of the river bed is not branched; the lowland part of the river is branched and significantly meandering, creating small islands in each 0.5-1 km. The width of the river changes from 2 m up to 16 m, mostly it is 8m. The depth is about 0.4-1.2 m, mostly-0.5m. At the origin the speed of the river is 3 m/sec, at the downstream 0.6-1 m/sec. The bottom of the river bed is uneven and covered by stone and boulders. The river is characterized by spring floods, autumn flashfloods and low water level in summer-winter. Floods mostly are observed from March to May, from July starts low water period, in this period occurs the lowest water level. There is no observed dangerous hydrological event in the river basin.

The river Bursa takes origin from underground springs, located on the south slope of the Greater Caucasus Range, at an elevation 2500m, above sea level. The river flows to the river Alazani from left shore, in 262 km from its mouth. The length of the river is 27 km, total fall of the river surface is 2240m, average slope at the upstream is 160 ‰, at the downstream – 16.6 ‰. The watershed covers 84 km, average height is 900m. The river Bursa gets its charge mainly from rain and melting snow. Water level of the river depends on spring floods, autumn flash floods and low water in winter and summer. Flooding starts in March and get its maximum in May, water level decreases in June. Flash flood period starts in September.

The river Chagurgula is the main tributary of the river Bursa (13 km), total density of the tributary network 0.77 km/km^2. The river basin is located between the Greater Caucasus Range (Kakheti part) and Alazani lowland. Its Northern bound goes along the watershed line of the Greater Caucasus Range, at an elevation 2700-2800 m. The river basin characterized by mountainous and lowland parts. In the mountainous part of the basin forest is dominant, the lowland covered by bushes. In the mountainous part, 10-11 km, the river flows on narrow, deep valley; average width is 550-6700 m, than the river flow gradually getting wider and on the Alazani Lowland reaches 2.5 km. The river bed at the upstream is straight line, at the downstream significantly meandering and not branched. There are 7 small islands in the downstream of the river, from which 2 is the largest. Width of the river varies from 2 m up to 12 m, mostly 6 m; depth is uneven from 0.12m up to 1m, mostly 0.3m. In the upstream speed of the river flow is high, 1.5-2 m/sec in the downstream – 0.25 m/sec. In the upstream the bed of the river is uneven and covered by boulders, in the downstream is covered by sand and gravel. Water flow in the river is not explored, some cases of measurement shows that the water flow increases from 0.11 m^3/sec (in 2 km from the river head) to 0.89 m3/sec (in 1.8 km upper from the mouth). The river is used for irrigation purposes.

The river Duruji is formed by confluence of two small rivers, on the nameless slope of the Greater Caucasus Range, at an elevation 2540 m above sea level. The river flows to the river Alazani from left shore (in 268 m from its mouth). The length of the river is 26 km, total fall of the river surface is 2260m, average slope in its mountainous part is 35.1 ‰, and in downstream 25.6 ‰. Average area of the watershed is 91.2 km2, average height is 1350m. The river has not main tributary, average density of tributary network is 0.72 km/km2. The watershed of the river is located on the South slope of the Greater Caucasus Range, between the rivers Bursa and Chelti. The watershed has asymmetric form; length is 24 km, average width – 3.8m. From the village Satskhenisi the river gorge has V–type form, only in a very small distance (near town Kvareli) it has trapezium form, which joining to the Alazani Lowland. The width of the river bottom is 5-15 m, near the village Satskhenisi and town Kvareli is 200-600 m. The river bed is significantly meandering, in some areas is divided by two branch and crates gravel islands. In the upstream the river bed is full of rapids. The width of the river changes varies from 1 (24 km up from its mouth), up to 3 m, mostly is 2 m. Depth of the river changes from 0.1 m to 0.6m, mostly 0.2m; velocity of the river flow varies from 0.6m/sec up to 1.8 m/sec. The bed of the river is uneven and full of detritus and boulders, in downstream the river bed is covered by sand and gravel. From the village Satskhenisi to Telavi-Kvareli road, along the left bank of the river (4.8 km) is constructed protected concrete dam (4 m height) against mudflow. The river flow is not explored. Floods mainly starts in the beginning of April and lasts up to June, maximum water level in this time is 1.4-2 m. Low water period starts from July and ends in August. The river Duruji is characterized by mudflow disasters.

Groundwaters. The Aquifer of Late Jurassic period is found on the southern slopes of the Greater Caucasus, traced by uninterrupted stripe of the gorge of the river Nakro (Upper Svaneti) up to the upper course of the river Alazani (Kakheti). The water-bearing horizon is formed here with marl slate, sandstones and limestone. The fresh of the aquifer is characterized with high yield, counting tens of litres a second. The regime of these springs is not permanent and depends on atmospheric precipitation. This water-bearing horizon is characterized with good drinking qualities and is widely used by local population. As for the economic content of the water, mainly it is hydrocarbonate calcium, mineralization from 0.2 to 0.8 g/l. This water-bearing complex supplies the city of Akhmeta.

Alazani artesian basin covering the same geographic area as the Alazani River Basin belongs to sub-mountainous and inter-mountainous confined aquifers. It is enclosed between impermeable strata of Quaternary alluvial-proluvial sediments and is very rich in resources of fresh subsurface pore and stratal water. The Quaternary layer is built with merged river debris cones, whose sediments are of 10-500m thickness, composed of boulders, cobble, gravel, sand, clay, loams, and loose conglomerates. Groundwater is located at the depth from 10 to 60m. Well-spring flow rates range from 0.2 to 165 L/sec, transmissibility coefficient is 500-1500 m2/day. The waters are mainly free-flowing, with flow rates of 1.5 to 8.5 L/sec. Their filtration coefficient is 3.9 m/day on average, piezometric levels range from (-) 3 to (+) 4 m. The total groundwater resource in the major part of the Alazani-Ayrichay Valley (6,000 km^2) is estimated at 39.3 m3/sec, with a reserve of 20.4 m^3/sec in Georgia. While the minimum flow measured at the most downstream gauging site on the Alazani-Ayrichay basin is 63.7 m3/sec, the exploitation of 39 m3/sec appears to be safe. According to the two observatory estimations of ground water balance, inflow is 46 m3/sec, of which the infiltration from precipitation is about 7.6 m^3 /sec and infiltration from the rivers Alazani and Ayrichay is 38.4 m^3/sec. The ground water discharge is also 46 m^3/sec, from where the aquifer discharge in the riverbeds of Alazani and Ayrichay is 29.4 m^3/sec and the amount of evaporation and transpiration is around 16.6 m3/sec. These estimations are indicators of abundance of groundwater resources in the region.

The aquifer of the Apsheron-Agchagal continental sediments composed of conglomerates, cobble, sand and loam with a total thickness of 2000 m are mostly spread in the Alazani valley, where Telavi and Gurjaani aquifers can be identified. The Telavi aquifer occurs at the depths of 90 to 350 m. Wells have high pressures (+ 15-+25 m) and flow rates (10-60 L/sec). The aquifer transmissibility is 100-200 m^2/day. The Gurjaani aquifer occurs at the depth of 125-500m. The aquifer thickness reaches 80m. The transmissibility is 150-300 m2/day. Well-spring flow rates are 1-5 L/sec.

Ground waters of the basin are of high quality. On the territory of Georgia old quaternary sediments contain hydro carbonate calcium-sodium waters, with mineralization not exceeding 0.7 g/L and total hardness of 1.8-6.5 mg-equiv. However, waters at the Georgian borders are mineralized to 1.5-2.7 g/l. In total, mineral composition of groundwater varies between 0.1-1.0 g/l.

Iori River Basin

Surface waters. Iori River has a length of 320 km (313 km in Georgia and 7 km in Azerbaijan). In Georgia, the river system consists of 509 smaller rivers with an Overall length of 1,777 km. The density of the river network is 0.38 km/km^2. The largest tributaries of the river Iori are: Kharshula, Sagome, Keno, Adedi, Gombori, Lapiankhevi, Ragolantskali, Lakbe and Ole (for more details please refer to the hydrological map of the Iori Basin, figure 2, annex 5).

The Iori basin has an asymmetric form. Its upper part is located on the south slope of the Main Caucasian range and the lower part – within the Kartli-Kakheti plateau. It has a narrow arc-shaped form stretched from north-west to south-east between the basins of the rivers Alazani and Kura from the top of Mount Borbalo till the Eldari prairie. Rivers Khashrula (12 km), Sagome (18km) and Verkhveli (16 km) flow into the Iori upper to the Sioni reservoir located 56 km downstream the river head. River basin here is stretched over middle and low mountains of the southern slopes of the Greater Caucasus.

Iori is fed by snow melting, rainfalls and groundwater, with following contribution by these sources: ground waters – 39%, rainfall – 33%, snow melting – 28%. Ground waters have the highest importance in lower reaches. Flow regime of the river is characterized by uneven annual distribution of the run-off, with spring floods, summer-fall high waters and flash floods and, winter steady low waters. Over 40% of annual flow occurs in spring, 27-33% – in summer, 16-17% – in fall and 8-14% – in winter. However, in the wintertime the flow regime is characterized by instability year by year and in some years equals to the summer flow. The minimum flow is observed in winter (December-February) and equals to 8-14%. High waters during the spring floods, caused by melting of seasonal snows and rainfalls, usually start in March, in the lower reaches of the river – in the second half of February and, achieve its maximum in May-June. Floods continue till the end of July and are accompanied by low short rain peaks. The summer-fall season floods provoked by intensive rainfalls, re-occur every year for 3-6 times a season with the duration of 2 to 10 days. High waters often reach the maximum levels during the spring floods. The winter low-water level is steady, its fluctuation does not exceed 0.1m, and in separate years the water level stays on the same mark for 10-30 days. The lowest daily minimums have been observed in January and early February. The highest sediment discharge and concentration have been observed during the spring floods. The maximum sediment load from monthly averages is observed at the river head in April and in low waters in June. The minimal sediment load is observed in winter (January-February). The sediment concentration changes significantly along the river. Ice conditions in downstream waters are noticed rarely. According to the survey data the number of days with ice phenomena makes on average 33 days. The maximum number of days with ice conditions makes up 60.44 and 18 respectively. Ice formations appear in the second half of December and persist till the end of January and the first half of March. Freezing period with the duration of 3 to 10 days has also been observed. During low-water level the water in the river is clean, transparent and good for drinking.

Annual flow of Iori River is 341 mln m^3. According to series of hydrological observations (1934-1993), multi-year average run-off of the river is 15.1 m^3/s, at 75% probability – 12.6 m^3/s and, at 97% probablity – 9.32 m^3/s; maximum run-off is 838 m^3/s at 1% probablity, 707m^3/s – at 2% probablity, 524m^3/s – at 5% probability and 445 m^3/s – at 10% probability (for more details please refer to the tables 2,3,4, and 9, annex 5). Recent hydrological data on Iori are absent. In 2007 scientific-research company "Gamma" estimated average annual and maximum discharges of the river at Sioni dam (upper reaches) and at Lelovani (downstream Sioni), based on the 1934-1993 data of the Lelovani gauging site. In accordance with these calculations, the average annual discharge near the dam varied from 7.94m^3/s to 16.0 m^3/s (95-10% probability) and at site Lelovani (downstream Sioni) – from 7.28 m^3/s to 14.6 m^3/s (95-10% occurrence). Highest values of average monthly run-off were estimated to be in May-June, varying from 24.8 m3/s to 29.1 m^3/s (75-25%) in May and from 20.5 to 22.4 m^3/s in June (75-25%). The lowest discharge values were estimated to occur in January-February, varying from 3.64 to 5.61m3/s (75-25%) in January, and from 3.82 to 11.8 m^3/s (75-25%) in February. Annual average discharge was estimated at 9.94-13.7 m^3/s (75%-25%). Maximum discharges were estimated from 781-967 m^3/s (0.01% probability) to 195-215m^3/s (20% probability) at Lelovani point and from 825-1020 m^3/s (0.01%) to 205-225 m^3/s (20%) at Sioni dam. According to the hydrograph, the time span for wave lifting during flash floods is 24-hours and for wave lowering – 108 hours (3 full days). The volume of the wave during the flash floods is 92.4 times 10^{6}m^3 (10X10^3 year flood) and 70.2 times 10^{6}m^3 (1000 year flood). The sediment discharge in accordance with Lelovani site data is 2.2-7.6 kg/s (50-1% probability).

Below are the brief descriptions of the major tributaries of the Iori river (for more details on characteristics of the rivers of the Iori River Basin please refer to Tables 2,3, 9, annex 5).

The river Ole forms by confluence some springs in 6-7 km South-West from the village Kvemo Bodbe, at an elevation 535m, flows to the river Iori from the left side in 118 km from its mouth. The length of the river is 29 km, total fall of the river surface is 215 m, and average slope is 7.41‰ the area of water shed is 395 km^2, average height is 590 m. The network of the basin developed weakly, exists only 40 tributaries, with total length 129km, average density of the tributary network is 0.33km/km^2. The largest tributaries are: river Koda (length 12 km) and Mtsaretskali (length 12 km). The river basin has asymmetric form, 80 % of the basin area is located on the left -bank part of the river. The river basin is located on the East side of the Gare-Kakheti plateau and at the South zone of the Tsiv-Gombori range. The relief is plateau-hilly. The bed of the river slightly meanders and is not branched. In some places, before the mouth of the river Koda, 2-2.5 km the river flows in lowland wetland banks, where wetland zone has width up to 300m. In this area of the river flow hardly noticed. The depth changes from 0.1m, to 0.5 m; The velocity of the river – from 0.2 m/sec. to 0.9 m/sec. After mouth of the river Mtsaretskali, water in the river gradually disappears in leakage ground. This part of the river bed is dray, water flows only in spring in times of heavy rains. The river Ole is dray in most part of year. In times of rains, mainly in Spring (April- May) and autumn (October - November) observed flash floods less than 4-5 day duration. In this period Height of the water level is 0.6m-0.8m (in the upstream) and 1-1.2m (in the downstream). According to the separate measurement, The water flow gradually decreases from 0.088m3/sec (near river origin) up to 0.014 m3/sec. (in 10 km upper from its mouth) and then reduces up to zero.

The river Adzedzi takes its origin from springs, which are situated on the South branch of the Kartli Range, in 3 km West from the village Simoniaskhevi, at an elevation 1198m, flow to the river Iori from left ban, in 259 m from its origin, near the village Orkhevi. The length of the river is 16 km, total fall of the rive surface is 223m, average slope is 13,9‰, the area of the water shed is 162 km^2, its average height is 1240 km, total length of the tributary network is 134 km, total density - 0.82 km/km^2. The basin is developed to right-bank direction, 64.8% of whole basin is located here. The basin mainly characterized by mountainous relief, with elevation from 980m to 1770m, Only in its middle part is located at the Ertso hollow, which represents itself as plain with length 8 km and width 5 km. The bed of the river slightly meanders and is not branched. The width of the river varies from2m, to 4 m, mostly it is 3 m. The depth varies from 0.1 m up to 0.24m, mostly 0.2m. The velocity of the river is changes from 0.6 m/sec up to 1.2 m/sec. The bottom of the river is plain and covered by sand-gravel ground. Annual flow of the river characterized by high water level and floods in spring and low water level in summer and winter. Flooding period starts in March and reaches its maximum in the middle of May, in this period water level is 1-1,2m, in some years water level increased in 1.6-1.8 m. High water level period ends in the end of June. After high water level period starts summer uneven low water period. In summer 3-4 times observed rain floods differing with rapid increase and fall. In some cases water level approaching to maximum spring level. There is no observed dangerous hydrological events in the river.

Ground waters. Ground waters of the Iori Basin are represented by Mestia-Tianeti basin of pore and fracture water, Iori-Shirak basin of pore and stratal water and at a lesser extent, by Marneuli-Gardabani basin of pore and stratal water and Kartli Plain artesian basin (Kartli-Tiriphoni-Mukhrani artesian basin)

Aquifers of the Greater Caucasus fold zone represented by Mestia-Tianeti basin of pore and fracture water are found in the upper reaches of the Iori Basin. These are mostly composed of terrigenous and carbonaceous flysch of the Early and Late Cretaceous and Late Jurassic ages as well as of Middle and Early Jurassic shale stratum. Due to numerous fractures and karsts, limestone and sandstones are highly permeable and saturated with water. Sporadically watered flysch sediments of the Early Cretaceous age are widespread within the Mestia-Tianeti pressure water system and are represented by terrigenous and carbonaceous facies. Terrigenous flysch is found in the lower part of the reservoir and mostly consists of clayey shale and sandstone. Upper part of the reservoir is represented by carbonaceous faces consisting of limestone and marl. Total thickness of the sediments is 1200-2000 m. The Early Cretaceous flysch can be characterized as highly fractured structure due to presence of folds, cut by large tectonic faults. Outcrops of the terrigenous flysch are mostly met in the upper weathered zone (to 20-25m), and have low flow rates, up to 0.2 L/sec in shale formations and up to 6 L/sec in sandstone inter-beds. Flow rates of the springs occurring in the limestone mainly exceed 1 L/sec; in rare cases reaching 25 L/sec. Carbonaceous flysch aquifer of Late Jurassic period is built with 1500m-thick limestone, dolomite and marl. Water in this aquifer has high flow rate of up to 70 L/sec. Shale strata aquifer of the Middle and Early Jurassic age is mainly represented by thick mass of clayey shale sediments of dislocated and fractured structure, especially along areas of large tectonic faults, thus causing major watering of these zones. The stratum includes zones of intensive and restricted water circulation. Unconfined fracture groundwater circulates in the former zone, with spring outputs ranging within 0, 02-0.1 L/sec. In large faults, where the crystalline rocks thrusts the shale mass, spring flow rates are much higher reaching 5 L/sec.

Sub-mountain and intermountain aquifers are represented by ground waters of Iori-Shirak and Marneuli-Gardabani pore and stratal water basins, built with merged river debris cones. Alluvial and alluvial-prolluvial debris cone sediments of Late Pliocene and Quaternary ages, frequently reaching 300-500m and occasionally - 1,000-1,500m in thickness, are composed of boulders, cobble, gravel, sands, clay, loams and loose conglomerates. Ground waters at the tops of the cones form a single unconfined aquifer. In the center and periphery, where clays or clayey matrix occur, these divide the single aquifer into the unconfined aquifer and several confined ones. Thus, in every above pore and stratal water basin the unconfined and several confined aquifers are present. Confined aquifers occur several kilometers below the contact zone between the bedrock and coarse-fragmented talus, and their distribution is lower than that of the unconfined aquifer. Aquifer of the Quaternary alluvial-proluvial sediments of 10-500 thickness is widespread within Tiriponi-Mukhrani, Marneuli-Gardabani, and the Iori tableland. In the Iori-Shirak artesian basin, the aquifer thickness ranges within 37-72m in the debris cones of the Iori tributaries. The waters are mainly free-flowing, with flow rates of 1.5 to 8.5 L/sec. Their filtration coefficient is 3.9 m/day on average, piezometric levels range from (-) 3 to (+) 4 m. In the central sunken part of the Marneuli-Gardabani plain, strong groundwater streams circulate at the depth of 20m. These include the Tamarisi, Gardabani, Koda and Tselaskuri groundwater streams with total natural resources of 36,802 m3/day. Sporadically watered lagoon-continental sediments of Mio-Pliocene age are widespread in the Kartli-Tiriponi-Mukhrani and Marneuli-Gardabani artesian basins. These are built with conglomerates cemented with clay and lime, occasionally by sandstone and clay. The total thickness of the strata reaches as much as 3000 m. Well-spring flow rates range within 0.10-5.7 L/sec. Most wells have piezometric levels to 42 meters below the ground level. Excess pressures in the wells reach +10 m. In Norio-Martkhophi and Mukhrovani-Ujarma segments ground water mineral content is up to 20-35 g/l, represented by hydrocarbonate and Na^+ type waters. In Norio segment ground waters consist of Naphten acid with up to 5-6 g/l content, iodine with 30-90 mg content and, bromine with 20-80 mg content.

The aquifer of the recent alluvial sediments built of cobble with sandy and sand-salty matrix and inter-beds and lenses of sand, sandy loam, loam and clay, is found in floodplains and above-floodplain river terraces. The aquifer thickness mostly ranges within 3- 15 meters, occasionally reaching 30-40 meters. The filtration coefficient is 10-30 m^2/day, occasionally 100-200 m^2/day. The aquifer has significant water resources, and the aquifer water has high drinking quality. Therefore, groundwater of this aquifer is abstracted to supply drinking water to the city of Sagarejo and the town Tianeti (on the river Iori).

Rioni River Basin

Rioni River and its tributaries, according to international classification, form the Black Sea coastal river type, the specific features of which are: catastrophic floods in almost all seasons, and, rich sediment and intensive sedimentation processes in the mouths of glaciers-fed rivers. The coastal zone is deeply intruded into the sea, where the river gorges descend by some kilometers to the bottom of the sea, in the form of an underwater canyon. In such portions, the river sediment produces spits, peninsulas and islands. At the same time, the accumulation processes are more intensive, where the rate of sinking of the coast is higher, and the sediment richer (for more details please refer to the hydrological map of the Rioni River Basin, figure 3, annex 5).

Rioni is the most efluent water body in Georgia. Its average elevation is 1,084 m and average inclination - 7.2 %. The river water level increases in spring (April) and reaches its maximum in June. The flooding continues until the end of August. By the end of September, flooding is caused by heavy rains and reaches its maximum in October – November. Minimum water level is observed during December-February. Overall, 38.8% of total run off occurs in spring, 28.5% - in summer, 18.4% in fall and 14.3% in winter. 34.7% of the run-off is is created by groundwaters, 32.5% - by rain water, 28.2% - by snow melting and 4.6% - by glaciers. The river annually brings 12.9 km3 water and 6.9 mln tons of sediments to the Black Sea. The sediment amount increases from river head to mouth ranging from 96,000 to 6.9 mln tons. Both flash floods and floods are specific to the river. Floods happen in spring-summer seasons caused by snow and glacier melting as well as by rainfall. In upstream areas flood season begins in early April, in middle reaches – in the first half of March and in the downstream – by the end of February. Floods reach their maximums in upper reaches in mid-June, middle reaches – by end of May and in lower reaches – in early May. Floods continue to occur until the end of August. By the end of September, floods are intensified due to heavy rains and reach their maximums in October-June. Even during the low waters (December-February) flash floods happen frequently due to rainfalls.

In upper reaches, average annual (long-term) water discharge of the Rioni river is 27.9 m^3/sec (near the village of Glola), 30.6 m3/sec (near the village of Utsera), and 43.7m^3/sec (near the village of Oni). The maximum water discharge (1% probability) of the river is 368m^3/sec near Glola, with a corresponding minimum(75 % probability) of 4.21 m3/sec. Average annual flow speed of the river is 31.8 m/sec near the village of Utsera, 45.3 m/sec (near the town of Oni), and 70.5 m/sec near Sori. Near Kutaisi long-term average annual discharge is 134 m^3/s and near Sakochakidze gauging station – 406 m^3/s. Maximum flow rate (1% probability) is 368 345m^3/s near Glola, 1806 m^3/s near Kutaisi and3730m^3/s – near Sakochakidze; Minimum discharge(75% probability) is 4.21 16 m^3/s near v. Glola, 37.9 m^3/s near Kutaisi and – 34.0 m^3/s near v. Sakochakidze. After Kutaisi flowing over the Kolkhida lowland the river width grows up to 250 m., water depth is 0.8-5 m. and flow speed - 0.7-1.5 m/s. The bottom of the river is build with shingle beds and sand. Height of the river bank before the town Samtredia is 0.2-2 m. At a lower part of the basin, the river flows on a highly marsh-ridden area. Width of the river there varies from 100 to 150 m, depth: 1-5 m, flow speed: 0.6-1.2 m/s. The bottom mainly is build by sand and fine-sand. The river mouth (delta) has a nearshore with a floor slope exceeding 1‰, classyfing this delta as very deep. This means that effect of waves of these deltas on the coast line is relatively strong. The delta area is 20 km^2, with a 9km-long main sleeve (for more details please refer to the table 5. Main Hydrological Ffeature of the River Rioni, annex 5).

Rioni belongs to hydro carbonate group of rivers with average mineralization (150-300 mg/l).

Main tributaries of the Rioni river are (for more details please refer to the tables 10-18, annex 5): Jejora, total length of which is 50 km, catchment area 438km^2, average altitude - 1865 m, volume of average annual run off - 400 million m^3; Lukhunistskali, with length of 39 km, catchment area - 293 km^2, volume of average annual run off - 374 million. m^3 Kvirila, with length of 140 km, catchment area -2630 km^2, average altitude - 790 m, volume of average annual run off - 2700 million. m^3; Maximum river flow for Kvirila is recorded during flash floods and amounts to 268 m^3/s near Chiatura and 883 m^3 /s near Zestaphoni. The lowest flow rate is recorded in summer period and amounts to 0.8 m3/s near Chiatura and 4 m^3/s - near Zestaphoni. Multi-year average run-off is between 20.7 and 61.7 m^3/s Khanistskali, with length of57 km, catchment area - 914 km^2, average altitude -1180 m, volume of average annual run off - 686 million. m^3 used for irrigation and power generation; Tskhenistskali, right-hand tributary of Rioni with length of 176 km, catchment area 2120 km^2, average altitude - 1660 m, volume of average annual run off - 2681 million. m^3; annual average discharge is 43 m3/s near mouth and maximum average discharge – 242 m3/s, near Nakalakevi; originates from Main Caucasus range, in upper reaches flows in narrow deep gorge and in downstream – over Kolkheti lowland; river is mainly fed by rain water; the Tekhuri, with length of 101 km, catchment area – 1047 km^2, average altitude – 730 m, average annual run off - 1692 million m^3; the Dzirula, with length of 83 km, catchment area -1270 km^2, average altitude - 850 m, volume of average annual run off - 880 million m^3. In addition to these rivers, there are medium to small rivers of Rioni basin, which are used for power generation and irrigation e.g. the rivers Sulori, Gubistskali, Tskaltsitela, etc. The length of Sulori is 34 km, maximum gradient -2322 m, average inclination – 61.8%, catchment area – 189km2. The river is used for irrigation and power generation; the length of the river Gubistskali is 36km, catchment area – 442 km2 and, average annual discharge – 16.3 m3/s. The river is used for irrigation; the length of the river Tskaltsitela is 49 km, catchment area -239 km2.

Total length of tributaries is 720 km. Out of total number of tributaries 8 have the length of 20-25 km, 14 rivers – 10-25 km and 355 tributaries – less than 10 km.

Rioni tributaries in upstream areas flow mainly in mountainous areas. The major source of their feeding is snow melting. Groundwaters play insignificant part. Three of them: the Lukhumi, the Tskhenistskali and the Tekhura (with own tributary Abasha) represent right bank of the Rioni river and begin at southern slope of Great Caucasus Range, while left tributaries: the Kvirila, the Dzirula and the Khanistskali have their sources at Imereti Upland and northern slope of Meskheti Range. Soil profiles along these rivers are characterized by rocky and stone compounds and in mountain zones are covered by thin layer of gravel sand and clay, just as in plane zones they are gravel-sandy or gravel-clay. The river beds in mountains are meandering because of high water stream and rocky relief. River bottoms are build by either sandy-pebble or stone material. Banks are sloppy and rocky. Their absolute altitude varies from 1.5 to 5-6 meter, speed of water stream - from 2 to 5 m/s. these rivers do not freeze in winter period, even in mountains. During the spring flooding (April-June) and abundant precipitation, the water level increases up to 3m (the water level in the Tskhenistskali river sometimes reaches 8m).

Below is the detailed characteristic of the Rioni tributaries.

The river Tskhenitskali takes its origin from the central part of the Grater Caucasus Range, in glaciers, at an elevation 2,700m, flows to the river Rioni from right side in 88 km from its mouth. The length of the river is 176 km, average slope is 15‰, the area of watershed is 2120 km^2, average height 1660 m. The right side is 2.5 times larger than left side. In the river flows following small rivers: Zeskho (19km), Gobishuri (12km), Laskanura (20km), Kheledula (34km), Leqtareshi (24km), Janaula (21km)and etc. Except them, to the river basin belongs 897 rivers, from which 13 have length less than 10 km. In addition in the river basin exists 8 channels, with total length 103 km. Total length of river network is 2200km, average density is 1.09 km/km^2. The basin includes glaciers with total area 12.9 km^2. The river basin is situated on the South slope of the Greater Caucasus Range, only its lower part is located within the boundaries of the Kolkheti Lowland. The basin bounded by Svaneti and Samegrelo ranges from the Western side, Lechkhumi range from the Eastern side, the Northern water shed line goes along the crib of the Greater Caucasus Range. The basin has meridional direction, from the main watershed stretches to the South direction. The length of the basin is 120 km, average width 18 km. The river is characterized by spring flooding and low water level in winter. Significant rise of water level observed at the end of February and beginning of March, in this time maximum level of water in the middle part of the basin reaches 0.5-0.8 m, in the upper part – 1.2-1.7m. Flood caused by rains occurs in Autumn. Dangerous hydrological events connected to the flooding, which observed on the down flow of the river. The river gets its charge from snow, rain, ground waters and glaciers. Main role in process of formation river flow belongs to the melting water. The water of river used for energy power generation and irrigation.

The river Lukhunistskali takes origin from the South slope of the Lechkhumi range (from small ground spring), at an elevation 2,650 m above sea level, flows to the river Rioni from the right shore. The length of the river is 39 km, average slope - 52.2 ‰, the area of the watershed is 293km^2, average height 1,750 m. Its main tributary is the river Kheoritskali. Except this, the river has 32 small tributaries, with total length 81 km, average density of the river network is 0.5 km/km^3. In the river basin is located one lake, with total area 0.01 km^2. The basin has asymmetric form, from the East and West is bounded by the Lechkhumi range, with average height 2900-3000m. The relief of the basin and in particular its upper part is complicated, with sharpening rocky peaks and deep valley of rivers. The highest peaks are: Kareta (3,553.2 m), Samertskhle (3,584m), Chtkara (3,540m), Lukhunistsveri (3,179.6 m) and etc. The river valley at the upper and middle flows is narrow and deep, its width is 5-7-m, the rest part of the watershed has V-type form with width 30-40m. From the its head, in 20-22 km, the river bed is meandering, full of rapids with 0.5-1m height of falls; on 5-6 m the river bed is branched and creates stony, low islands, near the village Likheti, in 3-4- m, the river flows violently. The width of the river changes from-5 to 12 m, mostly it is 7m, and the depth variation is from 0.4 up to 1 m, the speed of the river changes from 1 l/sec to 3 m/sec. The river is characterized by long flooding in spring, which caused by snow and ice melting. The river is used for energy power and producing drinking water.

The river Tekhuri takes its origin on the South slope of the Samegrelo range, at an elevation 2,360 m, flown to the river Rioni from right shore, in 57 m from its mouth. The length of the river is 101 km, average slope 23 ‰. Total area of the watershed – 1,040km2, average height 730m. In the river basin exist 503 rivers, with total length 1,047 km, from them 5 river have length more than 10 km and considered as main tributaries of the river. Those rivers are: Chkhorotsku (20 km), Gurdzemi (20km), Nakhuri (11km), Abasha (66 km), Chachkhuri (12km). The total density of the river network is 1.01 km/km^2. Upper part of the basin situated at the South slope of the Samegrelo range, down part of the baisn – on the Kolkheti Lowland. From the West the basin bounded by watersheds of rivers Tsiva and Khobi, from East – by watershed of Tskhenitskali. The upper part of the basin has high mountainous relief, with height up to 3000m and bounded by lower mountains with height up to 1000m. According to regimes of water levels, the river belongs type of the Black Sea shoreline rivers, with flash floods and deeply expressing spring floods. The spring floods usually start in the middle of March and reach its maximum at the end of April. The autumn characterized by intensive floods, caused by frequent rains, in that period, water level is more than in spring floods.

The river Tskaltsitela takes origin on the South-West slope of the Nakerala range, at an elevation 1080 m, above sea level, the river flows into the river Kvirila from the right shore (3 km from the mouth). The length of the river is 49 km, average slope – 23 ‰. The watershed covers 239 km^2. In the river basin exist 196 small tributaries with total length 318 km. The watershed is located at the South slope of the Racha Range and has symmetrical form. The length of the river basin is 35 km, average width - 7 km. The relief at the upstream of the river has mountain character, with height 700-1600m, the middle stream of the river is hilly, near the mouth river flows on lowland area. The width of the river bed changes from 3 m to 34 m, with dominancy 10 m. The depth of the river changes from 0.1 m to 1 m with dominancy 0.4 m. The speed does not exceed 1 m/sec. The bottom of the river bed at the upstream and middle stream of the river built by field stones and pebble stones, near the mouth area is mixed with pebbles and gravel. According to the annual variation of the water level, the river belongs to the type of black sea coastal zone and is characterized by the high water regime during the entire year. Spring floods occur 3-4 times a year, which is caused by rains and melting snow, water level increases from 1m to 3.7 m. In summer floods do not occurs so intensely as in spring, observed 3-6 times during whole period. Autumn characterized by significant and frequent rise of water level. Maximum annual water level observed exactly this period of a year, water level reaches 5 m. In winter water level of the river is changeable and depends on rains and melting snow. In this period water level increases by 2-3 m. The river not characterized by dangerous hydrological events. The river gets its discharge from rain waters. Turbidity of the river is 4400 g/m^3 in average.

The river Khanitskali takes origin on the North Slope of the Adjara-Imereti range, flows in the river Rioni from left shore, in 138 km from its mouth, near v. Vartsikhe. The length of the river is 57 km, average slope 35.1‰, the watershed area is 914 km^2, average height 1180m, above sea level. The largest tributaries are: Laishura (18 km), Kershaveti (21km), Tsablaratskali (29km), Sakraula (52 km). The other tributaries have the length less than 10 km. In total, the basin includes 413 small rivers, with total length 858 km, total density of the river network is 0.94 km/km^2. The basin has symmetrical form and situated from the South-East to the North-West. The length of the basin is 47 km, average width is 19.4 km. 10 % of the basin area is located at elevations from 1000 m to 2000m, the other territory located in foothills zone, the lower part of the river, near the mouth, located on the Kolkheti lowland. The relief of the upstream of the river khanitskali mostly is mountainous, only downstream part characterized by small hill relief. The river bed is slightly meandering. The width of the river varies from 3-5m to 17-22 m, depth – from 0.4m to 1.6m, mainly - 0.6m. Speed of the river flow changes from 0.5m/sec to 2.6 m/sec, in general - 1.5 m/sec. The spring flooding usually starts at the end of March, sometimes in the middle of February and lasts up to July. Maximum of the water level is 1.4-1.7 m. Low water level observed in summer and lasts from July to August.

The river Kvirila takes origin on the North Slope of the Racha Range, on the hollow of the Ertso Lake at an elevation 1711 m, above sea level. The river flows to the Rioni River from the left shore in 139 m from its mouth. The length of the river is 140 km, average slope is 11.6‰, area of the watershed is 2630 km, average height 790 m. In the river basin exists 1682 small rivers, with total length 545 km. The main tributaries are: Gvizga (19 km.), Gedura (13 km), Lashura (13 km), Chikhura (18 km), Djruchula (21 km), Sadzaliskhevi

(10km), Dzirula (94 km), Cholaburi (20 km), Lukhuta (21 km), Tskaltsitela (49 km). Total denisity of the river network is 1.45 km/km2. Upstream sections of the river are located at the South slope of the Racha Range and the Western slope of the Surami Range. The width of the upper part of the river basin is 20-22 km, the middle part is 55-60km, and the lower part is 30-32 km. The relief of the upper part of the river basin is typically mountainous, lower part is characterized by lowlands, except some parts, where surface is hilly and stony. The river Kvirila gets its discharge from snow, rain and ground water. The significant annual discharge is observed in March and reaches its pike at the end of April. Up to town Chiatura, quality of the river's water is good and usable for drink, whereas water in the downstream is polluted. Temperature regime of the river changes, comparatively high temperature is observed at the mouths of tributaries, which brings worm water. The river is used for irrigation, for operation of water-mills and for washing manganese ore near the town Chiatura.

The river Dzirula is formed by confluence small ground springs, which are flow from the western slope of the Surami range, at an elevation 1252.4 m, and flows to the river kvirila from left side. The length of the river is 83 km, total fall 1052m, and average slope 12.7 ‰. The area of the river watershed is 1270 km2, its average height is 850m. The river has 1386 tributaries, with total length 1677 km, from which the largest are following rivers: Dumala (34 km), Chkherimela (39km), Khelmosmula (16 km). Average density of the tributaries network is 1.38 km/km2. The river basin is located at the KarTalo-ImereTi height and bounded by the Surami range from East to South-West and by the watershed of river Kvirial from the North and North-west. Upper side of watershed has meridional direction, middle and down sides – latitudinal. The length of the basin is about 56km, average width 22 km. The basin is developed in downstream significantly, because of the watershed Tskaltsitela River. The relief of the western slope of the Surami rage (left slope) and the Imereti plateau is deeply partitioned. The Surami range goes along the river continuously at an elevation from 1100-1200m to 70m. The Basin covered by mixed forest and high bush. The river gorge is meandering, bottom of the river is narrow, mostly with width 50-60m, but in some part, the bed of the river is very narrow 20-25m and in some area is broadened to 300-500m. The river is characterized by high level of water in spring, which caused by snow melting and rains. Relatively low level of water observed in summer. In spring water level exceeded to 1.5-1.8 m, the lowest level observed in July and August. The river gets its charge from melting snow and rain waters. The most part of annual discharge flows in spring (48%), in summer and autumn equals 9-13%, in winter 30%. The river used for irrigation and operation of mills.

The river Jejora originates from the confluence of several mountainous glacier springs, located on South-West slope of the Main Caucasus Range at an elevation 2119.7m, above sea level. The river Jejora flows in the river Rioni from the left side, in 268 km from its mouth, near to town Oni at an elevation 768m. The length of the river is 50km, average slope is 27 %0. The area of watershed is 438 km2, Its average high is 1865m. Main tributaries of the river are: Gramula (length 16 km) and Kvedrula (length 19 km). Except them the river Jojora has 87 small tributaries, with total length 147 km. The density of the river network is 0.61 km/km^2. The river basin is situated on the South slope of the Main Caucasus Range. From the South-East the river basin is bounded by the Range of Racha and form the North-West – by watershed of the river Garula. The watershed has symmetrical from, which is 52-53 km in length and 10km in width, is characterized by rapid partition relief with high pikes (Zekari – 3833,6 m Khalatsa – 3941,7m.) The river jejora gets its charge from snow, glacier and rain waters.

Groundwaters. In upstream areas, groundwater of the Rioni Basin is represented by Racha-Lechkhumi artesian basins contained in Meso-Cenozoic sediments. Peripheral parts consist of Jurassic and lower cretaceous sediments and central parts – sediments of upper cretaceous and Cenozoic origin. Major aquifers are met in layers of mid-Jurassic volcanic, lower and upper cretaceous limestone, Neocene limestone and quaternary alluvial-delluvial sediments. Mid-Jurassic volcanic deposits mostly bear slightly mineralized hydro carbonate ground waters. Low discharge spring mineral waters are very abundant in the region. In tectonic folds and Jurassic deposits hydro carbonate and chloride waters are met, while in upper Jurassic deposits – sulphate rich waters. Lower cretaceous aquifers contain karst and karst-phorous groundwater, which flow on the surface as strong springs and in many cases bring an origin to various rivers (e.g. Sharaula). In the submersed part of Racha-Lechkhumi Syncline lower cretaceous sediments create slightly mineralized artesian aquifers with a death of 2000 m. presumably; these layers consist of thermal hot waters. Upper cretaceous layers that are not widely spread consist of karst waters. Recharge areas are located in upper parts of the syncline and discharge areas – in lower parts. Discharge happens mostly in tectonic faults and Lajanuri anticline, where the vein of limestone is emerged on the surface. In the Middle-Miocene sandy and limestone formations there are karst waters of high mineralization. Quaternary alluvial-delluvial sediments spread in floodplain areas and terraces there are rich in hydro-carbonate and calcium waters. Old quaternary sediments found in upper terraces, consist insignificant volumes of groundwater of hydro carbonate-calcium type.

Groundwaters in Imereti lowland (lower reaches or Rioni) belong mostly to Tskaltubo artesian basin of karst waters. The sediments are represented by lower and upper cerateous limestone and quaternary sands and pebbles. Lower cretaceous layers consist of falt-karst, fore-karst and karst artesian waters of high water discharge – 200-220 l/s. Upper cretaceous Paleocene limestone is not widely spread and contains low yield karst waters. Quaternary sandy layers are saturated with unconfined perforated ground waters which flow out to the as springs of high yield (up to several hundred liters per second). To the north and from the north-east to west aquifers become confined. In few areas highly mineralized chloride-sodium or calcareous groundwater in Jurassic porphyries and sands and pebble containing layers are found.

Overall, mineral composition of groundwater of Tskaltubo artesian aquifer is of hydro-carbonate and calcium. The total resource is estimated at 15m3/s. Tskaltubo is well-known for its mineral waters, with 0.7-0.8 g/l mineralization level. Water discharge is 18-20 l/s and temperature +33-35^{0}C.

Groundwater of Kolkheti lowlands (Lower reaches of Rioni), very downstream of Rioni River basin predominately in coastal zone, are represented by upper aquifers contained in recent coastal marine and alluvial, marshy and Rioni river recent alluvial sediments. Rioni river recent (quaternary) alluvial sediments are composed of sands, sandy gravels and clays and are found at 10-15m depth. The water is composed of bi-carbonates, calcium and magnesium. Black Sea recent marine and alluvial sediments are represented by sands and loams and are met at 5-10 m depth. The water is of bicarbonate, calcium and magnesium type. Recent marshy formations are represented by sands, clays and turf and peat at 5-30m depth. The groundwater is bicarbonate calcium-magnesium type. Groundwater is fed mainly by rain water (in Poti atmospheric precipitation is 1,660mm). Recent marine and alluvial sediments are the most common in the coastal areas with alluvial sediments varying from several hundred meters to several km in width. The water is mostly found at 1-5 meter depth in sands and gravels in the coast line and 0.5-1 m in marshes. The closeness of the groundwater column to the ground surface is the major determining factor for existence of marches. The water discharge here is 0.1-1 l/s. Overall, groundwater salinity is 0.3-0.5 g/l. Groundwater flows from east to west at very slow pace. Water recharge rate exceeds discharge rate.

2.2 Socio-economic Context

2.2.1 Demographic Situation

Alazani-Iori River Basins

Total population size of the Georgian part of the Alazani River Basin is about 392,500, of which urban population makes up only about 20% (for more details please refer to the table 1. Population size of the Alazani, Iori and Rioni Basins, annex 6). Eight out of 21 largest villages of Georgia with population over 8 thousand each are located in Kakheti. There are eight administrative municipalitiess (municipalities) within the Basin: Akhmeta, Telavi, Gurjaani, Kvareli, Signagi, Sagarejo[6], Lagodekhi and Dedoplistskaro that are located in Kakheti Administrative Region. Telavi is an administrative center of the region. The average population density is 38 individuals per square kilometer with maximum density reported for the north part of the Iori slope and on the adjoining mountainous-hilly section of the Alazani Valley, foothills of the Gombori and the Caucasian Range. Telavi and Gurjaani municipalitiess have the highest population densities, followed by Lakhodekhi, Kvareli and Signari. Akhmeta and Dedoplistskaro have the lowest population density as these areas are either mountainous or arid steppes (See the map of the Georgia and Alazani river basins population density, figures 1,2, annex 6).

The demographic structure is well balanced in terms of gender as the number of men and women is almost equal. In terms of age composition, 21% is non-employable young population, 19% - non-employable elderly and 60% employable adult. About 80% of the population of Kakheti constitutes Georgians, while the rest are Russians, Armenians, Azeries, and Ossetians etc.

Iori River Basin

Total population size of the Iori Basin is about 95,200 (for more details please refer to the table 1. Population size of the Alazani, Iori and Rioni Basins, annex 6). This figure is only estimate[7]. It includes total population size of the Tianeti municipality of Mtskheta-Mtianeti region and the Sagarejo municipality of Kakheti region as well the population size of following communities: Sartichala (Sartichala and Muganlo villages) – Gardabani municipality; Kachreti, Naniani and Jimiti – Gurjaani municipality, Bodbe and Ulianovka – Signagi municipality and Mirzaani and Japharidze – Dedoplistskaro municipality.

Rioni River Basin

<u>Total population size.</u> Total population size of the Rioni River basin is about 987,175[8] (for more details please refer to the table 1. Population size of the Alazani, Iori and Rioni Basins, annex 6). The region covers following municipalities: i) Oni, Ambrolauri, Tsageri, Lentekhi located within Racha-Lechkhumi and Lower Svaneti region; ii) Tkibuli, Samtredia, Terjola, Zestaponi, Sachkhere, Kharagauli, Bagdati, Vani, Chiatura and Khoni and the city of Kutaisi, Imereti regional center; iii) Abasha, Senaki, Martvili, about one third of the Khobi municipality, excluding town Khobi and, the city of Poti located within Samegrelo-Zemo Svaneti

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[6] The section of the Sagarejo municipalities that is located within the Alazani river basin is unpopulated. Therefore, Sagarejo population size is not included in the total population size of the Alazani river basin

[7] Population size of individual communities is taken from 2002 statistical book.

[8] This figure is only estimate that includes exact number of population of Racha-Lechkhumi, Imereti and Samegrelo-Zemo Svaneti regions and estimate of the population of Rioni basin section of the Guria region

region; iv) very small area of Chokhatari (Khokhnari and Zemo Kheti communities) and very small part of the Lanchkhuti municipalities located[9] in Guria region and, part of the Java municipalities located in break-away region of South Othetia[10].

Population of Racha-Lechkhumi and Kvemo Svaneti region. Population size of Racha-Lechkhumi and Lower Svaneti is 47,600, with about 19% urban and 81% rural population respectively; population density – 10/km2. There are 256 settlements in the region with three cities: Ambrolauri, Oni and Tsageri; two towns – Lentekhi and Kharisvala and, 251 villages. Population ethnic composition is as follows: 99.3% Georgians, 0.2% Ossetians, 0.2% Russians, 0.1% Azeries, 0.1% Apkhazians, 0.1% - others. The largest municipality is Tsageri, Followed by Ambrolauri, Oni and Lentekhi; the largest city is Ambrolauri. According to official statistics since 2000 total population size has reduced by 4,900 mostly due to internal migration to large urbanized areas.

Population of Imereti region. Population size of Imereti region is 700,400, with about 47% urban population and 53% rural population. Population density – 108/km^2. The administrative center of the region is the city of Kutaisi. The population size of Kutaisi is 192,500. There are 542 settlements in Imereti, including 10 cities, 3 towns and 529 villages. About 98.5% of the population is Georgians and the rest Abkhazians, Azeries, Russians, etc. According to the official statistics, total population size of the region has reduced by about 15,400 from 2000 through 2010.

Population Size of Samegrelo-Zemo Svaneti municipalities located within the Rioni Basin. Population size of Abasha, Senaki, Martvili and Khobi municipalitiess located within the Rioni basin is about 186,300, with about 28% urban and 72% rural population. Population size of the city of Poti is 47,700. According to official statistics the population size has increased from 2000 to 2010 by about 6,500. The population is represented by 99% of ethnic Georgian. The remaining 1% is represented by Russians, Abkhazians, Azeries, Armenians, etc.

Population Size of Guria Section of the Rioni River Basin. Approximate number of inhabitants of the villages of the Chokhatauri municipality located within the Rioni river basin is about 2,075[11] comprising of Kokhnari (population size according to 2003 data: 1,722) and Zemo Kheti (population size according to 2003 data: 353) communities. The territory of the region located within the Rioni river basin is 100% rural area. Over 96% of population in the region is ethnic Georgians.

2.2.2 Economic Activities

General Description

Although, recent official statistical data on economic performance of separate regions of Georgia are unavailable, there are a number of studies conducted in 2007-2008 to assess the situation in the country in relation to some of the major economic indicators, e.g. poverty, employment, etc., etc. For instance, in 2008 a diagnostic analysis was conducted by the Georgian Regional Development Commission to evaluate the

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[9] This figure is only estimate, due to the unavailability statistics per municipalities
[10] For the purpose of this study information on the area of the Java municipalities, part of the Rioni Basin is not given, due to the small size of area as well as unavailability of information on this area.
11 This figure is approximate, given the unavailability of disagregated data per settlements

situation in the regions of Georgia with regard to development. Among others, poverty and employment levels have been assessed. Findings of the study showed the poverty level measured against official state poverty line, was very high in Kvemo Kartli, (52.5%), Adjara (52.5%) Mtskheta-Mtianeti (52.5%) and Kakheti (50.2%) regions. More than half of the population of these regions did not meet minimum state living standards. About 40% of the poor population of Georgia lives in these regions. Relatively low poverty level was reported for Tbilisi (30.2%), Imereti (31.4%) and Samtskhe-Javakheti (32.6%). Samegrelo (41.1%), Shida Kartli (47.2%) and Guria (47.8%) were the regions with a middle-poverty level. The reduction of the poverty level was the highest in Samtskhe-Javakheti (14.5%) and Kvemo Kartli (13.5%). In terms of poverty level measured against UNICEF poverty line, Kakheti (37.2%), Adjara (36.8%), Mtskheta-Mtianeti (36.6%) and Guria (36.2%) were reported to be the poorest regions of Georgia. The lowest poverty level was reported for Tbilisi (17.3%), Imereti (19.4%) and Samtskhe-Javakheti (20.2%). In accordance with the world bank 2008 poverty assessment, highest incidence of poverty is observed in Shida Kartli (59.4 percent), followed by Kakheti (46.3percent), and Mtskheta-Mtianeti (40.6 percent). The intermediate level of poverty is observed in Ajara (27.4 percent) and Guria (33.2 percent). The lowest incidence of poverty is found in Tbilisi (12.9 percent), Samegrelo (14.4 percent), and Kvemo-Kartli (17.3 percent). In terms of percentage of population that receives targeted social assistance (TSA) the largest figure is attributed to Racha-Lechkhumi (40%).

In 2005-2008, the largest increase in unemployment was observed in Samegrelo, Kakheti and Samtkhe-Javakheti. The highest level of unemployment was reported for Tbilisi, followed by Adjara (14%) and Imereti (12.8%). This value has significantly reduced in Kvemo Kartli and Guria. Drastic reeducation of jobs has happened in Tbilisi (5.1%), Kakheti (8.5%) and Guria (5.3%), while increase in jobs has happened in Adjara (4%) and Samegrelo (0.6%). In urban areas the major employment type is contractual recruitment (69.7%). Self-employment in non-agriculture sectors is only 19.4%. In rural areas, the major type of employment is employment without any remuneration (43.1%) and self-employment (36.0%) in agriculture sector. Overall, in regions of Georgia self-employment and employment without salaries in the agriculture sector still stay as major forms of employment, reaching 80% of total employment structure in Guria and Mtskheta-Mtianeti. In Tbilisi, Mtskheta-Mtianeti and Adjara regions there is a trend of increase in employment in service, trade, transport and tourism sectors, caused by tourism and municipal transport sectors growth in Georgia. Overall, agriculture is a major (65%) sector of employment, followed by construction and state governance sectors (please see figures 3-5 for poverty related information).

Alazani River Basin

General. Kakheti region located within the Alazani river basin is a leading agricultural region of Georgia. The most developed branches are viticulture, followed by cereal production and livestock rising. Food production sector is also developed due to the large share of agriculture in the region’s economy. Wine production is the most important branches of this sector. Oil and gas extraction activities of limited scale are ongoing in Sagarejo and Dedoplistskaro municipalitiess. In addition, limestone extraction and processing together with marble extraction and processing industries operated in the region. Commercial logging and wood processing activities are ongoing in Akhmeta municipalities. Trade and services also play significant part in the region’s economy. In recent years, construction sector became fast-growing sector due to the on-going and planned road and other infrastructure projects. In 2006, gross regional product was GEL 1,100 million, with GEL 2,500 per capita gross regional product.

Agriculture. Agriculture is the main economic activity within the Georgian part of the Alazani Basin, with crop production and viticulture dominating there[12] (for more details please refer to tables 2-5, annex 6). Agriculture lands occupy 583,981 ha, of which 203,349 ha is occupied by arable lands, 47,347 ha – by perennial croplands, 330,698 ha – by pastures and 2,587 ha by heyfields. Dedoplistskaro is the municipality in the region with the largest area of agricultural lands, followed by Akhmeta, Sagarejo and Signagi. Dedoplistskaro and Akhmeta, with the smallest populations, together with Signagi have the most agricultural land resources per capita. In these municipalities the majority of agricultural lands are under annual crops or pastures, while in Gurjaani and Telavi Municipalities, the land is mainly used for perennial crops.

Historically, Shida (inner) Kaheti had and still maintains a leading role in winegrowing, cereals production, market gardening and stock farming on Alazani River Valley, while the Gare (outer) Kakheti had and keeps a leading role in livestock farming, winegrowing and fruitgrowing zones, as well as substantial development of market gardening, sunflower and cereals cultures on Iori River Plateau.

Vineyards occupy around 38,000 ha (75% of vineyards of the country) mostly, in Alazani Valley and over the slopes of the TsivGombori Range foothills (e.g. right bank of the Alazani, northwards from Akhmeta and southeastwards to Khirsa). On average, 95 thousand tons of grapes were picked in 2006-2009 in the region, which accounted for over 53% of total grapevine harvest of the country. The Right bank of the Alazani basin has particularly favorable climate and soils (e.g. brown, meadow alluvial, carbonate and black) for winegrowing.[13] Gurjaani and Kvareli municipalitiess are winegrowing centers followed by Telavi, Dedoplistskaro and Akhmeta[14]. Unique varieties, such as Rkatsiteli, Mtsvane, Khikhvi, Kisi, Saperavi and etc. are grown in the regions, which are well-known all over the world.

In general, the basin is rich in cereal and technical crops (e.g. wheat, barley, corn, sunflower, tobacco, etc.), fruits and vegetables (peach, strawberry, plum, melon, watermelon, pumpkin, tomato, cucumber, etc.). Wheat and Barley are mostly grown in Dedoplistskaro and Signagi municipalitiess[15]. Annual output of wheat is 44 thousand tons (over 64% of total output of the country). Corn is grown in Akhmeta, Lagodekhi, Telavi and Kvareli municipalities. The majority of sunflower crops are common across the Dedoplistskaro municipalities, followed by Signagi, Sagarejo, Gurjaani and Telavi municipalitiess. The meadow alluvium non-carbonate soils of the left side of the Alazani yield good harvest of tobacco, vegetables and fruit. During the Soviet era, there were large silk and tobacco production industries in the basin. But, most of them stopped operating after the Georgia's independence. Currently, tobacco is produced only in Lagodekhi municipalities. Fruitgrowing is highly prevalent in Kakheti, mostly represented with the following cultures: peach, strawberry, plum etc. local cheap fruit is a perfect opportunity to start fruit-processing factories in the region. Fruits are grown in Kvareli, Signagi, Gurjaani and Telavi. Peanuts are grown in Lagodekhi and Kvareli municipalities.

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[12] Over 82% of labor force is employed there. On average, Kakheti arabale lands account for about 38% of the total arable land of the country. On average, in 2006-2009 about 94,000 ha was sown which is 30 percent of the total sown areas of of the country (2006-2009 official statistical data).

[13] Most of the vineyard areas are not irrigated although irrigation is of utmost importance for richer and more sustainable harvest. During the Soviet times a modern engineering construction – Lower Alazani irrigation system was built on the right side of the Alazani. Its capacity is 18 cubic meters per second to irrigate 35,000 ha of lands in Telavi, Gurjaani, Signagi and Dedoplistskaro municipalitiess. In mid-60s Zemo Alazani channel was added to existing system.

[14] Gurjaani Municipality has the largest vineyards in Kakheti, with total area covering 7,618 ha, followed by Kvareli, with 6,382 ha and Telavi with 6,048 ha. The smallest vineyards are in Dedoplistskaro, with 1,499 ha and Akhmeta with 1,747 ha.

[15] On average, harvests of wheat are taken from 32,000 ha, which is over 64% of the country's harvested area.

In terms of municipal context of crop production, it is as follows:

- In Akmeta municipality, agriculture lands occupy 83,000 ha. Leading sectors are viticulture, cereal production, animal husbandry, with cattle and sheep breeding. Fruit and vegetable production as well as silk production is also developed. Before the break up of the Soviet Union, vineyards occupied 5,000 ha and for the production of the top quality wine brands 30,000-40,000t on grapes were harvested annually. In addition, wallnut growing was very developed due to the existence of the jam factory in the municipality. Sheep breeding was highly developed branch and still is, but at a lower extent. In the second half of the 20th century for instance sheep heads exceeded 100,000.

- In Telavi municipality, 15,771 ha are plough lands, 13,662 ha – annual crop lands, 9,221 ha – perennial crop lands, 209 ha – pastures, 1120 ha – fruit and vegetable gardens and 8,857 ha – vineyears. Forests and shrubs occupy more than 50%. Irrigated lands make up 4,900 ha. Leading branch is viticulture and the municipalities is the third largest producer among other municipalitiess of Kakheti.

- In Gurjaani municipality, the major branch of agriculture, which is a leading sector of the economy, is vine growing, followed by animal husbandry. Agriculture lands make up 39,431 ha, of which 19,287 ha is ploughed lands (arable lands); 10,875 ha perennial plantations and 9,061 ha – pastures and hayfields. More than 56% of the total land is occupied by forests and bushes. Vineyeards occupy about 20% of total agriculture lands, since the viticulture is the leading branch of the agriculture, which itself is a major economic sector of the municipality.

- In Kvareli municipality, in accordance with the most recent data (2009-2010), agriculture lands occupy 35,945 ha of the total area. The major branch of agriculture is viticulture, which contributes about 80% to the total agriculture income. The municipality is the second largest wine growing municipalitiess of the region. It is noteworthy to mention that the highest quality wine of well-known "Qindzmarauli" brand is made in Kvareli. Livestock raising and poultry production are also developed in the municipalities.

- In Lagodekhi municipality, agricultural lands occupy 38,960 hectares, including 24,971 hectares of plough lands, perennial plants – 2,777 hectares (vineyards – 1,883 hectares; fruit, etc. – 892 hectares); natural hayfields – 2,120 hectares; pastures – 1,117.9 hectares (summer pastures – 3,002 hectares, forest – 35,478 hectares; areas, occupied by water – 2,174 hectares). Water-logged lands – 117 hectares. In the current year, only the third of the existing plough lands is cultivated – 7,920 hectares (wheat – 960 hectares, barley – 210 hectares, maize – 800 hectares, vegetables – 4,000 hectares, melons and grounds – 700 hectares, kidney beans – 450 hectares, potato – 800 hectares). 17,051 hectares of plough lands remained uncultivated. Average yield per hectare: grain crops: wheat – 20 centners, barley– 20 centners, maize – 60 centners, vegetables – 125 tons, melons and grounds – 40 tons, potato – 32 centners. In 1981 the following was sown in the municipalities: grain crops – total 9,410 hectares, including; wheat – 7,292 hectares, barley – 1,242 hectares, oats – 60 hectares, maize – 816 hectares; potato – 100 hectares, vegetables – 115 hectares, melons and grounds – 162 hectares, tobacco – 3,900 hectares, edible roots – 48 hectares, sugar-beet for food – 40 hectares, forage crops – 823 hectare, annual sown herbs – 795 hectares, perennials – 1,569 hectares. In 1981 sown areas made total 16,962 hectares. Average yield per hectare was: wheat – 14.1 centners, barley – 11,9 centners, oats –4,5 centners, maize – 20.3 centners, potato – 21 centners, vegetables – 91 centners, melons and grounds – 43 centners, edible roots – 92 centners, sugar-beet for food – 25 centners, forage crops –106 centners, sown annuals plants (green mass)– 175 centners. As the data show, sown area in 2010 current year was reduced in comparison with the year 1981 by 9,042 hectares, but average yield of agricultural crops per hectare is much higher than the indicators of the year 1981. At present often even the half of the required amount of fertilizers is not applied; sometimes crops are sown without any fertilizers at all. In such circumstances soils exhausts year after year. The part of uncultivated agricultural lands, has turned into shrubbery due to absence of care; on the whole, uncultivated areas are mainly used as pastures.

- In Sagarejo municipality vine-growing is very well developed. Without irrigation, natural conditions of the territory of the municipality allow to produce grain crops (wheat, barley, oats, corn), sunflower and feeding crops. Leading branch of the agriculture of the municipality is crop production and animal farming. Total land area of Sagarejo municipality makes 113,331 hectares, including agricultural lands – 96,193 hectares, plough-lands – 30,054 hectares (irrigated – 8,000 hectares; non-irrigated – 22,054 hectares), perennial crop lands – 5,082 hectares (fruit gardens – 634,4 hectares; vineyards – 4,382.9 hectares); pastures – 5,6459.6 hectares, natural hay lands – 1,563 hectares, sown herbs – 290 hectares, wind breaks (shields) – 344 hectares, forests – 5,378 hectares, swamped lands – 242 hectares. At present, crop sowing areas occupy 12,457 hectares, including grain crops – (wheat, barley, corn) – 9,971 hectares, vegetables – 982 hectares, potato – 647 hectares, melons and gourds – 567 hectares, perennials – 290 hectares. According to 2008 data, average yield per hectare in the municipality made: grain crops – 10 centners, potato – 22 centners, vegetables – 31 centners, melons and gourds – 19 centners, perennials – 106 centners. In 1981 the area sown with agricultural crops on the territory of Sagarejo municipality made total 24,172 hectares, including grain crops – 10,996 hectares, kidney bean – 430 hectares, vegetables – 137 hectares, melons and gourds – 198 hectares, potato – 26 hectares, edible roots – 131 hectares, silage crops – 1,860 hectares, annuals – 6,812 hectares, perennials – 3,983 hectares. Average yield per hectare was: grain crops – 9.6 centners, kidney beans – 1 centner, vegetables – 112 centners, melons and gourds – 125 centners, potato – 63 centners, edible roots – 65 centners, silage crops – 64 centners, annuals – 53 centners, perennials – 61 centners. The area of sown crops in 1981 exceeded the indicators of the year 2009 by 11,715 hectares. Average vegetable, melons and gourds, potato and perennial yield per hectare was higher, and the indicator of grain crop yield on the territory of the municipality is lower relative to 2008. At present, in the municipality crops occupy only 40% of plough lands, and 60% of plough lands is uncultivated. Lack of agricultural equipments, in some cases – its technical faults, often – absence of funds for purchase of good-condition seeds and mineral fertilizers and rent of machinery, failure of irrigation system, etc. – these are the causes of non-cultivation of these lands. Due to these and other reasons the remaining land areas are used non-purposefully, mainly – as pastures that leads to exhaustion of soil; strong winds characteristic for this municipality and cutting of field protecting forest strips also contribute to it.

- In Dedoplistskaro municipality, total area of the municipality land makes up 165,680 hectares; including agricultural lands – 113,841 ha, of which plough lands – 47,040 are, perennials – 2,718 ha (vineyard – 1,400 hectares, fruit gardens – 1,318 ha); pastures – 64,083 ha (winter – 64,083 ha), forest – 20,941 ha, state water fund – 2,517 ha. According to the information of the year 1988, the area of wind-breaks strips on the territory of the municipality made up 1,770 hectares, of which 99% were destroyed. By 2009 38,000 hectares out of 47,040 hectares of plough areas were cultivated and sown; including wheat – 21,000 hectares, barley – 11,000 hectares, sunflower – 6,000 hectares; 9,000 hectares of plough lands are not cultivated. Average yield per hectare makes: wheat – 17 centners, barley – 12 centners, corn – 22 centners, kidney bean – 7 centners, sunflower – 8 centners. In 1981 the following was sown: grain crops – 21,771 hectares (wheat – 15,330 hectares, barley – 5,047 hectares, oats – 215 hectares, corn – 1,057 hectares); kidney beans – 122 hectares, sunflower – 7,001 hectares, edible roots – 954 hectares, silage crops – 6,821 hectares, annuals – 1,560 hectares, perennials – 5,221 hectares. In 1981 sown areas made 43,318 hectares. Average yield per hectare was: wheat – 21.2 centners, barley – 20,7 centners, oats – 13.1 centners, corn – 24,6 centners, kidney beans – 8.8 centners, sunflower – 8.4 centners, edible roots – 176 centners, silage crops – 121 centners, annuals – 155 centners, perennials – 154 centners. These data show that sown area in 2009 was reduced in comparison with the year 1981 by 5,318 hectares, yield is reduced too. Land areas, which are cultivated every year, don't provide the volume of yield, which will be possible to obtain in the case of nonirrigable land cultivation. Its main causes are reduction of soil fertility, insufficient introduction of organic and mineral fertilizers, inobservance of alteration of crop rotation, low quality of seeds, failure to provide agro-technical measures in timely manner, negative impact of winds in the result of cutting of field-protecting forest strips. At present the land areas, remained without cultivation are mainly used as pastures. Pastures of insignificant area, adjacent to villages, are scattered within the boundaries of lands belonging to the villages; these pastures can't satisfy feeding demands of livestock even at minimum level and livestock is fed at the expense of these uncultivated plough areas and these areas suffer from intense overgrazing. Due to irregular use of plough areas, remained without cultivation and none application of any measures for the purpose of their improvement, floral composition on pastures changes, grass becomes thinner and soil structure destroys, which facilitates the process of its degradation.

Livestock rising, including stock-raising of cattle and sheep is very significant in the basin[16]. A cattle breeding in summer and winter pastures is well-developed on both sides of the Basin, with sector growing trends in Akhmeta, Dedoplistskaro, Sagarejo, Lagodekhi and Signagi municipalitiess. Cattle-breeding bears milk-meat producing character, while sheep-breeding mostly of mutton-wool character. In some villages along the Alazani River farmers have been breeding buffaloes. The Tush population inhabiting Zemo and Kvemo Alvani in the Akhmeta municipality and Laliskuri Telavi municipality are mostly engaged in seasonal pastoralism. All municipalities of Kakheti Region produce pork, and according to 2005 data, the leading producers were Kvareli, Telavi, Akhmeta and Lagodekhi. In these four municipalities, forest resources are used for swine feed. In 2005, in six out of eight municipalities, pork production exceeded beef production. This shows increased demand for this product and its important role in the Kakheti economy and for households. In 2007, the number of pigs significantly decreased in Kakheti due to the spread of Montgomery's disease. Sagarejo and Lagodekhi Municipalities are the leading municipalities of the region in the poultry industry. Large-scale poultry farm enterprises are located in Patardzeuli village of Sagarejo Municipality.

In terms of municipal context of the animal husbandry, it is as follows:

- In Sagarejo in 2009 cattle heads made 38,754 (milkers – 18,522), average milk yield per cow – 900 kg; sheep – 182,563, pigs – 3,380. According to the data of the year 1981, in the municipality there were: cattle – 22,192 (cows – 7,964), average milk yield per cow – 1,593 kg; sheep – 121,060, pigs – 42,261. At present the quantity of cattle and sheep heads in municipality has increased – cattle – by 16,562, sheep – by 61,503, but average annual milk yield per cow is reduced by 603 kg. Pig heads is reduced to minimum. In parallel with the increase of quantity of cattle and sheep heads, the condition of summer and Winter pastures has much worsened, as no measures for pasture cultivation are taken; pasture are overloaded, mass overgrazing

[16] For instance, on average, number of sheep totalled over 287 thousand heads in 2006-2009 that accounted for about 43% of sheep number of the country.

occurs; due to improper exploitation grass became thin, which negatively affects the structure of soil and its fertility. Winter pasture areas of the municipality, located on Iori elevation, are much overloaded. Actually, not only sheep, but cattle graze on these territories (only 0.3 hectares of pasture falls per 1 conditional head). Due to dry climate, and, consequently, lack of potable water, the shepherds have to take livestock 12-15 km away every day. Movement of livestock to such a long distance causes even more damage to the pastures overgrazed and trampled due to high density of animals.

- In Dedoplistskaro municipality, here are 18,263 heads of cattle (cows – 8,000), Average milk yield per cow makes 1,200 kg; sheep and goats – 60,752 heads, pigs – 2,673, horses – 893, poultry – 64,701, bees – 3,423 families. In 1981 cattle heads made 28,035 (cows – 9,073), average milk yield per cow – 2,037 kg; sheep and goats – 147,898, pigs – 31,756, horses – 267; bees – 3,583 families; poultry – 176,163. Quantity of cattle heads in comparison with 1981 is reduced by 9,772, sheep – 87,146, poultry – 111,462; average annual milk yield per cow is reduced by 837 kg. Total area of winter and transitional pastures in the municipality amounts 112,100 thousand hectares, including 64,083 hectares of winter pastures in use. Intense utilization of pastures of Dedoplistskaro municipality causes disintegration of topsoil and turf occurs, which itself leads to the significant reduction of soil depth and often, to their full scavenging and denudation of salt-containing rocks. Intense exhaustion, disintegration and scavenging of rocks is one of the main reasons for erosive and denudation processes. Rocks carried and scavenged down to the lowered part of pastures in the result of erosive and denudation processes, consisting of salt containing clays and sandstones, lead to salinization of soil, thus negatively affecting vegetation cover of pastures and its composition. About 19,000 heads of cattle and 60,752 sheep and goats graze on these pastures during 8 months. During the last two decades, no measures, required for the improvement of pastures, have been implemented, and the pastures gradually become thin, their condition worsens year after year, which contributes to the intensification of top-soil erosion.

- In Signagi municipality, regardless of its one of the leading in animal husbandry, the number of cattle heads has significantly reduced during the last two decades. At present there are 11,450 heads of cattle, including cows – 3,700, average milk yield per cow makes 1,100 kg; sheep and goats – 18,760 heads, pigs – 2,450. Poultry and bees are not provided in data. In 1981 cattle heads made 28,271, including cows – 11,933, average milk yield per cow – 1,554 kg; sheep and goats – 128,699, pigs – 25,087, bees – 5,111 families, poultry – 178,486 wings. If we compare the present animal farming data with the year 1981, the number of cattle heads has dramatically decreased; cattle by 16,821 heads, sheep – by 109,939 heads; average annual milk yield per cow is reduced by 440 kg. The main reason of reduction of the number of cattle heads is the sale of the significant part of cattle - given to the population by public economies due to reforms carried out in agriculture – as meat. It was caused by the absent of possibilities to create conditions for keeping and feeding additional cattle due to unpreparedness of village population for the reforms. And the reason of reduction of milk yield not only in separate regions, but throughout Georgia, is the worsening of cattle breed, the reason of which is the abolition of breeding services in animal farming. As summer pastures, the municipality uses near-village pastures (1,700 hectares) and mountain pastures of Ninotsminda and Akhalkalaki municipalitiess (1,700 hectares, in rent); and the mains massifs of the winter and transitional pastures are located on Gare Kakheti elevation areas adjacent to the rivers Alazani and Iori, total – 46,195 hectares. These pastures, like the pastures of other municipalitiess of this zone, are conditionally divided into absolute winter pastures, located at the height of 90 – 500 m above sea level, and transitional pastures (500 – 1,000 m above sea level), which are used in the spring and autumn; here the pastures are represented by the areas of Iori and Alazani depressions, piedmont valleys, ranges, hills and ravines with hollows; and transitional pastures – by territories located on mountain and hillock slopes.

- In Lagodekhi municipality, at present there are 16,180 heads of cattle, including cows – 6,800, average milk yield per cow makes 1,200 kg; sheep and goats – 34,214 heads, pigs – 1,200. Poultry – 25,330, bees- 3209 families. In 1981 cattle heads made 21,313, including cows – 8,570, average milk yield per cow – 1,902 kg; sheep and goats – 9,580, pigs – 18,984, bees – 4,036 families, poultry – 89,963 wings. If we compare the present animal farming data with the year 1981, the number of cattle heads has decreased by 5,133 heads, average milk yield per cow – by 702 kg; number of sheep has increased by 24,634 heads; pigs – decreased by 17,784 heads, poultry – by 64,633 wings, bees – by 827 families. The main causes of reduction of the number of cattle heads and its productivity are analogous to those described in the materials of other investigated municipalitiess.

Kakheti region accounts for 20% of total beekeeping of the country. The leaders in this sector are Kvareli and Gurjaani municipalities (Please see major land uses, figures 6-9, annex 6).

In Dedoplistskaro municipalities, Leading branches of economy are: grain crop production, animal farming (mainly – cattle breeding), vine growing, production of fruit and vegetables. Major part of population is employed in agriculture. The territory refers to the zone of the Gare Kakheti Plateau grain crop-animal farming of agricultural industry, where production of fall wheat is the most significant.

Industry. The main industry in the basin is food processing, with wine (75% of total food production) production leading the sector. More than 50 wine factories are located in the midst of the Alazani Basin (Telavi, Gurjaani and Kvareli Municipalitiess). In the village of Eniseli, Kvareli region a high quality cognac is produced. Cereals and bread manufacturing is also notable in the region. Small sunflower-seed creameries and lemonade factories operate in almost all municipalitiess of the Basin.

Mining activities take place in the region as well. Oil and gas production in Sagarejo and Dedoplistskaro municipalities is particularly noteworthy; besides, shale-marble is produced in Telavi municipality and limestone is extracted and processed in Dedoplistskaro. Timber industry is particularly developed in Akhmeta municipality with two large forest concessioners operating there. A Number of wood processing industries operate in Telavi, producing parquet and furniture. There are also small metal processing, plastic and glass industries.

Tourism. In the Soviet period Kakheti region was well-known for tourism, due to its diverse nature, large number of cultural and architectural monuments, possibilities for recreational fishing and hunting and the good quality of local food and wines. The drastic fall of tourism sector due to the economic hardships that the country experienced in 90s and yearly 2,000s, was followed by the rapid economic recovery starting from 2003. Tourism sector has also significantly grown in recent years all over Georgia, including Kakheti region. The region certainly has some advantages for attracting both local and international tourists to visit historical monuments and enjoy wine tourism. Tusheti is a special tourism attraction for its unique landscape, nature, ethnography and protected areas. In 2010 total the number of visitors to Tusheti National Park more than doubled relative 2009.

There has been a sharp increase in small hotels and guesthouses in Tusheti, which makes these areas increasingly attractive to Georgian and foreign tourists. However, the road connecting these areas to Kakheti passes through a complicated landscape, and most of the year, helicopter is the only means of transportation to reach those areas. This obviously limits the number of tourists in these areas.

Protected areas-based tourism, especially the Vashlovani Reserve, have great potential for ecotourism development. This has particular importance for Dedoplistskaro Municipality, which is the most exposed to ecological problems and has the highest poverty rates. The wine tourism concept has recently become popular. Signagi is considered the centre of wine tourism in Kakheti due to its wine traditions, historic monuments and central location in the region. Many impressive steps have been taken following cooperation of the government and business sector in rehabilitating the historical facades of this town and developing the wine industry.

In general, Kakheti Region has the low gross and per capita turnover of hotels and restaurants. The same is true for the growth rate of the hospitality sector. It is most likely that the largest share of visitors to Kakheti come for business and not for tourism. Tourism development will also require investment in training and re-training of local staff.

Employment. Most of the Kakhetians are employed in agriculture and trade. Employment opportunities in the region are fairly limited because of monoprofile of its agriculture-dominated economy. Estimated labor force in Kakheti is 252,068 people (61.5% of total population); 47,398 people (18.8%) of the population are unemployed and 294,670 people (81.2%) – employed. The major sectors of employment are as follows: agriculture, 82.1 percent (168,035 people); industry, 9.5 percent (19,440 people); education and healthcare, 6.3 percent (12,894); and other sectors, 2.1 percent (4,300). According to official statistics, the rural population which owns certain amount of land is considered to be employed in agriculture. This methodology certainly leads to some unreliability and the unemployment problem in the region is much more acute than is suggested by the statistics. The average salary per month in the public sector in accordance with 2007 data, was GEL140, equivalent to US$82, while it was US$98 per month GEL167 in the private sector, which is relatively competitive in the country. However, according to unit cost of production, Kakheti is the lowest among the regions of the country, which could be explained by domination of subsistence agriculture, where the level of productivity is typically low.

The region's large geographical area and its population distribution are contributing factors to the development of its labor market. Most of the population lives near the highways. The large size of the villages could also be considered an advantage for the region in developing local infrastructure in the short term. Nevertheless, the region might face an escalated labor deficit, due to the gradual ageing of the population, as well as migration, especially from the border regions (e.g. Dedoplistskaro). In fact, maintaining labor resources would be almost impossible without rapidly stimulating the agricultural sector. In addition, as in the entire country, there is no organized labor market in Kakheti Region, which might threaten investment inflow in the region, as employers face the problem of finding a qualified labor force.

Iori River Basin

General. ***In Tianeti municipality of Mtskheta-Mtianeti region*** agriculture is a major sector of economy with leading branch of live-stock raising. Industry is weakly developed. There is Sioni 9 MW HPP connected to the grid. Tianeti and Sioni are resort areas of local importance.

In Kakheti section of the Iori River Basin of Kakheti region, agriculture activities, with winegrowing, cereal production and livestock raising are the key economic activities of the region. Industry is represented by food processing industries, with a dominant number of winemaking factories, oil and gas extraction and storage and, extraction and processing of construction materials including clay and limestone, etc.

In Gardabani, Kvemo Kartli section of the Iori River Basin represented by Sartichala and Muganlo villages of the Gardabani municipality agriculture sector is mostly developed. Industrial activities are represented by oil and gas extraction activities in Sartichala as well as by extraction of lime stones and other construction materials. There is primary oil processing and storage facility near Sartichala. There is also Sartichala large nursery under the ownership of the Ministry of Environmental Protection and Natural resources.

Agriculture. ***In Tianeti municipality*** located in upper reaches of the Iori River Basin, agriculture lands occupy 35,000 ha, of which arable lands occupy – 9,500 ha, perennial croplands – 600 ha and pastures and hey fields -24,900 ha. The livestock rising is the leading branches of the sector with cattle, pig and sheep breeding. Corn production is also developed in the region.

In the parts of Sagarejo, Gurjaani, Signagi and Dedoplistskaro municipalities located in the middle to lower reaches of the Iori River basin, agriculture contributes the largest share to the regional economy, with horticulture, livestock rising and viticulture leading the sector. Gurjaani is a center of winegrowing, followed by Sagarejo and Dedoplistskaro. Cereal (wheat and barley) production is the major agriculture activities in Dedoplistskaro municipality. Wheat and barley production is also significant in Sagarejo and Signagi. Sunflower is also one of the major technical crops in almost all municipalities. Overall, Dedoplistskaro has the largest areas of agriculture lands in both absolute and per capita numbers. Most of these lands are pastures that occupy about 47,040 ha. Of this about 125,000 ha are winter pastures. Sheep load as well as density of stables is very high in Eldari and Shiraki winter pastures. Sagarejo municipality is a leader in poultry production.

In Gardabani section of the Iori Basin located in the mid-west of it and represented by densely populated settlements of Sartichala and Muganlo etc. agricultural activities are represented by orchard growing.

Industry. ***In Tianeti municipalities*** there are very few industrial facilities. The largest industry is the power generation by 9.14 MW Sioni HPP.

In Kakheti section of the Iori Basin industrial activities are represented by food industry, predominantly, by wine making, non-alcoholic drinks production, oil and gas and construction materials extraction. The highest concentration of wine factories is in the Gurjaani municipality. There is also natural fruit concentrate factory in Gurjaani. In addition, small sunflower oil creameries operate in almost every municipalitee. There are oil fields in Sagarejo (Ninotsminda) and Dedoplistskaro municipalities. Some portion of the oil and gas extracted from Ninotsminda oil fields is stored in Sagarejo storage facility with 2 2000m3 storage capacity tanks. There are significant reserves of limestone in Dedoplistskaro “Artsivis Veli” deposit. Annually, over 500,000 tons of limestone is produced there.

In Gardabani section of the Iori Basin major industrial activities are oil and gas extraction in Sartichala as well as extraction of limestone, basalt, andesite, etc. There is oil and gas primary processing and storage facility near Sartichala that consists of six 5000m3 storage reservoirs each and two 10,000m3 storage reservoirs each. This station receives about 166,000m3 fluid from the oil fields of Ninotsminda, Martkhopi and Sartichala and produces about 45,340m3/y oil product.

There are three small hydropower plants in Martkhophi, Satskhenisi and Tetratkhevi that receive water through Samgori major irrigation canal from Sioni reservoir (for more information please see dams infrastructure below).

Tourism. ***In Tianeti section of the Iori Basin***, Tianeti and Sioni villages are recreation summer resorts of local importance. In Sioni, there are building blocks and cottages that during the Soviet period were under the management of the various scientific-research institutes of the Academy of Science of Georgia. Therefore, family members, relatives and friends of the staff of these institutes spent summer holidays there. After the Georgia's independence, these buildings were transferred to the staff of these institutes under their private ownership. Thus, many people from academic community visit Sioni in summer. There are also guest houses and small hotels in the village where people mostly from Tbilisi stay there. The Sioni reservoir is used for seeming, fishing and boating. Hiking and camping is also one of the types of leisure that the tourists follow there.

In Kakheti section of the Iori river basin, cultural, recreational, ecotourism and protected areas-based tourism is well developed. Agri-tourism and wine tourism is becoming more and more popular among local and foreign tourists. The city of Signagi is one of the beloved places that the tourists visit. The city has a number of high class hotels where the tourists can stay. There are two protected areas in Dedoplistskaro municipality: Vashlovani national park and Chanuna sanctuary and the tourists number has steady growing there. Sport hunting is also well developed in floodplain forests of Iori Plateau and there are a number of hunting farms there.

In Gardabani section of the Iori basin, tourism is not a significant sector. This is a small area of several villages with very few tourism sites and no tourism infrastructure. However, in immediate surroundings of these areas there are a number of important historical-cultural monuments.

Rioni Basin

General. ***In Racha-Lechkumi Region*** agriculute is the major economic sector with livestock raising contributing the largest share to the sector. Gross regional product in 2006 was about 107,121,500 GEL with 12,999,500 GEL (12%) attributed to industry, 10,027,000 GEL (9%) attributed to construction, 63,300,000 (59%) attributed to agriculture and 20,079,500 GEL (20%) attributed to trade and other services. Gross regional product per capita was 2,207 GEL and the region's share in GDP in 2006 was 0.9%.

In Imereti region, agriculture is a leading branch of the economy. Industry slightly lags behind it. In 2006 gross regional product per capita was 3,400 GEL. Agriculture contributed to the gross regional product about 33%, industry – 28%, construction – 12%, trade – 13%, transport and communication – 9% and other services – 5%. Average annual income per capita in accordance with experts' opinions was 1,440 USD.

In Samegrelo-Zemo Svaneti section of the Rioni Basin, agriculture is the major sector of economy, followed by transport. In 2006 Gross Regional Product was GEL 720,100,000 with agriculture contributing 38.7%, transport – 23.2%, construction – 17.4%, trade – 11.8%, industry – 8.5% and communications – 0.4% to it. Gross domestic product per capita was GEL 1,313.7[17]. Although, recent data are unavailable for Gross domestic product, experts estimated it at GEL 944,700 in 2010 or the growth of the regional economy by 31% compared to 2006 figures, with the following sector contribution: agriculture – 41.3% (GEL 390,500,000), transport – 21.9% (GEL 207,104,000), construction – 14.0% (GEFL 131,900,000), trade – 12.3% (GEL 115,900,000) and communications 0.4% (GEL 3,796,000).

In Guria section of the Rioni Basin, represented by very small unpopulated area of Lanchkhuti municipality and few northern villages of the Chokhatauri municipality, agriculture is the major economic activity, with leading branches of cattle rising and poultry production. Overall, The Guria is one of the poor regions of Georgia contributing no more than 4% to GDP. In accordance with experts' estimates, in 2006 per capita annual income was USD 791 in the entire Guria region.

Agriculture. ***In Racha-Lechkumi region*** total area of agriculture lands amounts to 112,259 ha (2010 data). Of these, 8,555 ha are annual lands, 75,302 ha – pastures, 25,230 ha – hayfields, and 3,172 ha – perennial crop lands with 1,674 ha of vineyards and 1,498 ha orchards. As it was mentioned above, livestock rising is the leading branch of the sector, with cattle and pig rising contributing the largest share to the total amount of livestock (for more details please refer to tables 2-5, annex 6). Tsageri municipality has the largest number of cattle heads and Lentekhi municipality - the largest number per household, while the total area of hayfields and pastures is smaller here than that in Oni and Ambrolauri. In recent years, several large livestock farms have entered the local market. With regard to horticulture, hey production contributes the largest share in total production, followed by potato, cereal and wine growing. Fruit and walnut production is also important for the region. Apples grown in Racha are used in baby food. In accordance with official statistics, in total 267 tones of apples and 15,000 tons of walnuts were produced in 2009. Overall, there is no trend for expansion of agriculture lands. Agriculture output is largely produced in privately owned farms.

In Imereti, major agriculture crops are corn, vegetables (greens, spices, cucumbers and tomatoes, etc.) and fruits. Honey production (Bagdati, Kharagauli, Terjola, and Tskaltubo) and viticulture are also important branches. Tea plantations are located in Tskaltubo, Tkibuli and Khoni municipalities. Nuts are grown almost everywhere. Orchards are widespread in Vani, Terjola and Samtredia municipalities. Agriculture lands occupied about 88,410 ha in Imereti region according to 2004-2006 official statistical data. Out of this, annual croplands occupied 72,101 ha, perennial croplands – 12,246 ha and pastuers&hey fields – 3,872 ha. In 2009, 49,100 ha was sown (17% of total sown areas), which was the highest figure for entire Georgia. However, the sown areas only amounted to 58% of total available lands in the region. Of total sown area, 44,900 ha was sawn of corn with 44,500 ha harvested area in 2009. This was the highest figure among the figures of various regions, amounted to about 35-36% of total sown and harvested areas of corn. Total production of corn was 95,400 tons (about 33% of total production), which was the highest figure as well. However, the average yield (t/ha) was only 2.1 t/ha, one of the lowest figures among various regions. Kidney beans' production was also the highest among all regions and amounted to 2,200 t that (22% of national figure). Sown area of vegetables amounted to 3,000 ha with 1,400 tons of the harvest. This figure was not high, compared with that of Kvemo Kartli, Shida Kartli, Mtskheta-Mtianeti and Kakheti regions. Melon

[17]This figue includes figures for all regions of Samegrelo-Zemo Svaneti. With exclusion of the regions not located in Rioni basin, this figure will be lower. Howev, it was impossible to get data dissagregated by regions.

production was significant in the region and amounted to 12,600 tons (29% of national figure), the second figure after the Kakheti with average yield of 15t/ha (higher than the national average). Fruit production was significant as well, and amounted to 17,400 t, about 10% of total fruit production. Of this, production of sub-tropical fruits was the second highest figure after that of Samegrelo-Zemo Svaneti and amounted to 4,800 t (23% of total production). Production of walnuts was the highest among all regions and amounted to 2,100 t (26% of total production). Production of grapes was the second highest after Kakheti figure and amounted to 30,300 t (20% of total production). Tea was also produced, but in small quantities and amounted to 300 t (5% of total production). Imereti was the leader in pig production with 35,700 heads (27% of total figure) and the second largest producer of cattle after Samegrelo Zemo-Svaneti, with 192,700 cattle heads (20% of total figure). A poultry production was also significant, but lower than in other regions. Consequently, Imereti was the leader in meat and milk production with annual figures of 112,400 t of milk production (20%) and, 12,700 t meat production (24%) respectively. The highest figure was also reported for honey production (800 to – 32% of total production).

In Samegrelo-Zemo Svaneti as it was noted above, agriculture is a leading sector. In 1990-2009 its sectoral composition has been changed due to the lost of the large market of the FSU. For instance, areas of tea plantations have reduced by 91% and production volume – from USD 200 mln to USD 1 mln. On the contrary, cereal crop land areas have increased from 29,200 to 70,200 ha. Similarly, areas of nut plantations have soured to 19,400 ha and the nut production has become one of the leading export branches of the sector. The region has also started growing exotic fruits of Kiwi and Pheikhoa with 700-800 ha of cultivated areas.

In accordance with 2009 official statistics, distribution of agriculture areas of the municipality located in the Rioni Basin was as follows: in Martvili municipality total agriculture areas amounted to 32,703.3 ha, with 11,254.6 ha arable lands (annual croplands), 4,995.7 ha perennial croplands, 163.0 ha hey fields and 16,290.0 ha pastures; In Senaki municipalities, total area of agriculture lands amounted to 22,531.2 ha, with 11,808.3 ha arable lands, 3,457.6 ha perennial crops, 26.0 ha hey fields, 7,071.3 ha pastures and 168.0 unsown areas; In Abasha municipality, total agriculture areas amounted to 20,105.0 ha, with 12,451.0 ha arable lands, 1,695.0 ha perennial croplands and 5,959 ha pasture; In Khobi municipality total agriculture areas amounted to 29,160.1 ha, with 14,755.8 ha arable lands, 5,322.6 ha perennial croplands, 11.2 ha hey fields and 9,070.5 ha pastures; In Poti total agriculture areas amounted to 1,014.3 with 182.6 ha arable lands, 329.0 ha perennial croplands, 66.4 ha hayfields and 225.3 ha pastures. Thus, the Senaki municipality was the leader among all Samegrelo municipalities of the basin in terms of total agriculture lands followed by the Martvili region. Overall, the Rioni Basin regions' share of Samegrelo-Zemo Svaneti region's total agriculture lands (268,311.60ha) was over 39% (105,513.90ha). The largest areas were covered by arable lands (64,856.60 ha) – over 92% of total arable lands (70159.3 ha), followed by pastures (38,616.10ha) – about 26% of total pastures (150403.1 ha) and, perennial croplands (15,799.90ha) – about 26% of total perennial croplands (150,403.1). As for the perennial crops, including nut growing, the municipalities of the Basin were not the leaders lagging behind the municipalities located outside it.

With regards to livestock rising, there has been no decrease in the number of cattle heads and pigs. Moreover, currently the region is the national leader in cattle growing. In accordance with official statistics, total number of heads of cattle and pigs in Senaki was 25,572 and 1,555 respectively in 2009. The number of poultry was 96,019; In Abasha the total number of cattle and pigs was 26,183 and 1,666 respectively. The number of poultry was 142,732; In Khobi total number of cattle and pigs was 36,917 and 2,001 respectively.

The poultry number was 196,963; In Martvili the total number of cattle and pigs was 31,713 and 2,218 respectively. The poultry number was 153,548. Thus, Khobi was the leader in total number of cattle, followed by Martvili, Abasha and Senaki. In terms of the number of pigs, Martvili was the leader, followed by Khobi, Abasha and Senaki. In terms of poultry, Khobi was the leader, followed by Martvili, Abasha and Senaki. Overall, the total number of the cattle, pigs and poultry of the Rioni Basin amounted to 80% of the entire Samegrelo-Zemo Svaneti's cattle heads, 72% of pigs and 70% of poultry.

In total, 33.6% of agricultural lands are under the private ownership in the region, with about 79% of annual croplands and over 62% of perennial croplands privatized. On the contrary, almost 100% of pastures and hayfields are under the state ownership.

In Guria section of the Rioni Basin, where a number of rural settlements of Chokhatauri municipality are located the agriculture sector is the only economic activity present there. Cattle and poultry production dominate the sector, followed by tea, citrus, corn and fruit production. Chokhatauri municipality is in high shortage in agriculture lands.

Industry. Major industrial branches in ***Racha-Lechkhumi region*** are power generation (Ritseula, Ladjanuri HPPs and Shaori reservoir) and water production and distribution. In 2004-2006 these branches accounted for over 76% of total output. These branches are followed by processing industries with 24% share of total output. Out of this, about 9-10% accounted for wine production, 8% – for bottled water production and bakeries and 4 % – for timber production. There are also a number of construction companies operating in the region and milk production factories operating in Lentekhi and Oni. Industrial facilities are represented mostly by SMEs, followed by medium-size industrial facilities. Bottled water production has high potential and it is possible to produce several million bottles of water annually. In addition, mining industry has a potential as the region is rich in ores of heavy metals including zinc, arsenic, lead, gold, construction materials represented by gypsum, clays, limestone, pebbles and minerals like barites, pyrites, phosphates, calcites, quartzite, etc. There is a growing trend of export of fir seeds and cones to Europe, where there is a high demand for this product, used for making Christmas trees. There is also a growing demand in Europe for wines produced in Racha-Lechkumi.

About 5% of population is involved in construction business in Racha-Lechkhumi region. There were a number of municipal infrastructure projects implemented in the region or are currently undergoing. In addition, it is planned to construct large HPP cascades, develop Shaori lake resort and construct by-pass roads that will definitely give an impetus to the development of various sectors including construction.

In Imereti region, major branches of industry are power generation, food and drink production, followed by Ferro-alloy and coal and manganese production. There are also various industries in the region that work at low capacity and contribute insignificantly to the total industrial production, including chemicals production, plastics production, mechanical production, wood production, etc. Construction business has been also growing since 2003 in Imereti region, thought growth rate has been recently reduced due to the global financial crisis. More than 520 industrial facilities operate in Imereti, out which medium-size facilities (with 20-100 workforce) are the most common. Large enterprises are: Zestaphoni Ferro-alloy plant, Tkibuli coal mine, Chiatura manganese mine and processing plant, Kutaisi mechanical plant, etc. The majority of facilities are concentrated in Kutaisi. There is an on-going project of construction of Kutaisi free industrial zone. At the initial phase it is planned to build 12 facilities of various profile. The construction works in the free zone is conducted by private company “Fresh” who is obliged to implement about USD 1.2 billion investment. Two plants one metallurgical and another textile plant will be built through FDI a well as through joint stocks of foreign and Georgian companies. Chinese companies will construct wood and stone processing plants and, the German company will build heavy machinery assembling facility. One household appliance plant is already operational there.

In the Samegrelo-Zemo Svaneti section of the Rioni Basin, mostly small to medium-size enterprises are represented. These include food production and processing industries (meet production, milk and other diary production, mills, bakeries, tea production, nut processing, bay leave processing, etc.), textile factories, wood processing, paper production, extraction and processing of construction materials. Large enterprises are concentrated in the city of Poti, which is the Black Sea port of international importance. There are large food processing and production (fish, meat, milk production, granaries, etc), wood processing, ship repair and oil processing factories. Among medium and small-size enterprises, transportation, transit and cargo storage facilities dominate.

In April 2008, Georgia sold its 51% share of the Poti port to the Investment Authority of the United Arab Emirates: RAs Al Khaimah (RAK) to develop a free economic zone through 49-year management concession, and to manage a new port terminal. The project envisages attracting investments, including FDIs in various areas of industries, including, Small & Medium Scale Enterprises, High Technology and Bio-tech Industries, building materials and engineering industries, fast moving consumer goods and domestic appliances industries, as well as IT, Media, Business Process Outsourcing (BPO) companies at the Free Zone. Heavy industries have also shown their interest to operate in the zone, due to the low power costs. At present, successful companies such as: Aray Tomorrow (LG Products, Georgia), Zamil Steel (Saudi Arabia), Azersun Holding (Azerbaijan), Multi Group (Armenia) JBF (India), Pran Foods (Bangladesh), Ghani Glass (Pakistan), Tegetta Motors (Georgia), Mercury Holding (Iran), Vestel (Turkey) and etc. has confirmed their interest and intentions to come to Poti. Furthermore, it is also planned to set-up an offshore financial centre in the Free-zone in second phase of the project development, which will offer all offshore financial services to the investors from all over the world.

In the Guria section of the Rioni Basin, there are no industries. The area is agriculture-based.

<u>Trade and services</u>. ***In Racha-Lechkhumi Region***, trade is more developed in Ambrolauri and Tsageri, which are the centers of the regions with relatively high population density and close location to Kutaisi. Trade in Ambrolauri is very intensive in summer time, when tens of thousands of tourists visit the region. Service sector is mostly represented by small shops and guest houses. Recently high-standard hotel started functioning in Ambrolauri. There are branches of major Georgian banks in cities of the region, including TBC bank, Bank of Georgia, etc.

In Imereti region, trade and service sectors are very important. They are well-developed in the cities, especially in Kutaisi. Many trade centers, wholesale and retail markets are operational there. The development of the sector is pretty much dependant on properly operating banking system that is well-presented in Kutaisi. There are regional branches of major Georgian banks there (e.g. TBC, Bank of Georgia, Bank of Republic, Pro-credit Bank, VTB and Tao Private Bank, etc.). Hotels also contribute significantly to trade and service.

In Samegrelo-Zemo Svaneti region, the trade in recent years didn't play a significant part (11%-12%) in the gross regional product, though It is intensive in municipal centers and in particular, in the city of Poti and is represented by small to medium-size retail shops, whole sale markets, hotels, etc., local branches of almost all major banks operating in Georgia. It can be said that after full-scale operation of the Poti industrial zone as well as the Black sea resort of Anaklia located in Samegrelo, the trade will intensify in the region.

In Guria section of the Rioni basin, there are no large markets in Chokhatauri municipality part of the basin and only small village shops operate there.

<u>Tourism</u>. Tourism is mostly of seasonal character in ***Racha-Lechkhumi region*** with tourists visiting the region in summer-fall seasons. In summer time there are about 40-50,000 tourists in Racha-Lechkhumi, mostly visiting Shovi and Utsera spa resorts and Oni and Ambrolauri. In addition to the very good climate and wild nature, tourists are interested in sightseeing. There are many historical monuments and churches in the region. People from Tbilisi and Kutaisi, who have relatives in villages, spend summer there. From foreigners tourists from Israel, whose relatives originated from Oni municipality, visit the region annually. There is also a growing interest in wine tourism. Ambrolauri and Lentekhi are well-known with production of high quality semi-dry and sweet wines of Khvatchkara, Tvishi and Usakhelauri. Shaori reservoir is also one of the major attractions of the tourists.

In Imereti region, both rural and urban tourism is developed. Kutaisi itself is very old city having many historical and cultural monuments within the city and nearby. Each of the municipality has historical and cultural sites. In addition, there is a Kharagauli part of Borjomi-Kharagauli national park and Sataphlkia and Prometheus karst caves that ware recently rehabilitated. There over 45 hotels in the region with majority of them located in Kutaisi. The region is also well-known for its spa resorts of Sairme, Nunisi and Tskaltubo. There are on-going projects in Sairme and Tskaltubo for development of touristic infrastructure there. Recently, the old town of Kutaisi has been rehabilitated. Given there is a plan to move the Georgian parliament to Kutaisi and develop a free industrial zone in Kutaisi, the city will become a one of the important business centers and presumably the business tourism will grow-up.

In Samegrelo section of the Rioni river basin, tourism potential is high especially, ecotourism and cultural tourism potential. Kolkheti National Park with about 28,571 ha of land and 1,574 ha marine area is a major attraction of Georgian and foreign tourists. The shallow Lake of Paliastomi located in the park, is of 182km2. It is very rich in fish, e.g. Kephal. In total 88 species of fish, both freshwater and marine water, inhabit the park's territory, including Black Sea salmon, Atlantic sturgeon, etc. Furthermore, the Paliastomi is one of the important areas of Africa-Eurasia water and wetland migratory birds. Hence, bird watching is one of the interest of foreign tourists. The area is also very unique and rich in flora. In fact, there are many relict and unique species specific to Kolkhic refugium, e.g. *Hedera colchica*. The sight is designated a Ramsar category of internationally important wetland. Through the WB assistance the park infrastructure has been arranged to meet international standards and to provide various services to visitors. Hence, currently following services are provided: ecotourism, bird watching, animal tracking, hiking, marine tourism, boating, educational tours, sports fishing. In addition to this, the close location of the park to archeological sites makes the area more attractive. The tourists can stay in visitors' center as well as in hotels of Poti, Grigoleti and Zugdidi. Recently, implementation of a very ambitious plan for development of beach resort of Anaklia has started that envisages construction and operations of a number of large to medium-size hotels, casinos and support infrastructure in the resort as well as construction of high-way from Poti to Anaklia. The distance is 20 km between two points. Furthermore, it is envisaged to build two international airports in Poti and Zugdidi that will definitely attract tourists from overseas.

Other attractions and types of entertainment and leisure for tourists are visits to karst caves in Martvili, Senaki, Khobi, horse-riding, sports fishing, hiking in woods, etc (for more details on cultural monuments see below the part "culture"). Very recently in one of the gorges of the local river in Martvili region, Georgian scientists have found foot prints of dinosaurs and remnants of gigantic carnivore lizard mosasaur. It is planned to designate this area as protected and it may become one of the major attractions for the visitors.

In Guria section of the Rioni Basin, there are no significant sightseeing.

Employment. ***In Racha-Lechkhumi region***, 50% of population is represented by employable adults. The unemployment rate is about 20%. However, many of unemployed people are involved in own farms and thus, are registered as self-employed. In 2007, total of 19,053 were employed and 4,797 were registered as unemployed. Most of people are engaged in agriculture sector. There is pessimistic forecast for development of the work force for agriculture sector within the 10-year horizon. Most of the people involved in this sector are 60 years old or older.

In Imereti Region, over 57% of population is represented by employable adults. Out of this number, only 10% is employed. In 2007, total number of employed people was 362,400 and that of unemployed – 41,800. Experts estimated that out of 362,400 employed persons only 123,200 were involved in economic sectors. Others were self-employed that amounted to about 73%.

In Samegrelo section of the Rioni Rioni basin, workforce in accordance with 2006 data amounted to 232,400 that were 49.3% of total population18. Of these, about 20,600 or 8.9% was unemployed and 211,800 or 91.1% employed. Of employed persons, over 84.1% was self-employed consisting of rural population owning 1 ha or more agriculture land.

In Guria section of the Rioni river basin, unemployment is high. Although there is no data per municipalities, within the entire Guria region about 55% of the total population is employable adult. The unemployed population in accordance with 2006 data was 21% of total workforce. Out of employed persons over 79% was self-employed.

2.2.3 Culture

Alazani River Basin

Alazani lowland and the adjacent line of the foothills is rich of historical-cultural monuments of different periods. Important monasteries are: ensemble Nekresi (IV-IX c, XVI c), Zegani (church V c), Dzveli Shuamta (V-VII c), Ikalto (VI-XII c), Akhali ShuamTa (XVI c), and others. Of special importance are Alaverdi Ensemble (temple XI c I half) and Mtavarangelosi temple of Gremi (XIV). Sites of ancient settlements, palaces and other buildings are Bodbe caves (XI-XIII c), Tcheremi ancient settlement with the religious and non-religious buildings of different ages, Palace complex of Vanta (the Middle Ages) and "Tskhrakara" of Zemo Alvani

[18] Recent disagregated data per municipalities on various economic parameters, including employment are not available

(palace XVI c). Among the forts Khornabuji castle (the Early Middle Ages), Bakhtrioni castle-gate, Kvetera castle (the Middle Ages, church X c), Sighnaghi castles (the Middle Ages) and Kvareli castles (XVIII c) should be mentioned. There is a king Erekle II's palace of the 18th century and a history museum with very old exponates and rarities in the city of Telavi.Recently old town of Signagi and Kvareli have been rehabilitated that are of great attraction to the tourists.

Iori River Basin

In Tianeti section of the Iori River Basin, there are old forts, orthodox churches, and ethnographic museums. It is noteworthy to mention Bochorma Fort of the 10th century, Archili Monastery of the 8th century and Archangel Michael's church of the 4th century, etc.

In Kakheti section of the Iori River Basin, there are a number of unique historical monuments in almost all municipalities. In Sagarejo municipality these are: Davit Gareja Monastery built in caves, ancient city of Ujarma, Ninotsminda Nunnery, Khasmis Sameba (Holy Trinity Church of Sameba), Katsareti Monkery, Manavi, Chailuri, Khashmi and Patardzeuli Fortresses. All these monuments are dates of 5th-8th centuries. In Gurjaani important cultural monuments are: the double-dome Church of St. Mary, Ascension Monastery Complex, Saint Saba-Healer Cross Shaped Temple and the historical monuments of villages Cheremi, Vachnadziaani and Zegaani. In Dedoplistskaro municipality key cultural monuments are: Khornabuji fortified city built on the top of a cliff in the 3rd-4th centuries and ancient chapel of St. Elia over there, which was adored by the locals from the times immemorial[19].

In Gardabani (Kvemo Kartli) section of the Iori River Basin there are very few historical monuments, e.g. Sartichala Accession Monastery. Surrounding areas nevertheless are rich in cultural heritage. For instance, key historic-cultural monument is Martkhophi Monastery of the 5th century, where Saint Anton, one of the 13 Assyrian Holly Fathers lived in the 6th century. There are Aparani, Archangel Michael trinity monks and nuns monasteries of 16-17th centuries. Therefore, Martkhophi is one of the most visited areas by cultural tourists as well as by orthodox pilgrims. Furthermore, there are ancient archaeological sites found in Martkhophi and Samgori surroundings represented by kurgans (barrows) that are the earliest among the so-called 'Early Bronze Age kurgans of Trialeti belonging to oldest Kura-Aras culture (3400 – 2000 B.C). Later group of Martkhophi kurgans with pit graves are also found in Martkhophi.

Rioni River Basin

Racha-Lechkumi. The region is very rich in cultural monuments similar to other regions of Georgia, mostly represented by churches, monasteries, castles and forts of medieval and later periods. Among them, noteworthy to mention Nikortsminda temple (XI c), Khotevi church of medieval period and, Barakoni S. Marry Church (XVIII) in Ambrolauri municipality. The oldest churches are dated of V-VII centuries, including St. Barbara church in village Gorisubani (V-Vic), Ambrolauri municipality, St. Maxim Monastery in v. Muri (VII c), Tsageri municipality, Basilica type of church in v. Gvesi, Tsageri municipality, etc. There is also cave monastery of medieval period in v. Khvamli, Tsageri municipality. In addition to orthodox churches, there is a Synagogue of the 19th century in Oni, which is almost every summer is visited by Jewish immigrants. Svanetian Towers that belong to individual families are of special mention. Along with churches,

[19] Cultural value of the city of Signagi is described above in Alazani River Basin part

monasteries, castles and forts, there are monuments of ancient periods, e.g. Bochina limestone caves and human settlements of Mezolyte era in Oni municipality, Brili and Shosheti multi-layer archeological site (necropolis) in v. Gebi, Oni municipality dated 3500 BC and antic Cyclops in v. Kvashkhieti, Oni municipality. In Brilli necropolis, an oldest cultural layer belongs to the middle Bronze Age. Here, on the southern slopes of Caucasus were one of the oldest metallurgical centers of ancient world and their products were distributed in other parts of Caucasus and Georgia. Apart from cultural monuments, there and are very unique natural monuments in the region, including karsts caves in v. Shkmeri, old forest groves of Dzelkova (*Zelkova carpinifolia*), etc.

Imereti. Imereti region is very rich in cultural and historical monuments, including churches, castles, and old bridges of late antique to up to beginning of the 20^{th} century. Among them it is noteworthy to mention Gelati Monastery (XII c) where the Gelati Academy, one of the prominent educational centers of the world during 400-year period was functioning ruins of Bagrati temple, Bridge of King Tamar, etc. There are more than 250 such sites in total. It is also noteworthy to mention monuments of antique era, e.g. Vani archeological Museum-reserve, founded in 1981. It is situated on the hill close to the town of Vani, on the left bank of the River Rioni. The museum includes: Site of Vani, expedition base and the museum itself. The museum houses the majority of the archeological materials discovered in the site of Vani, including the unique pieces of Vani Goldsmith. The exposition covers the period from VIII c. BC to I c. AD. The constant exhibition exposes architectural and goldsmith materials as well as the unique bronze statues and their fragments.

In terms of theatres and historical and cultural museums, municipal theatres and museums function in all municipalities, among them Kutaisi drama theatre and Opera have very old traditions. Recently, the unique building of the Opera house has been rehabilitated together with other landmark buildings in old part of Kutaisi.

Samegrelo-Zemo Svaneti municipalities located in the Rioni Basin. The region is very rich in archeological sites and cultural monuments dated BC as well as in churches, monasteries, castles and forts of medieval period and, modern museums. Very important monument is Nokalakevi, also known as **Archaeopolis**, (place where a town was built). It is located in Senaki municipality and is very important archaeological site. In later Georgian chronicles it is called **Tsikhegoji**, "the fortress of Kuji"; named on behalf of legendary king Kuji, founder of the fortress in third-century BC. The site was a capital of the western Georgian kingdom of Egrisi (Lazika). In 737-738 AC, the city was destroyed by the Arab commander, Marwan ibn-Muhammad, known to Georgians as Murvan Kru (Murvan the Deaf). Subsequently, Tsikhegoji has lost its importance and became a village. Archaeological studies have demonstrated that the site was inhabited in the early 1st millennium BC. The settlement grew larger in the 5th-4th centuries BC. The majority of the visible structures were built between the 4th to the 8th centuries AD when Archaeopolis functioned as the capital of Lazica. A total of 60 human burials of Hellenistic and Byzantine periods have been excavated from the site ranging from Byzantine to early Hellenistic periods as well as ruins of buildings. Various artifacts have been found as well including beaded paste and glass necklaces, silver and copper alloy bracelets, arrows and knives of the 4th through 6th century AD, fragments of painted wall plaster, ceramics and building materials, a fragment of cross with Greek inscription (dated to the 6th century AD), and a small gold enamel object.

The region is abundant with ruins of old fortresses, castles and cult buildings as well as with churches. Among monasteries, it is noteworthy to mention Martvili Monastery, Khobi Nuns Monastery, etc.

Ethnographical museums of Martvili and Senaki have very old and unique exhibitions of artifacts of various periods.

Guria Section of Rioni River Basin. No significant historical and cultural monuments in Chokhatauri part of the Rioni River Basin are found.

2.2.4 Local Infrastructure

Alazani River Basin

Transport. Road infrastructure is well-developed in Kakheti. There are about twenty companies, serving passenger transportation. The Length of the state importance roads equals to 580 km; presently, their condition is satisfactory, meeting average standards. Length of the international importance highway is 125 km. Last year Telavi-Gombori-road was constructed, which is a part of the Telavi-Gombori-Vaziani highway investment project; the project envisions building of two one-way tunnels and bridges. Local roads are being rehabilitated as well as street in towns of Dedoplistskaro, Kvareli, Sagarejo.

The Railway transport operates in the region having a slight importance. Length of the railway is 150 km. There are six aerodromes in the region, but only one in Telavi is functioning for the time being, accepting helicopters and small planes. The infrastructure of Telavi Airport is fully maintained and its full operation is possible in terms of small investments (for more details on transport, power and heat supply infrastructure please refer to annex 7).

Communications. An international trunk-line is available on the territory of Kakheti, while modern /technologies are established in Telavi and Gurjaani (a digital trunk-line).The territory is fully under coverage area of cellular communications companies - Magticom and Geocell. Internet technologies are less developed in Kakheti region, although dial-up internet is available in every district. There is also a satellite internet accessible in Telavi Municipality.

Power and heat supply. The region is entirely electrified. Population of Kakheti towns, as well as villages is supplied with electricity round-the-clock. Consumption is 18-20 megawatts per day. However, in high mountains, e.g. in Tusheti access to electricity grid is absent. Six small to medium-size hydro power plants are functioning in Kakheti: Khadori Hydro Power Plant with 24 MW installed capacity in Akhmeta municipality, Intsoba Hydro Power Plant with 1 MW installed capacity in Kvareli municipality, Chala SHPP with 1.5 MW installed capacity near village Shilda in Kvaleri Municipality, Kabali Hydro Power Plant with 1.5 MW installed capacity in Lagodekhi, Alazani Hydro Power Plant with 4MW[20] capacity in Gurjaani and, mini SHPP Khadori I of 0.65 MW capacity. All these HPPs belong to private companies selling electricity to the Electricity Sector Commercial Operator (ESCO) through PPAs. There is on-going rehabilitation project for Khadori-2 small hydropower plant that will bring 5.4 MW capacity to the power grid. The project is funded through a consessional loan issued under the UNDP-GEF and KfW Renewable Energy project. Furthermore, there are a number SHPP rehabilitation or green field projects planned or under implementation, including: Tetritsklebi SHPP with a designed capacity of 1MW, Napareuli SHPP greenfield project with a designed capacity of 400 KW, Lopota SHPP project with a designed capacity of 1.8 MW and annual output of 13TWh;

[20] Actual capacity of Alazani SHPP is1.5-2.5 MW and annual output of 33.250 mln kwh

Pshaveli SHPP greenfield project with 500 KW capacity and 2.8 TWh annual output[21] (for more details on existing and planned HPPs please refer to annex 9).

All municipal centers are provided with central system of natural gas supply; 88% of town population are attached to the system, but only 60% of them are supplied, while 23% of village inhabitants have joined the system, and only 35% of them receive natural gas. The majority of rural population uses bottled gas, while others apply timber as a fuel.

Irrigation and Drainage Systems. There are six irrigation systems, located in all municipalities of the Kakheti region. Of these, three systems: Kvarei, Lagodekhi and Dedoplistskaro are irrigation-drainage systems, while the others are only irrigation systems. The largest systems are: Naurdali canal, Upper Alazani canal and Lower Alazani canal. The main canal of the Lower Alazani Irrigation System is derived from Alazani below the mouth of the River Cheleti, at village Kondoli, which receives 20 m^3/s of water. Main canal passes along right side of Alazani River and then joins it. Total length of the main canal is 96 km. Designed capacity of the system is 34,496 hectares irrigated by the System. The main canal of the Upper Alazani Irrigation System is derived from upper Alazani river (Lopota river mouth), close to Pankisi pass, village Duisi. Canal passes along the right side of Alazani towards Alazani valley. The length is 79 km and capacity is 24m^3/sec. Irrigated area is 41,000 ha. Naurdali Irrigation System is located on the East side of river Stori is designed to irrigate 10,000 hectares (for maps of the Alazani River Basin irrigation systems please refer to the annex 8). At present, some parts of the systems, including intake facilities, and primary and secondary canals are already outdated and need rehabilitation.

Under the phase I of the WB-financed irrigation and drainage community development project, the lower Alazani irrigation system (main canal and headworks) has been rehabilitated. More specifically, the segments of the system to irrigate 8,460 ha land have been rehabilitated during this phase of the project.

After the 2006 flood seasons that significantly damaged irrigation systems in Kakheti, the second phase has been added to the project to reconstruct flood-damaged segments. More specifically, service road embankment and training walls of the reinforced concrete bridge damaged by the Didkhevi River near the Artana Village have been reconstructed; the section near the Naurdali Canal aqueduct damaged by the Didikhevi River has been reconstructed; the damaged stilling well, downstream apron and other structures downstream the weir dam on the Ilto River has been reconstructed; the embankment damaged by the Alazani River near the Villages o f Zemo Alvani and Kvemo Alvani damaged by the Kabala River over 1,000 m has been reconstructed together with reinforcement structures (made by gabions and lined with reinforced concrete slabs). The rest of the systems remain in poor condition. Most of the primary and secondary canals are not lined with concrete, and approximately 50 % of water is lost every year. Many of the systems need mechanical pumping, that in many cases is not implemented due to power shortages. For example, one of the irrigation systems in Dedoplistskaro municipality, "Zilicha II", which used to irrigate 4,427 ha of agricultural lands is located on the plateau and needs intensive mechanical pumping to the reservoir. There are no sparkle and drip irrigation systems in Georgia.

[21] Power house and electro-mechanical equipmnent of Pshaveli SHPP located on irrigation canal was purchsed under UNDP Community Small Hydropower project funded by the government of Norway and implemented by WI. The incomplete SHPP was handed over to the regional government of Kaklheti, with a view of completion of works. Panstock and headwork have to be built.

Dams and Reservoirs. Following reservoirs exist in the Alazani river basins: Lapiani (Kudi-gori) seasonal regulation reservoir, fed from river Duruji with 3.6 mln m3 available volume and 3.0 mln m3; Mtisdziri (so-called Kvareli lake) seasonal irrigation reservoir with 3.07 mln m3 total and 2.95 mln m3 active volumes, fed from r. Mamutlidere; Akhalsopheili seasonal regulation reservoir (so-called Zinobian lake) with 1.5 mln m3 total and 1.0 mln m3 active volumes, fed from the river Chagurgula; Cheremi reservoir with 1.2 mln m3 available and 1.06 active volumes, fed from rivers Patara Beti and Chermiskhevi; Zilichi reservoir on river Alazani with 4.5 mln m3 total and 4.0 active volumes and; Kutskaro reservoir with 0.5 mln total and 0.4 mln m3 active volumes. Waters of all above listed reservoirs are primarily used for irrigation. The secondary functions of these lakes are fisheries, recreation. The Kudigori and Akhalsopheli reservoir in addition to irrigation purposes are used for maintaining ecological balance. Akhalospeli reservoir, in addition to irrigation, fisheries and recreation is used for hydropower generation (for more details on dams and reservoirs please refer to annex 9).

Water Supply and Sewerage Systems. Most of municipalities centers of the river basin have central water supply systems, including towns of Telavi, Dedoplistskaro, Sagarejo, Kvareli, Akhmeta, and Lagodekhi. These systems are rehabilitated or are under the process of rehabilitation (for more details on municipal utilities infrastructure please refer to annex 10). For instance, EBRD finances the second phase of water supply rehabilitation project in Gurjaani as a result of which 3,300 inhabitants will have 24-hour water supply together with water metering systems. The project will be completed in 2011. Furthermore, the second phase of rehabilitation project is on-going in Telavi as a result of which 6, 589 consumers will have 5-hour water supply after completion of this phase in September of 2011. The third phase, which will end in 2014 will allow the city to have 24-hour water supply. Similarly, the second phase of water supply rehabilitation project is implemented in the municipality of Kvareli as a result of which 3,443 consumers of Kvareli will have 16-hour water supply after completion of the project in December of 2011. Two-phased rehabilitation project in Signagi financed by EBRD and ADB will allow the town population to have a 24-hour water supply after completion of the works in 2014.

Regardless of above achievement, there are very few rural systems in the region. During the Soviet times, such systems existed in total of 35 villages of Kakheti region, covering all the municipalities, but Sagarejo and serving 164,850 people living in rural areas (for more details on Kakheti water supply rural systems please refer to annex 10). After the break-up of the Soviet Union, these systems stopped functioning. Only recently, the government has started rehabilitation of existing or development of new systems for rural areas. For instance, in the Telavi municipaliy water supply systems have been built in following villages: Shalauri, Napareuli, Karajala, Ruispiri, and Kondoli. In Sagarejo municipality rural water supply systems have been developed for the following villages: Giorgitsminda and Antokhi; In Akmeta water supply systems have been developed in following villages: Omalo, Khalastskali; In Gurjaani municipality water supply systems have been developed in the villages of Shashiani, Arashenda, Vachnadziani, Velistsikhe, Bakurtsikhe; In Signagi water supply systems have been developed in the villages of Nukriani, Saqobo, Tsnori and Bodbiskhevi; In Kvareli municipality water supply systems have been developed in the villages of Mtisdziri, Shilda and Eniseli; In Lagodekhi municipality water supply systems have been developed in the village of

Leliani and; in Dedoplistskaro municipality rural water supply systems have been developed in the villages of Tsiteltskaro, Kedi-Arkhiloskalo and Kvemo Kedi.[22]

Most of the urban areas are covered by centralized sewerage systems, with little exception. There is only one city, Tsnori in Georgia that does not have a sewerage system at all. None of the systems covers the entire municipal areas, and on average, their coverage rate does not exceed 50%. Only two municipal systems in Georgian part of the basin cover a maximum of 70-80% of the town. Existing sewerage systems are outdated and their designed capacity is much lower than is required. None of the systems has wastewater treatment plants, and sewage is directly discharged either on agricultural lands or into the River Alazani and tributary rivers. Rural areas are not covered by centralized sewerage systems at all.

Landfills and waste disposal sites. Wastes in municipal areas are disposed on specially arranged poligons that do not meet minimum health and environmental requirements. Some of the urban areas, for example, the town of Lagodekhi does not have legal landfill site at all. Dedoplistksaro and Kvareli landfills have environmental impact permits. The majority of the existing landfill sites do not have defensive borders; therefore, the municipal waste is scattered all over the nearby territories and into riverbeds. The villages chaotically dispose household solid wastes in the storm water channels and in the nearest riverbeds. Waste disposals are located mainly on the right side of Alazani Rvier. Five waste disposal sites are close to Alazani Canal (3 of them are illegal dumpsites). The area of each waste disposal site is from 1 to 4 hectares. (Please refer to the map of the waste disposal sites in Alazani River Basin, figure 1, annex 10).

Iori River Basin

Transport, roads***.*** ***In Tianetion section of the Iori River Basin,*** there are roads of national and local importance. The total length of roads is 204 km. Recently significant sections of Sioni-Tbilisi road has been reconstructed. Construction of Telavi-Gombori-Tbilisi road has also significantly shortened the distance between Tbilisi and Sioni. However, many of local roads are unpaved and are only ground cover. Recently rehabilitation of internal roads has been started and in several villages these works have been completed. Microbuses and mini-vans drive passengers from Tianeti and Sioni to Tbilisi.

In Kakheti section of the Iori river basin, the ground transport is well-developed. There is newly rehabilitated Telavi-Gombori-Vaziani road. Gurjaani-Tbilisi road is also well-paved.

Gardabani section of the Iori river Basin is very close to Tbilisi and the road infrastructure is well-developed there (for more details on road, power and heating infrastructure please refer to annex 7).

Communications. ***In Tianeti municipality***, mobile service coverage good, covering entire region. Limited internet commenction is possible in Tianeti and Sioni. TV coverage is weak in remote villages.

In Kakheti section of the Iori Basin, communications infrastructure is well-developed, with full mobilie coverage and limited internet connection in cities and towns. In addition, mobile operators offer EVDO service and the population can use it for internet connection. TV coverage is also good.

[22] Information of water supply system rehabilitation works for Kakheti are completely covered in Alazani river basin and are not repeated for Iori River Basin

In Gardabani section of the Iori River Basin there is full mobile service coverage. Access to internet is offered also by mobile service operators. TV coverage is full.

Power and Heat Supply. ***In Tianeti section of the Iori river basin*** there is 24-hour power supply to the population of the municipality. The power is supplied through on-grid seasonal regulation Sioni 9.14 MW HPP (for more details on HPPs please refer to annex 9). It is built on the old river bed and utilizes the full river run-off. Almost all villages and all the towns are supplied with natural gas

In Kakheti section of the Iori river basin power and gas supply is full in cities and towns and almost all villages. The gasification of remote areas is on-going. ***In Gardabani section of the Iori river basin,*** there is a full power and gas supply to the population. There are three on-grid small to medium-size HPPs on Samgori Irrigation canal carrying water from Sioni reservoir. Through the Samgori irrigation canals the water is supplied to 14 MW installed capacities Satskhenisi HPP and through it – to Martkhophi 3.8 MW derivation SHPP with about 6 GWh average annual output (about 45% of installed capacity). From Martkhophi SHPP the water through main canal of Zeda (Upper) Samgori canal flows to Tetrakhevi SHPP of 12.4 MW installed capacity and to the Satskhenisi SHPP.

Irrigation and Drainage Systems. Sioni reservoir located in v. Sioni (Tianeti municipalities) provides water to Samgori Zemo (Upper) and Kvemo (Lower) main irrigation canals (for the layout of Samgori Irrigation Systems please refer to annex 9). The system was built in 1954-64. The headwork of the system is located on the old river bed of the Iori near Paldo Dam (Sagarejo municipalities) 20km downstream Sioni, from which the water is supplied to the Samgori system. The headwork was built in 1954 and is designed to distribute the regulated flow from Sioni Reservoir. Water discharge of 13 m3/sec is delivered through the water intake to the Upper Main Canal of Samgori Irrigation Scheme and 24 m3/sec flow is delivered through the Iori River channel to the Kvemo Samgori Irrigation Scheme in Gare (outer) Kakheti. Paldo Headworks consists of the low-pressure gated dam with intake and sand trap on the right side. It needs rehabilitation works, repairing of ownstream apron, dam sill, electric-mechanical parts, and upstream embankments and, cleaning of bottom flushing galleries and the upstream pool.

The Upper Samgori System was designed to irrigate 41,000 ha. Currently, it serves only 30,290 ha. The system irrigates arable lands in the Gardabani and Sagarejo municipalities. This is the largest capacity irrigation system in Georgia. The total length of the main canal of the Upper Samgori system is 39.4 km and designed capacity – 13.0 m3/s. Actual capacity is 9 m3/s. The canal is completely lined up with concrete. Before Lilo-Martkhophi canal the water passes through 5 tunels of Kavtiskhevi, Chankrebi, Gorgasalani, Ujardi and Mukhrovani and after passing the Samgori tunnel becomes dicotomized with many branches. 24 primary distributaries and Lilo-Martkopi Canal branch out of the Upper Main Canal that irrigates 13,000 ha in Gardabani Municipality through gravitation flow. Upper Samgori canal supplies water to Tbilisi Reservoir. Overall, the system comprises following structures: 9 tunnels with the total length of 8,440m; 2 galleries with the total length of 306 m; 5 two-line inverted siphons of reinforced concrete pipes with the total length of 1,763 m; 3 aqueducts with the total length of 177m; 3 chutes (flow accelerators) with the total length of 1,647m; 11 super passages (silt dikes). The length of secondary network is 90 km. There are three hydropower stations on Upper MC.

Lower Main Canal of Samgori Irrigation Scheme comes out of Tbilisi Reservoir. The canal abstracts water through Tbilisi Reservoir tower intake and tunnel. At the tunnel outlet there is a still structure equipped with regulation gates and cone valves. The Lower Main Canal length is 43.34 km and the design capacity of the head section is 12m3/sec, decreasing gradually down the canal. 25 primary distributaries come out of the Lower Main Canal. They irrigate about 17,290 ha in Gardabani Municipality through gravity flow. The following structures are built at the Lower Main Canal of Zemo Samgori Irrigation Scheme: 3 aqueducts with the total length of 228m; 6 one-line inverted siphons of reinforced concrete pipes with the total length of 2,329m; 3 galleries with the total length of 417m; 1 322 m long tunnel; 2 chutes with the total length of 338m; All of the Lower Main Canal (except for one 8.28 km long section of earth channel) is lined with concrete. Length of lower MC secondary network is 92 km.

Zemo Samgori irrigation system has following problems, which should be addressed through high-cost rehabilitation works: decrease in efficiency and capacity and worsening of operational conditions due to the damage of the upper canal facilities (spillways, tunnels); decrease in the efficiency and the capacity of the lower canal; Significant deterioration of secondary network and related structures.

A Feasibility Study for rehabitation of Zemo and Kvemo Samgori Schemes was prepared with MCG financial assistance. Initially, it was planned to rehabitate the scheme through MCG funding under the management of MDF. However, the cost exceeded available financing and thus, it was decided to utilize EBRD concessional loan. In fall 2010, a tender was announced for detailed design of the rehabilitation works under WB and EBRD funding to: carry out surveys (including topographic survey) and field assessments required for the development of detailed project design, ESIA bidding documents. The detailed design of Zemo Samgori Irrigation Scheme rehabilitation Stage 1 envisages the following: Paldo Headworks rehabilitation; First priority rehabilitation works on the Upper Main Canal; Rehabilitation of the selected secondary canals on 4,582 ha; Rehabilitation of Tbilisi Water Reservoir; Rehabilitation of the Headworks of the Lower Main Canal; Urgent rehabilitation works on the Lower Main Canal; and Rehabilitation of the selected secondary canals on 7,120 ha. It is expected to start rehabilitation works after detailed design is prepared and bidding completed. In addition to the large irrigation schemes, there are few other medium to small schemes on the river Iori and its tributaries. These are: i) Irrigation system taking water from Kushiskhevi seasonal regulation irrigation reservoir. Designed capacity of the main irrigation canal is 1.0m3/s; ii) Chachuna irrigation scheme in Dedoplistskaro designed to irrigated Tarribana valley from Dali reservoir. However, in fact, the system has never worked; iii) Mechanical irrigation system taking water from Tavskaro reservoir fed by Iori and Teletistskali. Designed capacity of the main canal is 1m3/s; iv) Mechanical irrigation canal of 0.6m3/s designed capacity fed from Telatskali seasonal regulation reservoir; v) Irrigation canal of 0.67m3/s fed by the Satskhenisi SHPP; vi) Cheremi irrigation canal of 0.3 m3/s designed capacity fed from Cheremi seasonal regulation reservoir; vii) Kranchiskhevi irrigation canal of 0.5 m3/s designed capacity fed from Kranchiskhevi seasonal regulation irrigation reservoir.

Dams and Reservoirs. The largest reservoir built on the river Iori is Sioni water reservoir in Tianeti municipality . It is located between villages Sioni and Lelovani at a 65km distance from Tbilisi. From the west it is bordered with Elebis ridge and from the east – with Kakheti ridge. The reservoir was built in 1951-1964. It is located in Sioni depression and is of V-shaped. The bottom is covered with the recent alluvial sediment. Right bank is steep and rocky and is covered with delluvial sediments. Landslides are frequent here; The left bank is less sloppy. Upper parts of the banks are covered by broad-leafed forests. The basic morphometric characteristics of the Sioni water reservoir are: area of the water table – 12.8 km; Maximum depth – 67.3 m; Average depth – 31.4 m; Total storage – 325.4 mln m3; Active (live) storage – 318.4 mln m3; Catchment area -551 km2; Full supply level (FSL) – 1,068.3 m; Forced supply level – 1,070.3m; Water surface area at FSL – 10.4 km2; Maximum length – 11.5km; Maximum width – 2 km; Height of embankment dam – 84.8 m.

Sioni reservoir waterworks consists of dam, irrigation and power tunnels with service shaft, separate water intakes, spillway and SHPP. The Sioni dam irrigation discharge in the amount of 25m3/s flows back into the Iori River down to the Paldo diversion structure, situated 30km downstream the dam. The Paldo diversion structure diverts 13m3/s flow into the Zemo Samgori irrigation canals and 12m3/s back into the Iori River and downstream irrigation canals.

The reservoir is of seasonal regulation type and in a system with Tbilisi reservoir is designed to supply Sumgori irrigation system with water and generate power (Iori cascade). In addition, it is used for recreation and fisheries. The water reservoir is filled at the expense of waters of spring tides (for more details on dams and reservoirs please refer to annex 9).

In 2007-2008, major renovation works were carried out on Sioni reservoir under the MDF management that covered: full rehabilitation of ground dam and lightening of the dam; arrangement of dam safety monitoring system; setting-up geodezic marks for surveylance of dam deformation; cleaning of dam sides from weeds and implementation of erosion control activities (building of drainge wells and collectors, etc); reconstruction of the bridge to the shaft and the control tower; reconstruction of irrigation and power tunnels, ventilation systems, electromechanical equipment, elevator and staircases; rehabilitation of the spillway; rehabilitation of the motor bridge; widening of the Iori bed in the radius of 220 m distance from the bridge; pumping out of the water from the wells of the spillway and irrigation tunnel and their cleaning; renovation of the operations building interior; Installation of diesel generator; replacement of electrical equipment and lightening of the road and the bridge.

Apart from Sioni reservoir, there are a number of reservoirs smaller than Sioni one, located mostly in Kakheti region. There are as follows: i) Dalis Mtis reservoir of seasonal regulation with 180 mln m3 total and 140 mln m3 active volumes in Dedoplistskaro municipality , designed to irrigate Taribana valley. However, the irrigation system has neve been put into operation; ii) Kushikhevi seasonal regulation reservoir with 5 mln m3 total and 4 mln m3 active storage in Gurjaani municipality . The reservoir is fed from rivers Iori and Kushikhevi; iii) Tavtskaro seasonal regulation reservoir with 3.36mln m3 total and 3.00 mln m3 active storage. It is fed from river Iori; iv) Telatskali seasonal regulation reservoir with 1.60 mln m3 total and 1.30 mln m3 active volumes fed from the river Iori and Kura; vi) Khranchiskhevi seasonal regulation reservoir with 1.92 mln m3 total and 1.25 mln m3 active volumes, fed by the river. Kranchiskhevi; vii) Mtskarestskali, fed from Iori with 1.5 mln m3 total and 1.3 mln m3 active volumes and; viii) Vake reservoir on river Iori with 1.29 mln m3 total and 1.05 mln active storages. In addition, Tbilisi seasonal regulation reservoir with 308 mln m3 total and 155 mln m3 active volumes not belonging the Iori Basin are fed from the river Iori through artificial canals.

Water Supply and Sanitation Systems. ***In Tianeti section of the Iori River Basin*** water supply systems have been rehabilitated in the town Tianeti that included: repair and air-placing of existing two reservoirs of 500 m3 - 220 m3; ground works – 19407 m3; assembling Ferro/concrete wells of water supply system of various diameter – 17 pieces; arranging of various diameter (25-400 mm) polyethylene pipe - 11,643 linear m; Arranging of the sand foundation - 3310.0 m3; Arranging of crushed rock layer of various fraction – 442.0

m3; Arranging of ballast layer - 1640.0 m3; replacement and repair of the international water distribution networks. The funding was provided through EBRD and ADB financing[23].

In Gardabani section of the Iori River basin, water supply systems exist in all villages.

Waste Disposal Sites and Landfills. ***In Tianeti municipality*** , there are no legal landfills operating currently. Wastes are dumped on illegal landfills and on river banks.

In Gardabani section of the Iori river basin, villages of Sartichala and Muganlo are served by Rustavi landfill located near village Akhalisopheli.

Rioni Basin

Transport. ***In Racha-Lechkhumi***, although there is a road of national importance connecting Kutaisi with Ambrolauri and Oni, which is maintained regularly, this infrastructure is the most vulnerable to floods, landslides and mudflows. There are about 30 transportation companies, providing services to passengers as well as carry out small cargo. The total length of the road of national importance is 311 km. Kutaisi-Ambrolauri part is 96 km and Ambrolauri-Oni – 30 km. Local roads were rehabilitated recently. Overall, over 18,000 GEL was spend on road rehabilitation works. Currently, rehabilitation projects are implemented for the city of Oni (internal road rehabilitation), for the bridge on the river Tskenistskali, for Lentekhi, etc. However, due to intensive geodynamic processes many parts of these roads need repair. The road connecting Racha with Lechkumi needs major rehabilitation. In addition, many local rural roads are in poor condition and without off-road transport it is very difficult to reach these areas (e.g. village Gadamshi, Chiora, Gebi, etc.).

Imereti is one of the important transportation hubs in Georgia located in TRACECA corridor. The distance from Kutaisi to Poty, city port is 102km and to Tbilisi – 236km. The road connecting Tbilisi to Poti port is being rehabilitated currently with a purpose to develop a highway. There are two airports in Kutaisi, of which one Kopitnari airport offers international fligt services. Roads of local importance have also been rehabilitated in municipalities. However, some roads are still in poor condition, especially those to villages. There are on-going and planned projects to rehabilitate these roads. Municipal passenger transport opearates in Kutaisi. There are also private companies of taxi services.

Location of the city of Poti sea port ***in Samegrel-Zemo Svaneti*** gives a strategic importance to the region. Poti is a major harbor at the eastern Black Sea coast at the mouth of the Rioni River. It is a cross point of the Trans-Caucasian Corridor/TRACECA, a multinational project which goes through Tashkent – Ashgabat – Türkmenbaşy – Baku and Poti to Romanian port of Constanţa and Bulgarian port Varna, linking the landlocked countries of Central Asia and the Caucasus to Eastern Europe. The seaport has been reconstructed several times, most recently through financing of the Dutch government and the European Union. In 2010, the total throughput of the port was about 7.3 million tons, 2 times the throughput of 2000 and, the container handling was 209,797 TEU (Twenty-foot Equivalent Units, Intermodal Shipping Container) 6-times the figure of 2000 (for maps and figures of transport, power and heat infrastructure please refer to annex 9).

[23] Kakheti water supply and sewarage systems are reviewed above in Alazani river basin part

Free economic zone in the Port, once operational will significantly increase the capacity and efficiency of the port. The project is spread over 300 hectares of the land plot and will involve direct investments of more than 400 million USD including the investments in the Poti Sea Port. The services to be provided in the Free-zone include the primary and secondary roads giving complete access to all industrial plots with-in the project area, Street Lighting, water supply, fire fighting system, sewerage network, storm-water drainage system, electric supply and telecommunication system and irrigation network for green-zone areas. The ongoing GoG and USAID co-financed Senaki-Poti Gas Pipeline project will supply gas to Free Industrial Zone (FIZ) that will give a significant impetus to economic growth.

Regarding the ground transport, there are roads of international, national and local importance as well as the railway in samegrelo. The length of the latter is 150km and the length of the roads is 1,888km. Completion and operationalization of on-going East-West high way (Poti-Tbilisi-Red Bridge road) will increase the transit importance and capacity of the region. Regarding on-going projects for rehabilitation of internal roads, they are being implemented for the cities of Senaki, Martvili and Abasha under the management of Municipal Development Fund.

As it was mentioned above, there is a plan to build an international airpot in Poti that if implemented will increase the transport potential of the region.

In Guria section of the Rioni River Basin, total length of the road of international importance is 65km, including Lanchkuti-Samtredia 32km section and Lanchkhuti-Poti 33 km section; the length of the road of national importance is 117 km, including Lanchkhuti-Chokhatauri 45km road, Lanchkhuti-Abasha 47km road , Lanchkhuti-Lesa-Ozurgeti 12 km road and shukheti-Atsana-Mamati 12.7km road. There is railway road of 40 km length between village Japana, Lanchkhuti municipality and v. Ureki, Ozurgeti municipalities. The government has started construction of the new by-pass road from Guria to Ajara. Roads of local importance are also under reconstruction by the government.

<u>Communications</u>. Mobile service coverage of the ***Racha-lechkumi*** region is satisfactory. Satelite and wireless internet connection is available in cities. The major problem in remote villages is TV coverage.

Communication system of ***Imereti*** is good. Major mobile companies operate there. Land lines are also operational in cities. Internet access is widely available in Kutaisi and at limited level in municipal centers. In those areas, where there is no internet coverage, people can still have it, since mobile operators offer services in all areas under their coverage. The coverage rate of mobile services is almost 100%.

Tele-communications system is well developed in the ***municipalitiess of Samegrelo-Zemo Svaneti region, located in the Rioni River Basin***. All mobile operators are presented in the region, offering various services, fixed (land-lines), wireless phones and EVDO (Evolution Date Optimized) – wireless access to the Wi-fi. In addition, a number TV and internet providers operate there, including Caucasus On-line and Silknet. Postage services are also presented in all municipalities.

In the Guria section of the Rioni Basin, mobile coverage by two major service providers MagtiCom and Geocell is full. They also offer wi-fi services as well as mobile TV services. In addition, fast growing company silknet offers wire and wireless pone and DSL internet services in Lanchkhuti. However, such services are not affordable to the poor rural communities.

Power and heat supply. Electricity is supplied round-the-clock ***to Racha-Lechkumi*** population. There are electricity grid and prower distribution companies there. Two HPPs Ritseula (6MW designed capacity) of river run-off type, selling power to ESCO through PPA and, Ladjanuri regulating HPP (112.5 MW designed capacity) operate in the region. Actual capacity of Ritseula SHPP is 3.5 MW. The electricity is provided to 18 communities of the municipality and part of the Ambrolauri. Currently, rehabilitation works are on-going at Ritseula to increase a power capacity to 6.5 MW with 34-36 GWh annual output. Out of this, 25 GWh will be additional to the grid. The company owning the SHPP has a plan to further increase the plant capacity to over 15 MW. Ladjanuri HPP works only at 12% of its installed capacity generating about 125 million kWh power annually. There is on-going project for small hydropower cascade in Lukhumiskhevi, Ambrolauri municipality. The project envisages development of three SHPPs of following parameters: 10.8MW installed capacity and 66.07 GWh annual output, 12 MW installed capacity and 73.58 GWh annual output and, 7.5 MW installed capacity and 46.03 GWh annual output. Total capacity of the cascade will be 30.3 MW. The EIA has been prepared for the project, public hearings held, environmental expertise conducted and environmental impact permit granted. Furthermore, It is planned to build Namakhvani and Oni cascades in upstream areas of the Rioni Basin. Oni Cascade will have a 282 MW installed capacity, with 1,556 GWh average and 1,176 GWh firm (90%) annual ouputs. The cascade will consist of following HPPs: 3.7 MW installed capacity and 17GWh average annual output Chantchachi HPP on river Chanchakhi, 70 MW installed capacity and 497 GWh average annual output Utsera HPP on river Rioni, 2 MW installed capacity and 9GWh average annual output Garula HPP on river Garula, 72 MW installed capacity and 41GWh average annual output Oni HPP on rivers Rioni, Garula and Sakaura and, 134 MW installed capacity and 621 GWh average annual output Sori HPP on rivers Rioni and Lukhunistskali. It is planned to sell over 1,306 GWh to Turkey and 250 GWh in Georgia. Total investment cost of Oni cascade is estimated at USD 664 mln, with USD 2.35 mln/MW unit cost. Namakhvani Cascade envisages construction of arch-type dam and three HPPs in Tvishin, Zoneti and Namakhvani villages. As per existing engineering calculations, Tvishi HPP might have 100MW installed capacity with two-unit scheme and water reservoir of 13.1 million m3 total volume. The reservoir might be of limited daily regulation, due to high sedimentation rate of the reservoir and very low active volume. Average annual output of the plant might be 403.5 GWh; Namakhvani HPP's installed capacity is calculated at 250 MW, with 156 million m3 total volume and 52 million m3 active (useful) volume reservoir of seasonal regulation; The plant can generate 928.0 GWh electricity per year on average; Installed capacity of Zoneti HPP is estimated at 100 MW with total volume of 12.5 million m3 and useful volume of 6.0 million m3 daily regulation reservoir. Average annual output for the plant is estimated at 346.0 GWh. The status of Oni and Namakhvani projects is that pre-investment studies have already been conducted. For Oni the government will announce the tender to attract the investor. For Namakhvani fiinanciers are Nurol Holding Inc. and SK Engineering & Construction. Initial scoping for the project has already been carried out. Recently, an MoU has been signed between EnergoProGeorgia and the Government of Georgia on the development of the river run-off (derivate type) Alpana HPP with 70.6 MW installed capacity, 356.82 GWh average annual output and 105.94 GWh fall-winter output and 57% effectiveness on the R. Rioni in Ambrolauri municipality (v. Kveda Sairme) (for more details on existing and planned HPPs please refer to annex 9In terms of provision of natural gas, major cities and towns as well as some lowland communities are provided with gas. In addition, liquefied gas and oil products are distributed by several private companies. However, the majority of remote areas use wood for fuel. Sports schools in Oni and Ambrolauri use solar water heaters for hot water supply.

Imereti region is very rich in energy resources especially, with hydroresources and, the power generation and the distribution are the largest economic sectors in the region contributing over 21-23% to the total industrial output (for more details on existing and planned HPPs please refer to annex 9). There are following medium to large size privately-owned HPPs: Rioni river run-off HPP with 48 MW designed capacity and 325 mln kwh annual output; Gumati regulating HPP cascade, with 48 MW designed capacity and 249 mln kwh annual output HPP 1 and 22.8 MW designed capacity and 127 mln kwh annual output HPP2, Dzevrula HPP with 80 MW designed capacity and 140 mln kwh annual output, Shaori-Tkibuli annual regulation HPP Cascade with 38.4 MW designed capacity and 138kwh annual output and, Vartsikhe HPP Cascade with 4 HPPs of 46MW designed capacity each and 1,050 mln kwh total annual output. All HPPs are located at river Rioni except for Dzevrula HPP, localted on river Dzevrula, Rioni tributary. The company owning the Vartsikhe Cascade has started full-scale rehabilitation of the system, which will end in 2015. EIA has been recently produced for rehabilitation works. In addition to medium to large-scale HPPs, there are a couple of small hydropower plants currently operational or under rehabilitation, e.g. Sulori SHPP in Vani municipality, with 800 KW installed capacity and 4.5 mln kwh annual power output rehabilitated under the USAID-WI Rural Energy Program, Khani-2 SHPP located on Dimi-Rokiti irrigation canal in Bagdati municipaliti, currently under rehabilitation process through financial assistance of UNDP. After the completion of the project 300 KW will be added to the power grid.

Access to 24-hour power supply is almost 100% for the entire population of the region. Energy Pro Georgia acts as a distribution company. Populations in municipal centers have individual meters and the process of installing individual systems is on-going in little towns and villages.

In the nearest future a new project for construction of 300 MW coal-fired thermopower plant will be commenced. Total investment for the project is estimated at over EURO 500 mln. The owner of the Tkibuli coal mines is Georgian Industrial Group (GIG), which currently works on attracting FDIs for the thermopower plant. Part of the financing is already guaranteed. The plant will use Tkibuli coal as a fuel. The draft EIA for the project has been prepared and preliminary public discussions held on it. In addition to this, 13.2 MW capacity thermopower plant will be constructed to use part of the electricity generated for own consumption (1.2MW) and the rest – to sell to the power grid. The EIA has been prepared for the project and preliminary public discussions held.

In terms of gas supply, the cities and nearby villages of Imereti region are well-covered by network of natural gas pipes of Zestaphoni-Kutaisi-Sukhumi main pipeline, which is connected with passes through Imereti region. However, for remote areas wood fuel is used for heating and cooking.

Samegrelo-Zemo Svaneti section of the Rioni Rion Basin are fully supplied with electricity generated through large-size Engury HPP on river Engury that supplies almost half of the Georgia and entire Abkhazia with the power. Its designed capacity is 1,300 MW and average annual output – 3.8 billion kW/h. There are no hydropower plants on the rivers of Rioni Basin, except for 1 small hydropower plant of 2 MW installed capacity on the river of Abashistskali in Martvili municipality that through the PPA sells electricity to ESCO.

In terms of gas supply, there is existing gas pipeline Saguramo-Zestaphoni-Sukhumi that goes through Senaki to Abkhazia. It supplies various western regions of Georgia including Imereti and Samegrelo with natural gas. In 2009 Azeri Company SOCAR, limited started gasification of municipalities of Abasha, Senaki, Martivili and Poti. In addition to this, construction of a new 30-km 700 mm diameter section of Senaki-Poti main gas pipeline has started aimed at providing gas to populations of the cities of Poti, Senaki, Khobi and adjustment rural areas as well as supporting the development of Poti Free Industrial Zone, including development and operations of liquefied natural gas facility to be constructed at the Black Sea coast and, Anaklia recreational zone (for more details on gas infrastructure please refer to annex 7).

Guria section of the Rioni Basin is fully electrified. Energopro Georgia is a regional distribution company, operating in west Georgia and supplying electricity to the consumers. The majority of the population still has communal metering systems. There is a plan to install individual metering systems all over Guria region.

In terms of gas supply, the company Socar implements the region's gasification program. There are on-going works for construction of 32km main gas pipeline in Lanchkhuti municipality and the gas supply issues will be fully resolved in the city of Lanchkhuti will as well as in the village: Khukhuti, Machkhvareti and Gvimbalauri. In Chokhatauri villages located in the Rioni basin gas supply activities will be started lateron. These remote areas still use fire wood for heating and cooking.

Irrigation and drainage systems. There are no irrgation systems in ***Racha-Lechkumi***, since the agriculture lands do not require irrigation as well as due to the pastures and heyfields representing the largest agriculture areas.

In Imereti there are a number of irrigation systems of small capacity on Rioni, Tskenistskali and other rivers. These canals are as follows: Mashveli system on river Rioni with 43 km length and 20 m3/s water discharge capacity designed to ameliorate 13,829 ha; Khoni-Samtredia (Kukhi) on lower reaches of river Tskenistskali with 13km length and 13 m3/s capacity, designed to irrigate 14,134 ha lands; Ajameti system on river Kvirila with 30km length and 3 m3/s capacity, designed to irrigated 2,799 ha; Dimi-Rokiti system on river Khanistskali with 3.37km length and 1.3 m3/s capacity, designed to irrigate 1,000 ha; Etseri system on river Dzevrula with 6.4km length and 1.2m3/s capacity, designed to irrigate 471 ha; Vartsikhe system on river Khanistskali with 8.15km length and 1m3/s capacity designed to irrigate 695 ha; Tskikhi-Sulori system on river Sulori with 4.51km length and 0.51m3/s capacity designed to irrigate 323 ha; Khodabuni system on river Kvirila with 9.4km length and 0.5 m3/s capacity designed to irrigate 429 ha; Siktarva system on river Kvirila with 2km length and 0.3 m3/s capacity designed to irrigate 79 ha; and Apkhanauri system on river Khanistskali on river Khanistskali with 4.7 length and 0.3 m3/s capacity designed to ameliorate 250 ha.

Under the II phase of the WB-financed IDCDP, in 2007-2008 areas of Rioni Irrigation and drainage systems damaged by 2006 spring floods were rehabilitated and river embankments reinforced in the most vulenrable and damaged areas. More specifically, downstream apron, stilling well and gate No2 o f Matkhoji Headworks of Khoni-Samtredia Irrigation Scheme damaged by the river Tskhenistskali have been rehabilitated and River embankments and spurs have been reconstructed downstream Matkhoji Headworks; Furthermore, damaged Geguti Irrigation Scheme Headworks has been reinforced and a 150m section of the main canal reconstructed; 150 m section of the damaged embankment on the right bank of the Rioni River near Akhalsopeli Village has been reconstructed together with a 500 m section of the damaged embankment on the right bank o f the Rioni River near Dzveli Samtredia Village.

In Samegrelo and Guria sections of the Rioni River Basin, amelioration systems represent drainage schemes. Samegrelo and Guria drainage systems are the part of the Kolkheti Plain Drainage system, which consists of Rioni-Choloki drainage system located in the foothills of the Rioni River left bank and, the Rioni-Khobi system located on the right bank of the Rioni River, stretching from the fluvial plane to the Tbilisi-Poti highway. These areas lie outside and to the north of the provisional boundaries of the Kolkheti National Park. The Rioni-Choloki system has two main collector drains: the western collector, flowing into the

Lesistskali River and after along the southern border of the Kolkheti National Park before flowing into the seaward outlet of Lake Paliastomi; and the eastern one, flowing into the Pichora River and after that into the Imnati-Grigoleti wetlands and Lake Paliastomi. The Rioni-Khobi system has also two collectors: the western one, flowing into the River Tsia (oftentimes is pumped), and eventually into the Khobistskali River and through an area of Kolkheti wetlands before flowing into the Black Sea; and the eastern one, flowing into the Tsiva River (or Main Drain), and thereafter into the Khobistskali River and again through the wetlands to the Black Sea.

Under the first phase of the WB IDCDP, Rioni-Choloki drainage scheme to drain 2,030 ha and Rioni-Khobi drainage scheme to drain 1,700 ha have been rehabilitated. Under the second phase, river bank reinforcement works have been implemented, including re-Construction of a 700 m section of the damaged embankment and bank protection training spurs on the left bank of the Rioni River near the Patara-Poti Village (Adjarians' Settlement), reconstruction of embankments and spurs on the right bank o f the Rioni River near the Patara Poti Village, reconstruction of embankments and spurs on the right bank of the Rioni River near the SagvamichioVillage, reconstruction of a 60 m section of the damaged embankment and enforcing it with gabions on the Khobistskhac River near the Khorga Village, reconstruction of embankments and submerged spurs near Lekhaindrao Village and Nagvazao Village damaged by the Tskhenistskali River.

Apart from rehabilitation of higher order canals, the WB-funded IDCDP has supported establishment and development of amelioration assocations as well as provided seed funding to them to rehabilitate lower order networks under their ownerhsip/management over 9,552 ha area.

<u>Dams and reservoirs</u>. There are two water regulating reservoirs in Racha-Lechkumi: Shaori and Ladjanuri. Shaori reservoir is located at the altitude of 1,134 m above sea level; its surface area is 13 km2; total catchment is 126 km2. Average depth is 9.8m and maximum depth - 1.45 m. Total volume is 90 mln m3 with 87 mln m3 active (live) volume. The lake is fed by rain and river waters. It is designed to regulate the water for Shaori HPP located in the city of Tkibuli and is of seasonal regulation. Lajanuri reservoir is built downstream of river Lajanuri by arch-type dam in Tsageri minicipality. Length of the reservoir is 3.2 km and average width – 0.5 km. Average depth is 30m and maximum depth – 70m. Total surface area is 1.6 km2. Total water volume is 20m3 with 17mln m3 active volume. It is fed by rivers of Lajanuri, Kheleshisgele, Liamgvrie, Usakhelogele and water derived from river Tskenistskali by canal. The reservoir is of weekly regulating type and provides water to Lajanuri HPP. In addition, Lajanuri is used for fisheries. Given the river brings high sediments to the lake as well given the erosive banks of the river the lake is highly silted with more than 10m thickness sediments (for more details on dams and reservoirs please refer to annex 9).

In Imereti region there are a number of dams and reservoirs designed for a regulation of water for hydropower generation and irrigation. These are: Tkibuli seasonal regulation reservoir on river Tkibula with 84 mln m3 total volume and 87 mln m3 active volume, used for hydropower generation; Gumati daily regulation reservoir on river Rioni with 39 mln m3 total volume and 13 mln m3 active volume, used for power generation; Vartsikhe daily regulation reservoir on River Rioni with 14.6 mln m3 total volume and 2.4 mln m3 active volume, used for power generation and irrigation (along with Rioni river the rivers ofKhanistskali and Kvirila are feeding sources for the reservoir); Kukhi reservoir with 1.9 mln m3 total volume and 1.85 mln m3 active volume on river Rioni. The Gumati reservoir is heavily silted, because of high sedimentation by river Rioni, which is 5.100 mln m3 at lake juncture. That's why the useful volume of the reservoir is only 33% of the total volume. Similarly, the river brings high volume of sediments at inflow area in Vartsikhe reservoir. The sediment volume is 8.600 mln m3. Therefore, the useful volume of the reservoir is only 17% of total volume.

In Samegrelo and Guria sections of the the Rioni basin, there are no reservoirs and dams worth of noting.

Water Supply and Sewerage Systems. A number of water supply system rehabilitation works have been implemented ***in Racha-Lechkhumi*** region in recent years (Ambrolauri, Oni and Lentekhi, etc). In Oni works for rehabilitation works for water supply and sewerage systems are still on-going. Currently water supply and storm water drainage system development project is undergoing in town Tsageri as a result of which the town population will have 16-hour water supply a day. It is planned to completely replace water supply system and build storm water drainage system in Ambrolauri. These works will start in May 2011 through financial assistance of ADB and completed in 2013. After the completion of the project, 24-hour water supply will be guaranteed to the city population. In Lentekhi the second phase of water supply and storm water drainage system development project will start soon and completed in 2013 as a result of which 24-hour water supply will be ensured for local population. Water supply systems have been rehabilitated for a few villages (e.g. villages Chrebalo, Itsa, Bugeuli and Saketsia in Ambroloauri municipality and v. Gveso in Tsageri municipality) or are currently under construction (e.g. in Nikortsminda). Regardless of this, most of villages in the region do not have centralized water supply and sewerage systems and wastewater treatment plants do not exists at all in any of settlement.

In Imereti region, during the Soviet period centralized water supply systems existed and properly operated in the majority of the cities that was common for entire Georgia. The network coverage was significant with over 79% average coverage rate. Rural areas on the contrary, were not covered by centralized systems and the local population used wells for drinking water. The population of the region has been supplied with potable water from following sources: Mukhiani – Kachre headwork of 4000 m3/h designed capacity; Partskhanakanebi headwork of 5500 m3/h designed capacity and; Gumati and Chomi water headwork with 400-600 m3/h designed capacity. The water cleaning plant served 70 % of total population. Wastewater system coverage in urban areas was much lower than that of water supply systems and amounted to about 40% on average. There were no separate systems for domestic sewage and industrial wastewaters. Wastewater treatment plants designed for both mechanical and biological treatment carried out only mechanical treatment of wastewaters even during the Soviet times. Such facilities existed for the cities of Kutaisi, Zestaponi, Chiatura, Tkibuli, Samtredia, Tskaltubo and Khoni and didn't exist for Bagdati, Kharagauli and Vani. In Vani, construction of the sewerage system and the sewage treatment plant started in 1987, but it has been suspended after the break-up of the Soviet Union. Kutaisi wastewater treatment plant is located in the village Patriketi, on the right bank of the Rioni river and its designed capacity is 110 000 m3 per day (in fact 84 000 m3 per day). It was built for mechanical and biological purification. Since 1978 the sewage treatment plant has not been under repair; In Zestaphoni, obsolete and amortized conditions of the sewage treatment plant made it impossible to operate it since 1986. The project of a new sewage treatment plant (25,000 m3/d capacity) was worked out and approved in 1988. Constructionb works started in 1990, but stopped due the collapse of the Soviet regime. In Terjola, the sewage treatment plant with 20,000 m3/d designed capacity was built and put into operation. In Samtredia, 600m3/y, in Tkibuli 10,000m3/d and in Tskaltubo 13,500 m3/d capacity wastewater treatment facilities operated. There were no sanitation systems in rural areas at all.

After the collapse of the Soviet country, water supply and sanitation systems were not maintained properly and there were no repair works at all. Water supply was intermittent and the proper water quality was not guaranteed due to the lack of finances. The absolute majority of wastewater treatment plants stopped functioning. For instance, in 1997, out of all wastewater treatment plants existing in the region, only 2 In Kutaisi and Tskaltubo operated only.

In accordance with 2007 data, in the city of Kutaisi only 6-hour water supply was ensured with 16,642m3/y abstractions and 116 l daily consumption norm; in Chiatura – 10-hour supply was ensured with 1,186m3/y water abstractions and 57l daily consumption norm; and in Zestaphoni – only 8-hour supply was ensured with 977m3/y water abstractions and 119l daily consumption. Relatively better situation existed in Tskaltubo in terms of duration of water supply, with 20-hour supply, 1,791m3/y water abstractions and 180l daily consumption, in Samtredia with 24-hour supply, 4,032m3/y water abstractions and 260l daily consumption and, in Terjola with 22-hour water supply, 1,451 m3/y water abstractions and 447l daily consumption. Network coverage was as follows: Kutaisi – 99.5%, Tskaltubo – 100%, Samtredia – 61.3%, Chiatura – 80%, Zestaphoni – 36% and Terjola -100%. Potable water source for all the cities of Imereti is only ground water. In terms of wastewater system coverage, in Kutaisi this figure was 74.1%, with 12,200m3/y wastewater collected (11,900m3/y domestic sewage and 300m3/y industrial sewage) and 0% treated; in Tskaltubo – 48.4%, with 880m3/y wastewater collected (580m3/y domestic wastewater and 300m3/y industrial wastewater) and 0% treated; in Samtredia – 8.3%, with 324m3/y wastewater collected (146 m3/y domestic wastewater and 178m3/y industrial wastewater) and 0% treated; in Chiatura – 55.6%, with 1050m3/y wastewater collected (346m3/y domestic wastewater and 794%m3/y industrial wastewater) and 0% treated; in Zestaphoni – 36%, with 280m3/y wastewater collected (280m3/y domestic and 160m3/y industrial wastewater) and 0% treated; and in Terjola – 16.5%, with 200m3/y wastewater collected (80m3/y domestic and 120m3/y industrial wastewater) and 0% treated. After the Rose revolution, the new government has started gradual rehabilitation and construction of water supply and sanitation systems all over Georgia, including Imereti. Following projects have been implemented in the region so far: In the city of Vani the water supply system has been replaced, headwork rehabilitated, chlorine station installed and sanitary zone arranged; The project was co-financed through state budget, local budget and ADB concessional loan; In Chiatura drinking water reservoir and protective walls were constructed, sanitary protection zone arranged, wells installed and pipes replaced. The project had the similar financial scheme as that of Vani; In the city of Bagdadi pressure and supply pipelines were replaced and water wells installed through state, municipal and ADB financing; In the city of Tkibuli water supply and sewerage pipes were replaced and wells installed through state, municipal and WB financing; In the city of Kutaisi and its district in water supply and sewerage network was rehabilitated through state funding; In the town of Kharagauli drinking water supply system was replaced and wells installed through state, municipal and WB financing; In the town of Khoni in Military settlement water supply and sewerage system was built; In the city of Tskaltubo pressure (major) pipeline was replaced up to the pumping station through state, municipal and WB financing; In the city of Terjola existing pumping station was rehabilitated and pumps and pipelines up to the regulating water reservoir replaced through ADB and municipal funding; In addition, water supply systems were developed in a couple of villages (e.g. in Sachkhere municipality , etc.) Currently, water supply system replacement is on-going in several municipalities of Kutaisi and Zestaphoni and, new water reservoir (2000m3) is being built, flow meters at pumping stations and water reservoirs and, collective and individual water meters in several municipalities of Kutaisi being installed; In the cities of Bagdadi, Tskaltubo, Chiatura and Samtredia the second phase of water and sewerage system rehabilitation project has started, after the completion of which the cities will be provided with drinking water full day. The second phase of the water supply system rehabilitation project has also started in Zestaphoni after completion of which the city population will have a 16-hour water supply instead of 2-3-hour supply; the third phase will start by the end of 2011 and completed in 2014 as a result of which the population will have a 24-hour water supply. It is also planned to finish rehabilitation works in Kutaisi and in the town of Vani (for more details on water supply and sewerage systems please refer to annex 10).

With regards to rural water supply systems, such works have been implemented for the following villages: v. Tsivtskala in Tkibuli municipalities; v. Maglaki in Tskaltubo municipality ; villages Tori-Ledjubani and Rgani in Chiatura municipality ; villages Argveti and Merjevi in Sachkhere municipality ; v. Tskalaphoreti in Kharagauli municipality ; villages Dedalauri, Nakhakhulevi, Kontuati and Matkhoji (rehabilitation of the headworks) in Khoni municipality .

In Samegrelo section of the Rioni Basin, centralized water supply systems exist in all the municipal centers, including Poti, Martvili, Senaki and Abasha. These systems have been built during the Soviet period. In accordance with 2007 data, in the city of Poti over 65% of city population was served by water supply system, with about 3,382m3/year water abstraction, 101 l/d household consumption and 10-hour daily schedule of water supply; in Senaki these figures were - 47.5% of network coverage, 2,122m3/y water abstraction and 150 l daily household consumption; In terms of wastewater collection and treatment, in Poti only 8.7% of total population was covered by the network, with 3,150m3/y wastewater collected (2,170 industrial and 980m3/y) and 0% wastewater treated and. Other urban areas of the region were not covered by sanitation network.

Since 2006, water supply and sewerage system rehabilitation have been carried out in the region. Namely, following works have been completed or are on-going: in the city of Martvili pump station has been replaced, water reservoir and wells installed, water captages rehabilitated and part of the internal network replaced (total cost - GEL 920,819.24 with 85% ADB and 15% municipal government financing); In the city of Abasha main pipeline and network have been built and control and water receiving wells installed (total cost GEL 1,084,471.05 with 85% ADB and 15% local government financing); For the city of Poti water headwarks located in Martvili municipality , with total capacity of 300 l/s has been rehabilitated, chlorine station with capacity of 1 kg/h chlorinization and 300 l/s water treatment built, main pipeline from the headworks to the vi. Nosiri (47 km) and from Nosiri to the settlement of Nabada (26.5km), Poti, have been built through EBRD, EUWI and Sida financinbg, flow meters have been installed on pumping stations and reservoirs and, communal and individual water meters have been installed through MCG financing; In the city of Senaki, currently works for replacement of water pumps, refurbishement of chlorine station, installation of chlorination equipment and rehabilitation of entire network of water supply and sewerage system is on-going through ADB financing (GEL 60mln); In the city of Poti, wells and valves are being installed, internal water supply entirely being replaced, including converter pipe and, pumping stations for sewerage systems rehabilitated. After the completion of the first phase of the project the population will have 12-hour water supply a day and after the completion of the 2nd phase- 24-hour water supply; In the city of Martvili rehabilitation works for water supply internal networks continued, which will result in 24-hour water supply to the consumers. In addition to rehabilitation of urban systems, rural water supply systems are being currently developed in a couple of villages located nearby Poti as well as in villages Balda and Skurdi of Martvili municipality. Farthermore, such works have been completed in following villages: v. Inchkhur-Martvili in Martvili municipality.

In Guria section of the Rioni Basin, rural settlements in municipalities do not have central water supply systems.

River Bank Reinforcement/Reventment structures. In several areas of Lentekhi municipality flood protection works have been implemented. In Imereti various dams and reventment structures have been rehabilitated as well (River bank reinforcement activities are described in detail above in the part of "Irrigation and Drainage Systems").

Landfills and Waste Disposal Sites. There are three legal waste disposal poligons ***in the cities of Racha-Ambrolauri region*** located in Ambrolauri, Oni and Tsageri. In villages, local population dumps wastes directly into the river banks and water canals. There are no poligons/landfills for hazardous wastes in the region. Total area of the Ambrolauri polygon is 4 ha and that of Ambrolauri - 3.5. Annual amount of household waste disposed on Ambrolauri dump is about 100 tons. In town Tsageri a new landfill was arranged, the environmental impact permit was issued by the Ministry of Environment Protection. This landfill, just like the old landfill, is located in the riverbed of Tskhenistskali.

In Imereti region, polygons for disposal of municipal wastes exist in following cities and towns: Kutaisi, Chiatura, Khoni, Terjola, Kharagauli, Sachkhere, Samtredia. In Vani municipality there is an illegal waste disposal site (area - 1.5 ha). Annual amount of the municipal waste for Imereti region is 209 630 tones and the wastes are disposed on the waste polygons of 34.16 ha area. Since the proper waste management system does not exist in Georgia and old dumping polygons are overloaded, many illegal waste dumps have appeared in the region (as elsewhere in Georgia). Most of such dumps in small towns and villages are located close to riverside. The state of municipal waste dumps in the big cities is as follows: i) Kutaisi waste dump serves Kutaisi, Tskaltubo and Bagdati municipalities. The owner of the dump is the city sanitary cleaning service. The area of the polygon consists of 42 ha and is operational since 1962. Annual amount of waste from Kutaisi there is 550m3, while from Bagdati and Tskaltubo municipalities - 1200 tones. The dumping polygon is located between left side of the Kutaisi-Geguti motor way and the Rioni river, not very far (1 km) from the dwelling zone. The dump is almost unfenced. Primary waste processing here is carried out by bulldozes. It is the only secure activity. Isolating ground layers, circulated water supply system for flammable wastes, trenches for collection of atmospheric precipitation, monitoring holes for groundwater leachates, etc do not exist there, hazardous biological wastes are also damped on the site. The dump's washing service is not equipped by dezifenction tanks for waste trucks. The polygon simultaneously serves for disposal of industrial wastes from Kutaisi, Tskaltubo and Bagdadi municipalities; ii) Total area of Samtredia waste dump is 4 ha and It is unfenced. Annual amount of household waste is 2864 m3. No waste pressing takes place here, and there is no waste utilization. Household wastes are mostly dumped directly on the city streets and other open places; iii) Zestaponi dumping polygon occupies 4 ha. The owner of the dump is the sanitary cleaning service. The polygon is unfenced and open for domestic animals. In the past, when the Zestaponi Ferroalloy Factory operated at full load, annually 10,000 tons of industrial and household wastes were disposed on the polygon. Besides, near the headworks of irrigation system illegal dumping of household waste takes place; iv) Sachkhere municipality waste dump occupies 2 ha area and is an unfenced polygon. There do not exist any utilization holes and wastes are not pressed; v) Tkibuli waste dump with 2 ha area is also unfenced polygon. Wastes are not pressed and covered by isolating ground layer. Mining tales are also dumped there. The amount of such wastes accumulated there since 1990s, is as follows: 2,160 tons from the Tsulukidze coal pit, 1950 tons from the Imereti coal pit, 1,600 tons from the Mindeli coal pit, 1,750 tons from the West coal pit, 2,440 tons from the Central enrichment plant; vi) Khoni waste dump occupies 4 ha area and 1,000 kg household waste is disposed annually here. It is an unfenced dump and waste is not pressed. In some cases industrial and household wastes are disposed illegally; vii) Vani municipality waste dump occupies 2 ha. It is an unfenced territory and there is no waste utilization; viii) Chiatura municipality waste dump is spread over 5 ha area for household waste disposal and over 3 ha – for industrial waste disposal. The polygon has no design documentation and there is no fence at all. Waste is not pressed and covered by isolating ground layer. The polygon is open for domestic animals. Industrial and household wastes are often dumped illegally; ix) Kharagauli municipalitywaste dump is unfenced, wastes are not fenced there and annual amount of waste disposal is 400 tons; x) Terjola municipality waste dump occupies 5 ha. The polygon is unfenced and wastes are not pressed and covered by soil. Industrial waste from the municipality is being disposed at Kutaisi waste dump.

In Samegrelo section of the Rioni Basin, there are legal municipal poligons in all towns, except for Martvili, though not meeting minimum sanitary-hygiene and environmental standards. Illegal dumpsite located on the River Abasha bank, operates in Martvili. In Abasha municipality , the dumpsite is located between the rivers Abasha and Rioni. In Senaki municipalities, local dumpsite is located in the vicinity of the Village Tkiri. In Khobi municipalities, 1 ha land area at the outskirts of the village of Pirveli Maisi, was allocate to arrange new waste disposal site. However, no more actions have been taken to build the landfill since allocation of the land area. Hence, currently, only old waste disposal site operates that does not meet any environmental and sanitary requirements. In the city of Poti municipal waste disposal poligon operates since 1967. Its total area is 3ha and the site is unfenced. Domestic waste is mixed with medical and biological wastes. Annual waste generation is 180,000m3 that is disposed to the site mentioned above.

In Guria section of the Rioni Basin, which is represented by rural settlements there are no special waste disposal sites and people dump their waste into the river beds.

3.0 INSTITUTIONAL CONTEXT

3.1 Regional Governments

3.1.1 Regional Governments Located in the Alazani Basin

In the Alazani river basin, there is one regional administration of Kakheti region located in the city of Telavi and headed by the Kakheti Governor (special envoy of the President of Georgia). The governor, in accorance with the statute on the regional governance as well as the law on supervision of municipal level activities is responsible for ensuring law and order in the region, coordinating development of regional and municipal development programs and supervising their implementation, oversighting the activities of local authorities and compliance of these activities with national laws and regulations, supervising spending of state transfers to the regions; ensuring protection fo human rights, etc. He/she has a right to participate in the sessions of the state government, submit proposals to the President on pre-scheduled dissmisal of the local councils, coordinate the work of local branches of state Ministries and agencies, establish and coordinate the work of ad-hock task groups and temporary commissions, issue executive orders.

Kakheti regional governor has one first deputy and two deputies. The administration itself is composed of the following offices: administrative office, office of relations with local governments and state agencies, office of state supervision, financial office and regional development office. In addition to this, there is an Agency for Regional Development affiliated to the regional administration who provides advisory and techical assistance services to the governor (for governance related details information please refer to annex 11). It is a legal entity of the private law established as a corporation of Kakheti Municipality Gamgeobas, regional administration representatives, business sector representatives, companies and citizens (14 board members altogether). Kakheti Regional Development Agency has a Board (Gamgeoba) called once in several months period to make the administrative decisions. The Agency is run by the RDA Director, there is a project development specialist employed by the Agency and 8 coordinators working in every municipality of the region.

Kakheti region has its regional development strategy for 2009-2014 (developed through UNDP assistance), which is in line with the country's Basic Data and Directions for 2009-2012. in accordance with it, the region's priorities for the given time-span are as follows: 1. Setting up food processing enterprises with a focus on fruits and vegetables, milk collection, cheese and button production and ensuring accesibility of financial resources for SMEs; 2. Support to agriculture development with a focus on wine making and animal husbandry sectors through setting up extension and training services, promoting cooperative farming, improving veterinary services, etc. 3. Improving the provision of drinking water to the population through ensuring the relevant quantity and quality of potable water; 3. Support to the tourism development through improving the relevant infrastructure, services, marketing and promotion, education as well as through ensuring access to cheap financial resources and protecting the region's cultural heritage; 4. Improving health and environmental conditions through arranging special landfills and improving waste collectiona and management.

Regarding the budget of the region, in accordance with existing policies for state transfers to the regions, Kakheti municipalities each year receive equalizing transfers as well as targeted transfers to execute the functions delegated to the governor by the state. This includes responsibilities for public health protection; arrangement of the mandatory military service; assistance to IDP and, memorialization of Georgian soldiers died to depend the country. Furthermore, Kakheti similar to all other regions receives state funding for implementation of infrastructure projects of regional and state importance. 2011 total transfer for Kakheti is set at GEL 23,635,400 and for replenishing the infrastructure fund for implementation of the infrastructure projects in Gurjaani, Sagarejo and Lagodekhi municipalities – at GEL 2,500,000. There are also state targeted programs, e.g. rural assistance program which in 2011 is set at GEL 40,000,00 and which covers entire Georgia, including Kakheti. Finally, each state Ministry has its own budget that among operational costs includes programmatic funds, and Kakheti might also benefit from such programs. The Regional Development Ministry is fully responsible for development of regional and municipal infrastructure that covers all over Georgia, including Kakheti. Its 2011 budget is set at GEL 350,214,800. The priority infrastructure projects include road rehabilitation, disaster risk reduction activities and development of water supply, storm water drainage and sanitation systems. Overall, total of GEL 113,545,000 was spent on Kakheti infrastructure improvement in 2009, including 57.45% spent on roads; 23.47% - on rehabilitation of preschool and primary education institutions' buildings; 13.97% - on rehabilitation/development of potable water supply systems; 2.26% - on rural assistance and; 0.04% - on rehabilitation of sanitation systems for detailed information on regional expenditures in 2009 please refer to annex 11).

3.1.2 Regional Governments Located in the Iori Basin

The Iori River Basin is shared by three regions of Mteskheta-Mtianeti, Kakheti and Kvemo Kartli and there are three regional administrations responsible for each given region.

Mtskheta-Mtianeti regional administration is located in the city of Mtskheta, Mtskheta Municipality. The administration is represented by the regional governor and three deputies with one first deputy governor. The office consists of the administration, finance, relations with local government and state agencies, public monitoring and regional development departments as well as Regional Structure of Special office of the State Governor Administration – Dusheti, Tianeti, Kazbegi, Mtskheta municipalities (for more details on governance related information please refer to annex 11).

Mtskheta-Mtianeti region does not have a regional development strategy. In 2011, through the state trasfer the region received GEL 9,130,400 as well as GEL 1,100,000 as a transfer for implementation of infrastructure projects in Mtskheta and Dusheti municipalities. Of total transfer, only GEL 1,464,800 is allocated to the Tianeti Municipality. In addition to this, through the state budget of the Regional Development Ministry and other Ministries budget the region will also benefit as well as from rural development support program. For instance, in 2009 total spending on improvement of the regional infrastructure was GEL 60,083,000, of which 56.1% was spent on road rehabilitation; 11.2% - on rehabilitation of pre-school and primary education institutional buildings; 10.7% - on rehabilitation/development of potable water supply systems; 4% - on improvement of sanitation systems; 2.1% - on rural assistance; 0.4% - on reconstruction of public and household building and apartments and; 15.6% - on various needs (for more detailed information on 2009 regional expenditures please refer to annex 11).

Structure, functions and 2011 state financing of ***Kakheti Regional Administration*** is described in the part 3.1.1 above.

Kvemo Kartli Regional Administration that among others is responsible for Gardabani municipality is located in the city of Rustavi (for more detailed information on governance related information please refer to annex 11). It is represented by the regional governor, one first deputy and two deputies and various departments, including departments of administration, finance, culture, sports and youth, state supervision, and executive (gambeoga). The region's 2011 state transfer is GEL 33,672,100, with GEL 2,775,300 allocation to the Gardabani municipality. The region does not have its short-to-medium term development plan. Its priorities are defined year-by-year basis and are in line with the BDD for 2009-2010 and the country's regional development strategy. These priorities include rehabilitation of roads, irrigation systems, water supply and sewerage systems, rural assistance, etc. For instance, in 2009, total state expenditure for improvement of the region's infrastructure amounted to GEL 107,921, of which 61.7% was spent on road rehabilitation; 10.8% - on improvement of potable water systems; 7.1% – on rehabilitation of irrigation systems; 8.1% - on rehabilitation of schools and kindergartens; 1.9% – on rural assistance; 2.5% – on rehabilitation of buildings and apartments; 1.4% - on improvement of sanitation systems and; 6.5% - on various needs.

3.1.3 Regional Governments Located in the Rioni Basin

Rioni River Basin fully or partially covers four regional administrations: Racha-Lechkumi and Kvemo Svaneti, Imereti, Samegrelo-Zemo Svaneti and Guria.

Racha-Lechkhumi and Kvemo Svaneti Administration is located in the city of Ambrolauri and represented by the regional governor, its deputies and various departments (for more details on governance related information please refer to annex 11). The region does not have its own short-to-medium term development strategy. In 2011 it received GEF 7,762,310 state transfer, of which 26% is allocated to the Ambrolauri municipality, 20% - to Oni municipality; 32% - to Tsageri municipality and 21% - to Lentekhi municipality. In addition, GEL 450,000 is allocated to Oni and Ambrolauri municipalities for implementation of regional and municipal infrastructure projects, with 67% and 33% share of allocation respectively. Furthermore, the region benefits from state programs of rural assistance and regional infrastructure development as well as from state programs of various sectoral Ministries. The priorities of the region are infrastructure development with a focus on road rehabitation/construction, rehabilitation and/or development of water supply, storm-water drainage and sewerage systems, rehabilitation of schools, hospitals and kindergartens, development of rural infrastructure, etc. In 2009, for instance total of GEL 31,192,000 was spent from the state budget for regional development, with 60% spent on road rehabilitation, 11% - on rehabilitation of water supply systems, 6% - on rehabilitation/development of sewerage systems, 5% - on rehabilitation of pre-school and primary education institutional buildings; 2% - on rural assistance; 1% - on rehabilitation of building and apartments and, 14% - on various needs.

Imereti Regional Administration is located in the city of Kutaisi. The office is represented by the Governor, first deputy governor and two deputy governors (for more details on governance related information please refer to the annex 11). The administration has following services: administrative service, service for relations with local government and state bodies, service for regional development, service for state supervision, financial-operations service, service for emergency situations. The region does not have its short-to-medium-term strategy(s) and it defines its priorities on an annual basis. These priorities usually are in line with BDD and the country's regional development strategy. In 2011, the region received state transfer in the amount of GEL 62,195,800, with over38.5% allocation to the Kutaisi and the rest to other municipalities. In addition, the region has received GEL 7,650,000 for implementation of a number of infrastructure projects, with about 26% allocation to Zestaphoni municipality, 20% allocation to the city of Kutaisi, 16% allocation to the Chiatura municipality and the rest to all other municipalities of the region. The region does not have its short to medium term regional development strategy and it defines its priorities based on BDD, country's regional development strategy and municipal level priorities on an annual basis. In 2009, total state expenditure on the improvement of the regional infrastructure amounted to GEL 110,606,000, of which 28.7% was spent on road rehabilitation works; 23.3% - on improvement of potable water systems; 12.5% - on rehabilitation of schools and kindergartens; 10.6% - on rehabilitation of building and apartments; 2.4% - on rehabilitation of irrigation systems; 2.0% - on rural assistance; 0.4% - on improvement of sanitation systems and; 20.2% - on various.

Samegrelo-Zemo Svaneti Regional Administration is located in the city of Zugdidi and is composed of the regional governor and two deputies of which one is the first deputy. The specialized departments include administration service, service for state supervision, regional development service, service for the relations with municipal governments and the state bodies, service for management of emergency situations and financial service (for more details on governance related information please refer to annex 11). The region does not have a short-to-medium-term strategy and the regional priorities are set on an annual basis in line with the BDD and the country's regional development strategy. The major strategic direction for the region similar to other regions is regional infrastructure development, including improvement of road, water and sanitation, irrigation and drainage infrastructure, rural infrastructure, etc. For instance, in 2009 the stated spent GEL 101,372,000 on these purposes, of which about 45% was spent on improvement of road infrastructure, 17% - on rehabilitation of schools and kindergartens, 14% - on improvement of potable water systems, 4% - on improvement of sanitation systems, 3% - on rehabilitation of building blocks and apartments, 2% - on rural assistance and 15% - on various issues. In 2011, the state made a transfer of GEL 32,215,500 to the region, of which Zugdidi municipality received 31.3% (GEL 10,084,200), Poti – 18.4% (GEL 5,916,000), Martvili - 11.1% (GEL 3,591,500), Mestia – 5.2% (GEL 1,682,500), Senaki – 10% (GEL 3,212,400), Tchkhorotsku - 9.8% (GEL 3,163,200), Tsalendjikha – 3.1% (GEL 983,000) and Khobi – 0.6% (GEL 180,000). In addition to the state transfer, the state has allocated GEL 5,400,000 for replenishment of the fund for the implementation of regional infrastructure projects, of which 37% (GEL 2,000,000) was allocated to zugdidi municipality, 22% (GEL 1,200,000) – to Abasha municipality, 20% (GEL 1,100,000) – to Senaki municipality, 17% (GEL 900,000) – to Chkhorotsku municipality and 4% (GEL 200,000) – to Martvili municipality.

Guria Regional Administration is located in the city of Ozurgeti and is represented by the Governor, first deputy governor and two deputy governors. The office consists of administration service, financial and operations management service, service for relations with local government and state agencies, service for state supervision, service for regional development and service for the management of emergency situations (for more details on governance related information please refer to annex 11). Guria regional administration does not have a short-to-medium terms development strategy and the priorities are compiled on an annual basis in line with BDD, the country's regional development strategy and based on the municipal priorities. In 2009, the state spent GEL 29,351 on the improvement of the region's infrastructure, of which 54.5% was spent on road rehabilitation, 17.3% - on rehabilitation of schools and kindergartens, 12.6% - on improvement of potable water systems, 3.8% - on rural assistance, 1.8% - on reconstruction of buildings and apartments and, 0.2% - on improvement of sanitation systems.

3.2 Municipal Authorities

3.2.1 Municipalities Located in the Alazani Basin

General. There are eight municipalities in the Alazani river Basin that belong to the Kakheti regional administration. These are: Akhmeta, Telavi, Gurjaani, Kvareli, Sagarejo, Signagi, Lagodekhi and Dedoplistskaro municipalities. Each of the municipality is composed of the elected municipal counsil (Sakrebulo) and executive Gamgeoba, the members of which are appointed. Each of the municipality has its own local budget approved by the municipal council (for more details on municipal-level governance information please refer to annex 11).

Telavi Municipality. ***Administration of the Telavi Municipality*** is located in the city of Telavi. The city is situated in the bottom of the north-east side of Gombori Mountain, on Alazani valley, 550-800 m. above the sea level and distance from Tbilisi is 158 km. The municipal council is headed by the chairmen elected by the majority of members of the municipality council who is supported by the deputy chair and the secretariat. Sakrebulo consists of following commissions: procedural and voting commission, infrastructure, agriculture and natural resources commission, public health and social affairs commission, financial-budgeting commission, education, culture, sports and youth affairs commission.

Telavi Gamgeoba, an executive body is represented by the Telavi Governor (Gamgebeli), his deputies and administrative office. In addition, there are following services in Gamgeoba: service of economy and infrastructure, finance service, service for culture, sports, protection of cultural heritance and youth affairs, service for supervision, service of public health and social protection, fire fighting service, military recruits registration and enrollment service and territorial units.

Telavi municipality budget for 2011 is GEL 5,775,300, which is less than that for 2010 by GEL 4 662 900. Priority areas are social protection, infrastructure development, culture and pre-school education. Of these, over GEL 2,000,000 will be spent on cultural activities, over GEL 1,000,000 – on infrastructure, GEL 500,000 – on social protection and, over GEL 500,000 on pre-school education.

Akhmeta Municipality**. *Akhmeta municipality*** is located in the north-east part of Georgia, bordered by Dagestani Republic and Telavi Municipality from the east, Sagarejo and Telavi Municipalities from the south, Dusheti and Tianeti Municiplaities from the west and Republic of Chechen-Ingush from the north. The most of the municipality's territory is presented with a hilly relief. The slopes of Caucasian Mountains make up the Northern and the central part of the municipality. The municipality area is 2583 sq. km, that is the 3, 1% of the whole territory of Georgia.

Administration of the Akhmeta Municipality is located in the town of Akhmeta, situated on the intersection of three rivers: the Alazani, the Ilto and the Orvili. Akhmeta used to be two separate villages of Uto and Zhaluri.

Municipality Sakrebulo is headed by the Sakrebulo Chair and the Deputy Chair. The council consists of fractions of “National Movement” and majoritarians as well as the following committees: procedures and voting, budgeting and economic, construction and infrastructure, agrarian, environmental and natural resources and, that of social protection. Alkmeta Municipality Gamgeoba is headed by the Gamgebeili and his deputies. There are following services in the local government: administrative service, logistical service, legal division, financial service, economic development, infrastructure and local procurement service, construction and architecture division, land register and management division, culture, educations, sports, social and youth affairs service, pre-school education division, supervision division, military recruits registration and enrollment service, tourism promotion and public relations service and, fire fighting and rescue service. In addition, the administration has its territorial units and representatives in each unit.

2011 Budget of the Akhmeta Municipality is set at GEL 4,016.800. Major priorities of the municipality for 2011 are social and health protection and infrastructure development (water sector, roads). Of total budget GEL 1,185,200 is allocated for staff salaries, GEL 217,000 – for fire fighting services, GEL 25,000 – for local offices of the Ministry of Internal Affairs, GEL 68,000 – for military defense, GEL 591,800 – for infrastructure O/M and development, GEL 730,000 – for education, GEL 964,500 – for sports and cultural activities and, GEL 235,000 – for health and social protection.

Gurjaani Municipality. ***Gurjaani municipality*** is situated on the north-east slope of the Gombori Mountain Range, 415 meters from sea level. The distance between Gurjaani and Tbilisi is 96 km.

River Alazani borders Gurjaani municipality on north-east separating it from the municipalities of Kvareli da Lagodekhi. It borders Telavi municipality on the north-west and Sighnaghi municipality on the south-west. The Municipality occupies 849,2 km^2. Gurjaani Municipality comprises 1 town and 28 villages.

Administration of the Gurjaani municipality is located in the city of Gurjaani. The self-government body – Sakrebulo is headed by the Sakrebulo Chair and the local government – by the municipal Gamgebeli, first deputy Gamgebeli and two Deputy Gamgebelies. Structural units of the Gamgeoba is represented by: admninstrative serivce, financial-budgeting service, culture, education and social development service, supervision service, architecture, economic development and infrastructure service, military service recruits registration and enrollment service and fire fighting service. In addition to this, the administration has its representatives in the communities located in the municipality.

Gurjaani 2011 municipal budget is set at GEL 7,641,500. Of this, management costs are set at GEL 3,466,700, fire fighting costs – at GEL 223,900, military defense costs – at GEL 74,600, infrastructure operations and maintenance as well as its improvement costs are set at GEL 1,969,200, education costs – at GEL 689,500, sports and cultural activities costs – at GEL 754,800 and, social and health protection costs – at 462,800.

Kvareli Municipality. ***Kvareli Municipality*** covers the southern slopes of the Main Caucasus Range and the part of the Alazani Valley. It occupies the area of some 1000, 8 km^2. The river Alazani flows across its south-west border, Dagestan Autonomous Republic borders the Kvareli Municipality from the North, Lagodekhi Municipality – from the east and and Telavi Municipality – from the west and north-west. The main water resources of the municipality are River Alazani and its left tributes: Incoba, Chelti, Duruji, Avaniskhevi, Shoroxi, Apnistskali and Areshi. About 45 % of the territory of the municipality is hilly and the other 45 % is a plateau characterized by the clay soil. There are three massive artificial water reservoirs on the territory of the municipality. The oldest among them, the so-called "Kvareli Sea", was created in 1962-65. It is located on the southern slopes of the Caucasus Mountains on valley surrounded by the hills. The depth of the reservoir is 10 meters, the length of it is 2 kms, and the width is approximately 300 meters. It occupies 40 ha of land and in older times it used to be a well-attended resort-like recreation center for all the population of the Kakheti region. There are 1 city and 22 villages in the Kvareli Municipality.

Administration of the Kvareli municipality is located in the town of Kvareli. It is on halfway of the rivers Duruji and Bursa 450 meters above the sea level and 143 km-s away from the capital city of Tbilisi. Kvareli Municipality is connected with other regions and Municipalities of Kakheti with the main highways.

The Sakrebulo of the municipality is headed by the chair and deputy chair and the municipality gamgeoba – by the Gamgebeli and his deputies. Gamgeoba consists of the following units: administration service, financial service, labor, health and social protection service, supervision service, economic development and local property management service, architecture and infrastructure service, culture, education, sports, protection of cultural monuments and youth affairs service, military service recruits registration and enrollment service and, the fire fighting services. In addition, the administration is divided into territorial organs and has its representatives in each territorial units.

2011 budget for Kvareli municipality is set at GEL 3, 736,100, of which GEL 1,013,200 is allocated for management costs of local administration, GEL 155,900 – for fire fighting activities, GEL 45,200 – for military defense, GEL 968,300 – for infrastructure O/M and improvement, GEL 570,000 – for educational activities, GEL 703,500 – for cultural and sports activities and, GEL 280,000 – for social and health protection.

Lagodekhi municipality is located in the very north-east part of Georgia, on the border of Azerbaijan, on the left bank of the river Alazani. The municipality is located 200-3500 meters above the sea level. It is bordered by Dagestani Republic from the north, Azerbaijan from the east as well as the municipalities of Kvareli, Gurjaani, Dedoplistskaro and Signagi. Distance from Tbilisi is 160km. Lagodekhi municipality is characterized by the mildly humid subtropical climate. The municipality area is 890,2 sq. km. it includes one town and 63 villages. Population size is over 52,000.

Administration of Lagodekhi Municipality is located in the city of Lagodekhi. Sakrebulo is headed by the Chair and the Deputy Chair. Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebely and Deputy Gamgebeli. The office consists of the following structural units: administration service, consisting of public service and information and organizational divisions, financial service, consisting of budgeting-treasury, accounting and procurement divisions, labor, health, social protection and youth affairs service, supervision service, economic development and infrastructure service, military service recruits registration and enrollment service and, fire fighting serives. In addition, the administration is divided into territorial organs and has its representatives in each community.

2011 Budget of the Lagodekhi municipality is set at GEL 3,984,500. Of this, management costs, including salaries is GEL 1,340,600, military defense costs – GEL98,000, fire fighiting costs – GEL 422,900, economic activities – GEL 50,000, environmental protection – GEL 180,000 that covers waste collection and disposal, municipal services – GEL 270,000 that covers water supply and street lightening, health protection – GEL 80,000, culture, sports, leisure – GEL 700,000, education – GEL 625,000, with GEL 580,0000 earmarked for pre-school education, social protection – GEL 218,000.

<u>Sagarejo Municipality</u>. ***Administration of Sagarejo municipality*** is located in the Sagarejo town, 45 km eastwards from the Capital city of Tbilisi. Municipal Sakrebulo is headed by the Chair and Deputy Chair. Gamgeoba is headed by the Gamgebeli, first deputy and two deputy. The office is composed of structural and territorial units. Structural offices are represented by following services: administration unit, with HR, juridical, information and analysis and archive divisions, budgeting and local finance management service, with budgeting, financial management, logistical and procurement and social divisions, supervision service, economy and property management service, architecture and infrastructure development service, military recruits registration and enrollment service and, fire fighting and rescue service. Territorial units are represented by the Gamgebeli representatives (envoys) in all communities under the geographic coverage of the municipality.

2011 municipal budget of the Sagarejo municipality is set at GEL 5,238,000, of which GEL 1,413,400 is allocated to cover general administration costs; GEL92,700 – for military defense; GEL 194,600 – for fire fighting; GEL 841,6 000 – for economic activities (GEL 51,600 earmarked for agriculture and GEL 190,000 for vehicular transport and roads); GEL 499,000 – for environmental protection (waste collection, disposal, landfills and research); GEL 418,000 – for municipal services (GEL 178,000 earmarked for water supply, GEL 200,000 for street lighting and GEL 40,000 for various activities); GEL 81,000 – for public health protection; GEL 702,300 – for culture, leisure and sports; GEL 710,800 - for education, with GEL 666,800 earmarked for preschool education and; GEL 284,700 – for social protection.

<u>Signagi Municipality</u>. ***Signagi municipality*** is located on Gombori slope and Alazani valley. The municipality area is 1,251.7 sq. km. The territoriy boarders Lagodekhi Municipality and Azerbaijan to the north and north-

east, Gurjaani and Sagarejo municipalities to the west and north-west and Dedoplistskaro municipality to the east. The water resources of the municipality are the river Iori and Alazani. The river Iori crosses the Iori slope from south. Its left tributary is the river Ole and the right tributary is the small river Alandariskhevi. The river Alazani crosses the municipality area for north. Its tributaries are: Ole and Didi Ole. There are 2 towns (Signagi and Tsnori) and 19 villages In Signagi municipality. Administration of Signagi Municipality is located in the town of Signagi.

Municipal council of Signagi is headed by the by the Chair. The Gamgeoba is governed by the Gamgebeli, first deputy and the deputy. The office is composed of structural and territorial units. Structural units consists of: Gamgeoba administration, financial-budgeting service, economic and infrastructure development service, education, culture, tourism, cultural heritage and sports service and, social and health protection service. Territorial units are represented by Gamgebeli representatives in each community and town.

2011 budget of Signagi municipality is set at GEL 3,614,600, of which GEL 530,600 is administrative costs, GEL 62,400 reserve fund replenishment costs, GEL 2,000 procurement-related admin. costs, GEL 18,800 – obligagion payments, GEL 156,000 – fire fighting costs, GEL 128,600 – road maintenance and construction costs, GEL 294,500 – cleaning and waste management costs, GEL 8,000 – apartment building block construction costs; GEL 15,100 – various municipal service costs, GEL 176,300 – water supply and sanitation systems O/M and improvement costs, GEL 150,500 – street lighting costs, GEL 456,000 – pre-school education costs, GEL 2,100,000 – secondary school education costs, GEL 408,700 – culture and sports activities costs, GEL 77,900 – health and social protection costs and, GEL 21,000 – reimbursement to the population affected by the natural disasters.

Dedoplistskaro Municipality. ***Dedoplistskaro Municipality*** occupies 22% of the Kakheti Region Territory with a total area of 2,532 km^2. Its territory is spread over the plateau between the Alazani and Iori Rivers. The lowest point of the territory is 90 m above the sea level at the mouth of the River Iori entering the Mingachavir Reservoir, whilst the highest point is the Mount Nikorastsikhe is at 1,001 m above the sea level in the south of Dedoplistskaro. To the south of the Municipality Vashlovani State Reserve and National Park is located that is stretched over the 10,000 hectares of land. There are few seasonal rivers on the territory of the State Reserve. The whole territory is surrounded by the mountains. The central and the north part of the Dedoplistskaro Municipality are mostly the cultivated agricultural lands with vineyards, corn fields and gardens. The Municipality is bordered with Azerbaijan on the east and south and with the Sighnaghi Municipality on the west and north. There is one town and 15 villages in the municipality.

Administration of the Dedoplistskaro municipality is located in the town of Dedoplistskaro. The municipal council is chared by the Chairman and the Gamgeoba – by the GamgebeliI, First Deputy Gamgebel and the Deputy Gamgebeli. The office consists of structural and territorial units. Structural units are composed of: administration service, economic and infrastructure development service, culture, education, sports, cultural heritage protection and youth affairs service, health and social protection service, military recruitees registration and enrollment service, supervision service and, fire fighting and rescue service. Territorial units are prepresented by the head of the units appointed by the Gamgebeli.

2011 budget of dedoplistskaro municipality is set GEL 2,493,500, of which GEL 1,020,900 is government administrative and service costs, GEL 84,600 – military defense fosts, GEL 205,800 – security and state order activities costs (state security and fire fighting services), GEL 456,700 – economic activities costs (vehicular transport and roads), GEL 226,200 – environmental protection costs (GEL 225,000 earmarked for waste management and GEL 1,200 for wastewater discharges), GEL 523,400 – municipal services costs (GEL 111,200 earmarked for building blocks construction, GEL 201,500 for water supply systems, GEL 109,000 for outside lighting and, GEL 101,700 for various municipal services), GEL 72,000 – public health protection costs, GEL 446,000 – culture, leisure and sports activities costs, GEL 370,000 – preschool education costs and, GEL 339,000 – social protection costs.

3.2.2 Municipalities Located in the Iori Basin

Iori River Basin fully covers Tianeti municipality of the Mtskheta-Mtianeti region, fully or partially covers the following municipalities of the Kakheti region: Sagarejo, Gurjaani, Signagi and Dedoplistskaro[24] and slightly covers the Gardabani municipality of the Kvemo Kartli region (for more details on municipal level governance information please refer to annex 11).

Tianeti Municipality. Tianeti municipality is located in the north-east of Georgia. The municipal center is a small town Tianeti, located in a 78km distance from Tbilisi. Total population size of the municipality is 14,119.

Administration of the Tianeti municipality is located in the municipal center – Tianeti. The municipal council is headed by the chairman and the deputy. The Municipal council consists of following commissions: Commission of legal, mandatory – procedural issues and ethics; Financial-Budgetary commission; Commission of agrarian issues, natural resources and environmental protection; Commission of social Issues and; Commission of infrastructure. Municipal Gambeoga is headed by the Gamgebeli, First Deputy Gamgebeli and Deputy Gamgebeli. Structural units are composed of: Department of Financial and Technical Issues; The Financial – budgetary Department; Department of Infrastructure and Economic Development; Department of Municipal Purchase; Department of Culture, Education, Sport, Monuments Protection, Tourism and Youth; Department of Labor, Public Health, Social Protection, Refugees and Forcibly Displaced Civilians; Fire Department; Department of Mobilization, Military Registration and Recruitment.

2011 budget of the Tianeti municipality is set at GEL 2,361,500, of which GEL 971,300 is government administrative and service costs; GEL 68,800 – military defense costs; GEL 85,700 – security and public order costs, including police and state security services and fire fighting costs; GEL 175,400 – economic activities costs, including commercial activities costs, transport costs and other various economic activities costs; GEL 67,700 – environmental protection costs, including GEL 58,300 waste collection and disposal costs and GEL 19,400 wastewater discharge management costs; GEL 344,000 – municipal services costs, including GEL 7,100 building blocks construction costs and, GEL 336,000 sanitation and other costs; GEL 117,400 – public health protection costs; GEL267,700 – leisure, culture and sports activities costs; GEL 259,500 public education costs, including GEL 247,400 preschool education and GEL 11,000 primary and secondary education costs and GEL1,100 various education-related costs.

[24] Kakheti municipalities are described in part 3.2.1 above

Gardabani Municipality. ***Gardabani municipality*** from the south is bordered by Azerbaijan, from the north – by Mtskheta municipality, from the east – by Sagarejo Municipality and, from the west – by Tetritskaro and Marneuli municipality. Total area of the municipality is 1,702 km^2. Regional center is located in the city of Gardabani. There are following settlements in the municipality: 1 city – Gardabani, two towns – Kojori and Didi Lilo and, 14 rural communities.[25]

Administration of the Gardabani municipality is located in the city of Gardabani. The municipal council is headed by the chair and the deputy chair. There are following commissions in the municipal council: financial-budgeting, economic issues and property management commission, spatial planning and infrastructure and commission, voting and mandate, procedural, juridical and ethics commission, culture, preschool education and intermunicipalities commission, sports and youth affairs commission, land property rights commission. In addition, there are two fractions in the Sacrebulo: “United National Movement” and “Majoritarians”.

The Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebeli and the Deputy Gamgebely. Structural units of the administration consists of following offices: finance-budgetary, supervision, architecture and infrastructure, juridical, etc. Territorial units are represented by the Gamgebeli representatives in each community covered by Gardabani municipality.

2011 budget of the Gardabani Municipality is set at GEL 8,775,900, of which government administrative and service costs is GEL 3,861,800; military defense costs – GEL 133,600, public order and security costs – GEL 694,300, including GEL 436,300 police and state security costs and GEL 258,000 fire fighting costs; economic activities costs – GEL 65,000, including municipal transportation costs; environmental protection costs – GEL 655,000, covering primarily waste collection, disposal and utilization costs; municipal services costs – GEL 1,225,100, including GEL 270,000 building blocks construction costs, GEL 20,000 municipal services development costs, GEL 280,000 water supply systems O/M and improvement costs, GEL 380,000 outdoors lighting costs and 275,100 other municipal services costs; public health protection costs – GEL 220,000; GEL 752,600 – sports, entertainment and sports activities costs and 642,000 education costs, with GEL 561,000 allocated to preschool education and; GEL 526,000 – social protection costs.

3.2.3 Municipalities Located in the Rioni Basin

Rioni Basin fully covers Ambrolauri, Oni, Lentekhi and Tsageri municipalities of the Racha-Lechkhumi region; fully covers Tkibuli, Sachkhere, Khoni, Vani, Badgati, Kharagauli, Tskaltubo, Samtredia, Zestaphoni municipalities and the city of Kutaisi of the Imereti region, fully or partially covers Abasha, Senaki, Martvili, Khobi municipalities and the city of Poti of the Samegrelo-Zemo Svaneti region and, only slightly covers Chokhatauri and Lanchkhuti municipalities of the Guria region (for more details on municipal level governance information please refer to annex 11).

Ambrolauri Municipality. ***Ambrolauri municipality*** is located on the southern slopes of the Greater Caucasus. Its south-east border runs along the Racha ridge, northern border – along the Lechkhumi ridge. Total area of the municipality is 1,141 km^2, of which agriculture lands occupy 240 km^2. Rioni and its tributatries: Krikhula, Znakura, Shareula, Lukhunistskali, Ritseula and Askilistskali flow in the municipality. Total population size is about 16,000 and population density – 16 persons per km^2. There are 72 settlements in the municipality of which 1 city (Ambrolauri), 1 town and 70 villages.

Ambrolauri municipality administration is located in the city of Ambrolauri, which is also a regional center. The city is situated in the valley of Rioni, surrounded by high mountains. Ambrolauri was granted the municipal status in 1966.

Ambrolauri municipality council is headed by the Chair and the Deputy Chair. There are following commissions in the council: i) mandates, voting, procedural and ethic commission, ii) financial-budgeting commission, iii) spatial planning and infrastructure commission; iv) property management and natural resources commission; v) social affairs commission. There are two fractions: “National Movement” and “Majoritarians” in the council. The council is supprted by the secretariat/administration. The municipality Gambeoba is headed by the Gamgebeli and the Deputy Gamgebeli. There are following structural units in the Gamgeoba: administrative service, architecture and oversight office, education, sports, culture, youth affair, health and social protection service, municipal services and infrastructure development service, economy and property management service, army recruitment service, financial-budgeting service, fire fighting and rescue service.

2011 budget of the Ambrolauri Municipality is set at GEL 1,216,800, of which GEL 47,300 is military defense service costs, GEL 137,100 – public order, security and fire fighting costs, GEL 119,900 – economic activities costs, GEL 110,000 – environmental protection costs, primarily waste collection, disposal and utilization costs, GEL 119,000 – municipal services costs, including outdoors lighting and various municipal services provision costs; GEL 43,000 – public health protection costs; GEL 412,200 – culture, entertainment and sports activities costs; GEL 214,000 – education costs, including GEL 180,300 pre-school education costs and GEL 33,700 – education support costs and; GEL 67,200 – social protection costs.

<u>Oni Municipality</u>. ***Oni Municipality*** that was granted municipal status in 1965, is bordered by Java from the east, Lentekhi and Ambroaluri Municipalities from the west, Sachkhere Municipality – from the south and the republics of Kabardino-Balkaria and North Ossetia, Russian Federation from the north. Total area of the municipality is 1,236.3 km2. Population size of the municipality is about 8,400 and population density – 5.4 persons per km^2. The municipal center is located in the city of Oni. There is 1 city (Oni) and 65 villages in the municipality.

Administration of the Oni Municipality is located in the city of Oni, municipal center. The Municipal council is chaired by the Chairman and the Deputy Chairman. The council consists of following commissions: mandates, voting, procedural and ethics commission, social affairs commission, financial-budgetary commission, spatial-territorial planning and infrastructure development commission and, property management and natural resources commission. The Municipal council is supported by the secretariat/administration. Municial Gamgeoba of the Oni Municipality is headed by the Gamgebeli and the Deputy Gamgebeli. The office consists of: administrative, financial-budgeting, economic development, statistics and property management, public health and social protection, architecture, oversight and infrastructure, education, culture, sports and youth affairs, military recruitment and, fire fighting and rescue services.

2011 Budget of Oni Municipality is set at GEL 2,114,400, of which municipal admin. costs is GEL 992,000, security and public order costs – GEL 110,200 (fire fighting and emergency management costs – GEL 96,200, local policy service costs – GEL 14,000), military defense costs – GEL 44,200; economic activities costs – GEL 165,200, including agriculture and municipal transportation costs; environmental protection costs – GEL 115,400 (GEL 67,000 waste collection, disposal and utilization costs and GEL 47,700 wastewater discharges management costs), municipal services costs – GEL 283,500 (GEL 41,100 communal service management costs, GEL 86,700 water supply systems O/M and rehabilitation costs and GEL 155,700 outdoor lighting costs), public health protection costs – GEL 22,000, sports, culture and entertainment costs – GEL 268,100, pre-school education costs – GEL 59,000 and, social protection costs – GEL 57,500.

Tsageri Municipality. ***Tsageri Municipality*** from south-east is bordered by the Ambrolauri municipality, from north – Lentekhi municipality, from south-east – by Khobi and Tskaltubo municipalities and from the north-west – by Martvili municipality. The total area of the municipality is 756k m^2, population size – over 16,000 and density - 22 persons per km^2. The municipal center is the city Tsageri, located by the river Tskenistskali at the altitude of 475m above the sea level. The municipal status was granted to the city in 1968. Total population size is over 1,800.

The administration of the Tsageri municipality is located in the municipal center – Tsageri. The municipality council is headed by the Chairman and the Deputy Chairman. Th Sakrebulo consists of administration, social affairs; mandates, voting, procedural and ethics; spatial planning and infrastructure development; financial-budgeting and; property management, economic affairs and natural resources commissions. Municipality Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelis. There are following structural units in the Gamgeoba: administration service, financial-budgeting service, architecture and supervision service, economic development and property management service, municipal services and infrastructure development service, education, culture, sports and youth affars service , public health and social protection service, fire fighting and rescue service and, national army recruitment service. Territorial units are headed by the Gamgebeli representatives in each community under the coverage of the Municipality.

2011 Tsageri municipality budget is set at GEL 3,525,700, of which GEL 1,662,000 is government administration and service costs, GEL 146,000 – emergency situations management costs, GEL 10,000 – local police structures operations costs, GEL 62,000 – defense costs, GEL 439,500 – infrastructure O/M and development costs (e.g. GEL 100,00 road maintenance and rehabilitation costs, GEL 53,400 equipment costs, GEL 10,000 municipal transport costs, GEL 700 technical oversight costs, GEL 60,000 cleaning and waste disposal costs, GEL 99,800 municipal structure maintenance and improvement costs, GEL 10,000 city spatial planning and zoning cost, GEL 5,000 addressing homeless pets issues costs, GEL 15,000 co-funding commttments to NGO-implemeented infrastructure projects, GEL 25,600 storm water drainage systems cleaning and rehabilitation/construction costs, GEL 60,000 outdoors lighting system maintenance and rehabilitation costs), GEL 402,100 – education costs with more than 50% financing of the pre-school education facilities, GEL 559,000 – sports, cultural and recreation activities costs and, GEL 245,100 – public health and social protection costs.

Lentekhi Municipality. ***Lentekhi Municipality*** from the south is borderded by Tsageri, Ambrolauri and Oni municipalities, from the west – by Martvili and Chkhorotskhu municipalities, from the north – by Zemo Svaneti and from the east – by Russian Federation. Total area of the municipality is 1,344 km^2, population size – over 8,500, population density – 6.7 persons per km^2 (2002 census data). There are 59 settlements, including 1 town and 58 villages in the municipality. The municipal center is the town Lentekhi, located on the banks of the river Laskanura, Tskenistskali tributary at the altitude of 760m above the sea level. It is situated in an 102km distance from the city of Kutaisi. The status of the town was granted to lentekhi in 1969. Total population size is over 1500.

Administration of the Lentekhi Municipality is located in Lentekhi, municipal center. The Municipality Council is headed by the Chairman and the Deputy Chairman. The council consists of mandates, procedural and ethics commission, financial-budgeting commission, spatial-territorial planning and infrastructure commission, property management and natural resources commission and, social affairs commission. There are also ad-hock working groups and political fractions in the council. Lentekhi Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelis. The office consists of following functional units: administration service, financial-budgeting service, spatial planning, architecture, construction service, infrastructure, economic development, statistics and property management service, culture, education, sports and youth affairs service, public health and social protection service, army recruitment service, fire fighting and rescue service and, logistical and procurement service. Terriorial units are divided per comminities and headed by the representatives of the Gamgebeli in each community.

2011 budget of Lentekhi municipality is GEL 1,710,200, of which GEL 804,000 is government administrative and service costs, GEL 38,000 – defense costs, GEL 117,700 public order and security activities (fire fighting, police and security guards) costs, GEL 64,000 – economic activities costs, GEL 70,000 – environmental protection costs (waste collection and disposal), GEL 30,000 – municipal services costs (outdoor lighting), GEL 49,000 – public health protection costs, GEL 395,500 – sports, culture, entertainment and youth activities costs, GEL 104,000 – education costs (primarily pre-school education costs) and, GEL 38,000 – social protection costs.

Tkibuli Municipality. ***Tkibuli municipality*** from the north-east is bordered by Ambrolauri, from the south – by Terjola, from the east – by Chiatural and from the west – by Tskaltubo municipality and the city of Kutaisi. The municipality is located at the elevetation of 600-800m above the sea level. It is stretched on both banks of the river Tkibula, the right tributary of the river Kvirila. The total area of the municipality is 470km2. The municipal center of the municipality is the city of Tkibuli, which was granted this status in 1939. It is located in a distance of 264km from Tbilisi and 42km from Kutaisi. There are 10 territorial units, including 1, 7 communities and 2 villages. In total, the number of villages is 45. The total population size of the municipality is over 31100, with over 14,400 urban and over 16,600 rural populations. Population density is 65 persons per km^2.

Administration of Tkibuli municipality is located in the municipal center – Tkibuli. Sakrebulo is headed by the Chair and the Deputy Chair. There are following commissions in the Sakrebulo: mandates, procedural, education, sports and culture commission, financial-budgeting commission and social affairs commission. The Sakrebulo is supported by the Secretariat/administration. Th Gamgeoba is headed by the Gamgebeli and the Deputy Gamgebeli. In addition, Gamgebeli has two assistants. The office is represented by administrative, economic development and infrastructure, health and social protection, supervision, financial, army recruitment and fire fighting services.

2011 budget of the Tkibuli municipality is GEL 5,094,000, of which government administrative and other general costs in GEL 885,300, military defense costs – GEL 65,700, security and public order costs – GEL 269,900 (fire fighting and local police structure operational costs), economic activities costs – GEL 992,200 (vehicular transport and roads), environmental protection costs – GEL 245,800 (waste, collection, disposal and utilization/treatment), municipal/communal service costs – GEL 1,016,800 (GEL 199,100 residential building blocks construction, GEL 732,300 communal services improvement and GEL 85,400 outdoors lighting costs), public health protection costs – GEL 51,800, culture, sports, recreation and entertainment costs – GEL 975,500 and, social protection costs – GEL 200,200.

Chiatura Municipality. ***Chiatura municipality*** from the north is bordered by Ambrolauri municipality, from the east – by Sachkhere municipality, from the south – by Kharagauli municipality and from the west – by Tkibuli, Terjola and Zestaphoni municipalities. Its total area is 542km^2, population size – over 55,000 and population density – 184 persons per km^2. The municipal center is located in the city of Chiatura. The city is stretched on Chiatura plateau and narrow gorge of the river Kvirial at an elevation of 340-500m above the seal level. The distance from Tbilisis is 220 km. The city was established in 1879, when the extraction of manganese started in the region.

Administration of the Chiatura municipal government is located in the city of Chiatural. Sakrebulo is headed by the Chair and the Deputy Chair. There are following commission in it: mandates, procedural and ethics commission, finance-budgeting commission, spatial-territorial planning and infrastructure commission, social issues commission and, property management and natural resources commission. The Sakrebulo is assisted by the secretariat. Gamgeoba is headed by the Gamgebeli and two deputy Gamgebelis. Functional units of the Gamgeoba consists of: administration service, infrastructure and communal services provision service, spatial, planning, architecture and construction service, economic, development, statistics and municipal property management service, financial-budgeting and procurement service, culture, education, sports, public health and social protection and, youth affairs service, fire fighting and rescue service and army recruitment service. Territorial units of the municipality are represented by the envoys of the Gamgebeli in each unit.

2011 budget of the Chiatura Municipality is GEL 6,657,599, of which GEL 2,674,800 is general administrative costs, GEL 98,000 – defense costs, GEL 438,500 – publi order and security costs (fire fighting, local police offices and security costs), GEL 326,400 – economic activities costs, GEL 325,000 – environmental protection costs (GEL 245,000 waste management and GEL 80,000 wastewater discharge management costs), municipal services costs – GEL 170,000 (GEL 20,000 water supply and GEL 150,000 outdoors lighting costs), public health protection costs – GEL 107,000, sports, leisure, cultural activities costs – GEL 1,501,400, education costs – GEL 711,400 (pre-school education costs), social protection costs – GEL 305,100.

Sachkhere Municipality. ***Sachekhere municipality*** is located in upper to middle reaches of the rivers Kvirila and Dzirula. It is bordered by Amrolauri and Oni municipalities from the north, Java and Kornisi (Znauri) municipalities from the east, Khashuri and Kharagauli municipalities from the south and Chiatura muncipality from the west. The relief is middle-low mountainous. The northern part is located on the southern slope of Racha ridge and south and south-east – on Imereti upland. Total area of the municipality is 788.5 km^2, population size – over 54800, density – 48 persons per km^2. There is one city and 13 communities in municipality.

The center of the municipality is the city of Sachkhere. It is located on the bank of the river Kvirila in the north-west of the Sachkhere valley. The altitude varies from 500 to 550 m above the sea level. The city is in a distance of 176 km from Tbilisi and 91 km from Kutaisi. Total population size is about 7,000.

Administration of Sachkhere municipality government is located in the city of Sachkhere. Sakrebulo is headed by the Chair and the Deputy Chair. The Sakrebulo consists of: humanitarian affairs commission, social affairs commission, finance-budgeting commission, agriculture, environmental protection and natural resources commission and infrastructure commission. Gamgeoba is headed by the Gamgebeli and the Deputy Gamgebeli. The Gamgebelo is supported by an assistant. The office consists of administration, finance, economic, social, culture, construction and architecture, fire fighting and army recruitment services.

2011 budget of Sachkhere municipality is GEL 4,249,500, of which GEL 1,348,300 is general administration and government service costs, GEL101,000 – defense costs, GEL 358,600 – public order and security costs (policy, security and fire fighting), economic activities cost – GEL 119,500 (forestry and transportation costs), environmental protection costs – GEL 285,000 (GEL 195,000 waste management, GEL 80,000 wastewater discharge treatment costs and GEL 10,000 biodiversity and landscape protection costs), municipal services costs – GEL 455,000 (GEL 35,000 sanitation, GEL 320,000 water supply, GEL 90,000 outdoor lighting and GEL 10,000 various communal service costs), public health protection costs – GEL 76,500, culture, recreation and sports costs – GEL 732,900, education costs – GEL 637,700 (with GEL 527,200 pre-school education costs) and, social protection costs – GEL 135,000.

Tskaltubo Municipality. ***Tskaltubo municipality*** is located in the central part of West Georgia, on east of Kolkheti lowland within the valleys of the rivers Rioni and Gubistskali. From the east it is bordered by Kutaisi, from the west – by Samtredia and Khoni municipalities, from the north – by Tsageri and Amrolauri municipalities and, from the south – by Bagdati and Vani municipalities. The total area of the municipality is 707.5km2. The relief is plain hilly. From total of 67,113 ha agriculture lands occupy 30,543 ha. Forest fund consists of 24,685 ha with 23,706 ha forested area. The city of Tskaltubo is the administrative center of the municipality. It is located on the bank of the river Tskaltubo at an elevation of 120m above sea level. The city status was granted to it in 1953. The city is 10km far from Kutaisi and 200km far from Tbilisi. Apart from the city of Tskaltubo there are 41 settlements in Tsaltubo municipality.

Administration of Tskaltubo local government is located in the city of Tskaltubo. Municipal Sakrebulo is headed by the chairman and deputy chairman. There are following commissions in the Sakrebulo: finance-budgeting commission, agriculture, environmental protection and natural resources commission, spatial and territorial planning, economic development and infrastructure commission and social affairs commission. The Sakrebulo is supported by the secretariat/administration. Municipal Gamgeoba is headed byt the Gamgebeli and two deputies. The Gamgebeli is supported by the personal assistant. There are following functional units in the Gamgeoba: administration, finance-budgeting service, architecture and infrastructure development service, economy and property management service, education, sports, culture and youth service, public health and social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Tskaltubo Municipality is GEL 5,972,200, of which general administrative cost is GEL 2,056,400, defense cost – GEL 2,056,400, public order and security cost – GEL 224,000 (fire fighting, police and security), economic activities cost – GEL 1,121,700 (agriculture and transport costs), environmental protection cost – GEL 423,000 (GEL 420,000 waste management and GEL 3,000 various environmental activities costs), municipal service cost – GEL 548,900 (GEL 30,000 residential building blocks construction, GEL 100,000 water supply, GEL 248,900 outdoor lighting and GEL 170,000 various communal services costs), public health protection cost – GEL 49,400, culture, sports and religion activities cost – GEL 731,900, education cost – GEL 574,300 (with GEL 485,000 preschool education costs) and, social protection cost – GEL 166,700.

Khoni Municipality. ***Khoni municipalities*** is situated on the bank of the rive Gubistskali and the river Tskenistskali valley. Tskvenisktskali divides into two parts its mountainous areas. The municipality from the north is bordered by the Tsageri municipality, from the south – by the Samtredia municipality, from the south-west – by Abasha municipality, from the west – by Martvili municipality and from the east – by Tsaktubo municipality. Total area of of the municipalities is 428.5 km2, of which about 58% is mountainous-hilly. The lowest point is the village Kutiri located at an elevation of 62 m above the sea level, the highest point is the peak Lekhi – 2,436.7m. Total population size of the municipalities is 31,200 and the density – 74.1/km2 . The city of Khoni is the administrative center of the municipality. It is located on Imereti lowland on the bank of the river Tskenistskali at an altitude of 114 m above the sea level. It is in a 22km distance from Samtredia. Its total population size is over 11,200.

Municipal administration of the local government of the Khoni Municipality is located in the city of Khoni. The Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and ethics commission, finance and budgeting commission, spatial-territorial planning and infrastructure commission, property management and natural resources commission and, social affairs commission. Municipal Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelies. The office consists of following functional units: administrative service, finance service, culture, sports, education, cultural heritage protection and youth service, administrative supervision service, public health, social protection and labor service, economic and infrastructure service and, fire fighting and rescue service.

2011 budget of the Khoni municipality is GEL 3,833,400, of which general administrative cost is GEL 1,688,500, defense cost – GEL 74,000, law and order and security cost – GEL 160,000, economic activities cost – GEL 160,000 (transport costs), environmental protection cost – GEL 324,900 (GEL 180,000 waste management, GEL 134,900 wastewater management and GEL 10,000 various environmental protection activities costs), municipal service cost – GEL 280,000 (GEL 150,000 residential building blocks construction, GEL 70,000 outdoor lighting and GEL60,000 various utilities services costs), public health protection cost – GEL 50,000, cultural, sports and religious events cost – GEL 595,000, education cost – GEL 290,000 (with GEL 210,000 pre-school education costs) and social protection costs – GEL 211,000.

Terjola Municipality. ***Terjola municipality*** is located in the east part of the Kolkheti Plain at an 110-400 m elevation from the sea level. Total area of the municipality is 356.24km2, of which 21,503 ha is annual croplands, 4,571 ha – perennial croplands, 872 ha – pastures and 10,000 ha – forest lands. Total population size of the municipality is 4,500 and density – over 127 persons per km2. The municipality from the west is bordered by Kutaisi, from south-east – by Zestaphoni, from north – Tkibuli municipality, from north-west – by Chiatura municipality and from south – by Bagdati municipality. Municipal center of the municipality is located in the city of Terjola, which is 200km far from Tbilisi and 18km far – from Zestaphoni. It is located on the Imereti lowland on the right bank of the river Chkhari at an elevation of 170m above sea level. Total population size of Terjola is over 5,000.

Administration of the local government of Terjola municipality is located in the city of Terjola. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: legal issues, mandates, procedural and ethics commission, finance and budgeting commission, spatial-territorial planning and infrastructure commission, social-economic and, property management and natural resources commission and, social affairs commission. Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelis. The office consists of following functional units: administrative service, finance and budgeting service, culture, sports, education, cultural heritage protection and youth service, construction and architecture activity supervision and infrastructure development service, public health and social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Terjola municipality is set at GEL 5,020,500, of which general administrative cost is GEL 1,015,000, defense cost – GEL 59,800, law and order and security cost – GEL 210,600, economic activities cost – GEL 490,000 (transport costs), environmental protection cost – GEL 490,000 (waste management), municipal service cost – GEL 1,122,900 (GEL 307,800 sanitation, GEL 39,000 water supply and GEL 100,000 outdoor lighting and GEL 676,100 various utilities services costs), public health protection cost – GEL 59,100, cultural, sports and religious events cost – GEL 680,900, education cost – GEL 826,700 (with GEL 731,700 pre-school education costs) and social protection costs – GEL 290,500.

Zestaphoni Municipality. ***Zestaphoni municipality*** is stretched over the east part of Kolkheti Lowland on both sides of the river Kvirila and the Imereti Plateau. From the east it is bordered by Kharagauli municipality, from the north-east – by Chiatura municipality, from the west – by Terjola municiplity and from the south – by Bagdati municipality. The rivers Kvirila, Dzirula, Cholaburi, Chkherimela and their tributaries flow in the municipality . Total area of the municipality os 423.7 km^2; total population size – 75,400 and; the density – about 180 persons per km^2. There is 1 city, 1 town and 17 territorial units (communities) with 56 villages in the municipality . Municipal center of the municipality is the city of Zestaphoni, located on both banks of the river Kvirila in Kolkheti Lowland at an elevation of 160m above the sea level. The distance from Tbilisi is 183km.

Administration of the local government of Zestaphoni municipality is located in the city of Zestaphoni. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: legal issues, mandates, procedural and ethics commission, finance-budgeting commission, spatial-territorial planning and infrastructure commission, economic and property management commission and, social affairs commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelis. The office consists of following functional units: administrative service, finance and budgeting service, culture, sports, education, cultural heritage protection and youth service, economic and infrastructure development service, social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Zestaphoni municipality is set at GEL 9,252,000, of which general administrative cost is GEL 3,682,300, defense cost – GEL 80,400, law and order and security cost – GEL 228,600, infrastructure O/M and improvement cost – GEL 1,868,800 (GEL 8,000 agriculture, GEL 204,700 transport, GEL 914,500 rural infrastructure rehabilitation, GEL 433,000 waste collection, disposal and utilization, GEL 3,300 wastewater treatment, GEL 32,800 residential building blocks construction, GEL 259,500 equipment, GEL 4,200 water supply and GEL 8,800 outdoor lighting costs, cultural, sports and religious events cost – GEL 1,678,700, education cost – GEL 1,171,300 (with GEL 874,000 pre-school and GEL 297,300 secodnary education costs) and, public health and social protection costs – GEL 541,900.

Kharagauli Municipality. ***Kharagauli municipality*** is located in the central part of Georgia. From the east and south-east it is bordered by Khashuri, from the west and south west – by Zestaphoni and Bagdati municipalities, from the north and north-east – by Sachkhere and Chiatural municipalities and from the south – by Borjomi municipality. The relief is mountainous-hilly and the altitude varies from 285 to 2,642m above the sea level, average elevation is 420m. Total area of the municipality is 91,300 ha (230km^2). There are 1 town (Kharagauli) and 20 territorial units (communities) composed of 78 villages in the municipality. Rivers Dzirula and its tributaries: Khelmosula, Dumala, Vasheura, MechkheTura, Borimela, Rikotula, Gedsamanistskali, Sakasria, Goreshiskhevi and Chkherimela flow in the municipalities. Forest occupy over 68.2% of the total territory (650km^2). Borjomi-Kharagauli Park is located here occupying 230km^2 (85,000 ha) in Kharagauli municipality. Total population size of the municipality is 27,500 and population density – up to 30 persons per km^2. The town Kharagauli is an administrative center of the municipality. It is in a 198km distance from Tbilisi and 65km distance from Kutaisi. It is located on both sides of the river Chkherimela at an elevation of 280-400m above the sea level. Total population size is over 2,300.

Administration of the local government of Kharagauli municipality is located in the town Kharagauli. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: legal issues, mandates, procedural and ethics commission, finance-budgeting commission, spatial-territorial planning and infrastructure commission, economic and property management commission and, social affairs commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelis. The office consists of following functional units: administrative service, finance and budgeting service, culture, sports, education, and youth service, economic and infrastructure development service, social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Kharagauli municipality is set at GEL, 3,808,800 of which general administrative cost is GEL 1,158,700, defense cost – GEL 50,000, law and order and security cost – GEL 186,200, economic activities cost – GEL 426,000 (GEL 325,500 transport and GEL 100,500 various activities costs), environmental cost – GEL 170,400 (GEL 145,900 waste management and GEL 24,500 wastewater treatment costs), municipal service cost – GEL 409,000 (GEL 162,600 water supply costs, GEL 55,000 outdoor lighting costs and GEL 191,400 various municipal service costs), public health cost – GEL 52,000, sports, culture and entertainment cost – GEL 889,200, education cost – GEL 323,300 (with GEL 223,200 preschool education and GEL 60,100 secondary education costs) and, social protection costs – GEL 144,000.

Bagdati Municipality. ***Bagdati municipality*** is spread on the Meskheti Ridge and its foothills (Lower Caucasus) and, on Imereti lowland. Total area of the municipality is 815km^2, of which agriculture lands occupy 82.22 km^2. Major rivers of the municipality are: Khanistskali, Rioni tributary and its inflows: Saraula, Laishura and other rivers. The 2/3 of the southern part of the municipality is covered by forests that transform into alpine landscapes at an elevation of 2800-3000 m. Overall, 67.5% of total area is covered by forests. Total population size of the municipality is 28,700, population density – about 35 persons per km^2. There are 23 settlements in the municipality , including 1 city and 22 villages. The city of Bagdati is an administrative center of the municipality. is located in the valley of the river Khanistskali at an elevation of 232 m above the sea level. It is in the midst of the roads to Kutaisi, Zestaphoni, Vani and Abastumani. Population size of the city is over 4,000.

Administration of the local government of Bagdati municipality is located in the city of Bagdati. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: legal issues, mandates, procedural and ethics commission, finance-budgeting and economic issues commission, infrastructure commission, agriculture, environmental protection and natural resources commission and, social affairs commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli and the Deputy Gamgebeli. The Gamgebeli is supported by the assistant. There are heads of the functional and territorial units appointed by the Gamgebeli. The office consists of following functional units: administrative service, finance and budgeting service, culture, sports, education, and youth service, economic and infrastructure development service, health and social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Bagdati municipality is set at GEL, 3,682,600, of which general administrative cost is GEL 1,350,500, defense cost – GEL 64,200, law and order and security cost – GEL 199,500, economic activities cost – GEL 102,000 (GEL 12,000 agriculture and GEL 90,000 transport and roads maintenance costs), environmental protection cost – GEL 350,000 (GEL 170,000 waste management and GEL 180,000 biodiversity and landscape protection costs), municipal service cost – GEL 603,300 (GEL 423,300 residential buildings construction, GEL 20,000 water supply costs, GEL 110,000 outdoor lighting costs and GEL 50,000 various municipal service costs), public health cost – GEL 30,000, sports, culture and entertainment cost – GEL 517,900, education cost – GEL 352,000 (with GEL 287,000 preschool education costs) and, social protection costs – GEL 113,200.

Vani Municipality. ***Vani municipality*** is located in the south-west of Imereti region. From the east the municipality is bordered by Bagdati municipality, from the west – by Samtredia and Chokhatauri Municipalities, from the south – by Adigeni and Chokhatauri municipalities and from the north – by Tskaltubo and Samtredia municipalities. The Municipality is spread over Imereti Lowland and northern slopes of Meskheti ridge. Its total area is 557.9 km2. Following major rivers flow in the municipality: Rioni, Sulori, Kumuri and others. Total population size of the municipality is 33,800, population density – about 60. There are 1 city (Vani) and 20 communities in the municipality. The administrative center is the city of Vani, located on the bank of the river Sulori in Imereti lowland at an altitude of 60m above the sea level. Total population size of Vani is over 4,000

Administration of the local government of Vani municipality is located in the city of Vani. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: legal issues, mandates, procedural and ethics commission, finance-budgeting commission, infrastructure commission, agriculture and environmental protection commission and, social and economic issues commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli, first Deputy Gamgebeli and the Deputy Gamgebeli. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative service, finance and budgeting service, supervision service, culture, sports, education, and youth service, economic and infrastructure development service, health and social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Vani municipality is set at GEL, 4,422,100, of which general administrative cost is GEL 2,030,800, defense cost – GEL 76,400, law and order and security cost – GEL 188,100, economic activities cost – GEL 222,200 (GEL 65,800 agriculture and GEL156,400 transport and roads maintenance costs), environmental protection cost – GEL 144,000 (waste management costs), municipal service cost – GEL

649,200 (GEL 87,700 water supply costs, GEL 120,200 outdoor lighting costs and GEL 441,300 various municipal service costs), public health cost – GEL 50,500, sports, culture and entertainment cost – GEL 560,600, education cost – GEL 398,200 (preschool education costs) and, social protection costs – GEL 102,100.

Samtredia Municipality. The majority of the territory ***of Samtredia Municipality*** is located on the Kolkheti Lowland and very small part – Sajavakho plateau. Total area of the municipality is 341.1 km2, population size – 60,300 and density – about 166 persons per km2. There are 50 settlements in the municipality, including 1 city – Samtredia, 1 town – Kulashi and the rest – communities. Administrative center of the Samtredia municipality is the city of Samtredia, located on the right bank of the river Rioni. The distance from Kutaisi is 27km. Total population size is about 29,700.

Administration of the local government of Samtredia municipality is located in the city of Samtredia. Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and human rights protection commission, finance-budgeting commission, education, culture, sports and youth commission, infrastructure commission and, labor, public health and social protection commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelies. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, finance, budgeting and accounting service, culture, sports, education, cultural heritage and youth service, territorial arrangement, architecture, transport and infrastructure development service, health and social protection service, public relations service, supervision, local tax collection, procurement, logistics, statistics, economic and property management service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Samtredia municipality is set at GEL 4,883,800[26], of which general administrative cost is GEL 1,566,600, defense cost – GEL 85,000, law and order and security cost – GEL 273,000, economic activities cost – GEL 66,200 (GEL 47,900 transport and roads maintenance costs and, GEL 18,300 various economic activities costs), environmental protection cost – GEL 145,400 (GEL 61,300 waste management costs, GEL 32,100 wastewater treatment costs, GEL 50,000 biodiversity and landscape protection costs and GEL 2,000 other environmental activities costs), municipal service cost – GEL 438,500 (GEL 315,000 procurement machinery and equipment, GEL 23,700 water supply costs, GEL 94,300 outdoor lighting costs and, GEL 5,500 various municipal service costs), public health cost – GEL 60,500, sports, culture, sports and entertainment cost – GEL 1,167,500, education cost – GEL 689,600 (with GEL 605,700 pre-school education costs) and, social protection costs – GEL 391,500.

Kutaisi Municipality. ***Kutaisi is an administrative center*** of Imereti Region, which covers 12 municipalities. It is autonomous municipal entity. The city is located on the banks of the Rioni River at an altitude of 96-235m above the sea level. It is relatively close to the sea ports Batumi and Poti, e.g. the distance to Batumi is 139 km and the one to Poti – 103 km. The distance to the capital is 221km. Total population size is 192,200 and densitity – about 2,750 persons per km^2.

[26] about 69% less than 2010 budget

Kutaisi Sakrebulo is headed by the Chairman, First Deputy Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and human rights protection commission, finance-budgeting and audit commission, juridical commission, education, culture, sports and youth commission, infrastructure commission, social issues and public relations commission, economic issues commission, municipal services commission, labor, public health and social protection commission. The Sakrebulo is assisted by the Secretariat/Administration. Mayor's Office is an executive body of Kutaisi. It is headed by the Mayor and two Deputy Mayors. The office is assisted by the Mayor's administration. It consists of following functional units: economic policy and strategic development service, financial service, health, social protection and IDPs service, municipal service, culture, sports, education, cultural heritage and youth service, residential areas development service, military affairs service, emergency situations management service, municipal procurement service, transport service and, architecture service.

2011 budget of the city of Kutaisi is set at GEL 43,923,900, of which general administrative cost is GEL 8,538,100, law and order and security cost – GEL 1,552,700, economic activities cost – GEL 463,300 (GEL 50,000 general economic and commercial activities costs, GEL 215,300 municipal transport and road O/M costs, GEL 48,000 tourism promotion costs and, GEL 150,000 various economic activities costs), environmental protection cost – GEL 3,462,800 (GEL 3,168,000 waste management costs and GEL 294,800 wastewater treatment costs), municipal service cost – GEL 14,205,800 (GEL 2,538,3 00 procurement of necessary machinery and equipment, GEL 944,100 water supply costs, GEL 2,288,300 outdoor lighting costs and, GEL 8,435,100 various municipal service costs), public health cost – GEL 694,500, sports, culture, sports and entertainment cost – GEL 8,450,700, education cost – GEL 5,472,500 (with GEL 5,156,000 pre-school education costs) and, social protection costs – GEL 1,083,500.

Abasha Municipality. ***Abasha municipality*** is located in the west Georgia, Kolkheti Plain. From the north it is bordered with Martvili municipality, from the east – with Samtredia municipality, from the south – with Samtredia and Lanchkhuti municipalities and from the west – with Senaki municipality. Total area of the municipality is 320,8 km2, of which 210 km2 of area are occupied by agriculture lands. The relief is plain, lowland, altitude varies from 20 to 50m above the sea level. Large rivers of Rioni, Tskenistskali and Abasha flow there. Among small rivers: Nogela, Kovza and Zana flow in the municipality. In the south-east of the region there is "Siriachkoni" wetland. Total population size of the municipality is 27,800, and density – over 85 persons per km2. There are 41 settlements in the municipality, including 1 city (Abasha) and 40 villages. The administrative center of the municipality is the city of Abasha. It is situated between the rivers Abasha and Nogela at an elevation of 23m above the sea level. Population size is over 6,000.

Administration of the local government of Abasha municipality is located in the city of Abasha. The municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and ethics commission, finance-budgeting commission, education, culture and social issues commission, infrastructure, economic development and property management commission and, labor, public health and social protection commission and, agriculture and land management commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli and two Deputy Gamgebelies. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, finance service, culture, sports, education and cultural heritage protection service, labor, health and social protection service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Abasha municipality is set at GEL 4,358,800, of which general administrative cost is GEL 2,209,100, defense cost – GEL 52,4 00, law and order and security cost – GEL 186,700, economic activities cost – GEL 521,200 (GEL 480,200 agriculture activities costs, GEL 500 transport costs and, GEL 40,500 various economic activities costs), municipal service cost – GEL 497,200 (GEL 293,600 residential building blocks construction costs, GEL 140,000 equipment procurement costs and, GEL 63,600 outdoor lighting costs), public health cost – GEL 60,000, sports, culture, sports and entertainment cost – GEL 482,500, education cost – GEL 255,000 (pre-school education costs) and, social protection costs – GEL 94,600.

Martvili Municipality. ***Martvili municipality*** is located in the north-east of west Georgia. From the north it is bordered by Lentekhi municipality, from the east – by Khoni and Tsageri municipalities, from the south – by Abasha municipality and from the west – by Senaki and Chkhorotskhu municipalities. The southern part of the municipalities is a plain area. From the south-west to the north-east, the altitude changes from 60 to 170 m. The highest point is the source of the river Techura at 3,003 m above the sea level. On the south-west there is the mountain ridge of Askhi, reaches in karst cave, spring, waterfalls and mineral deposits. Total area of the municipality is 880.6 km2. It is composed of 1 city and 20 villages. Total population size is 44,700 and density – over 45 persons per km2. Total agriculture lands occupy 37,613 ha, including 11,254 ha arable lands, 12,137ha pastures and 4,995 ha perennial croplands. The administrative center of the municipality is the city of Martvili. It is located by the river Abashistskali and its population size is 6,696.

Administration of the local government of Martvili municipality is located in the city of Martvili. The municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and ethics commission, finance-budgeting commission, education, culture and social issues commission, economic development and infrastructure commission and, social issues commission and, agricultural commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebeli and Deputy Gamgebeli. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, economic and infrastructure development service, finance-budgeting service, culture, sports, education and cultural heritage protection service, labor, health, social protection and IDPs service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Martvili municipality is set at GEL 5,647,400, of which general administrative cost is GEL 2,425,700, defense cost – GEL 60,000, law and order and security cost – GEL 158,0 00, economic activities cost – GEL 41,3 00(GEL 10,000 agriculture and GEL 31,300 transport and road maintenance costs), municipal service cost – GEL 1 540,500 (GEL 227,600 residential building blocks construction costs, GEL 28,3 000 water supply costs, GEL 112,000 outdoor lighting costs and GEL 1, 172,600 various municipal service costs), public health cost – GEL 139,5 00, sports, culture, sports and entertainment cost – GEL 927,400, education cost – GEL 245,000 (with GEL 175,0 000 pre-school education costs) and, social protection costs – GEL 110,000.

Senaki Municipality. ***Senaki municipality*** is located by the river Rioni and from there is stretched over the both slopes of the mount Unagira. It is situated in the center of the east part of Kolkheti Lowland. The relied is mostly represente by lowlands, uplands, mountains and river valleys. In the north of the municipality uplands and foothills dominate and in the south – lowlands represented by Kolkheti Lowland discected by the tributaries of the rivers Tsivi and Tekhura. Maximum elevation of the lowland does not exceed 30m. Following rivers flow in the municipality: river Tsivi, originating from the north of the Eki Mount, Techura, originating from the slopes of Egrisi ridge and as well, a number of smaller rivers Fitsu, Dguru, Zanadzga, Uchagalum Chiche, Galu, Ekuskiri, etc.

Extreme east part of the Municipality is bordered with the v. Tskemi, west part – with Khobi municipality near the river Khobistskali, extreme northern part – with Chkhorotskhu municipality near the v. Akhutti and south part – with Lanchkhuti and Khobi municipalities. Total population size of the Senaki municipality is 52,300 and density – over 100 persons per km^2. Municipal center of the municipalities is the city of Senaki. It is situated on the right bank of the river Tekhura at an altitude of 28m above the sea level. The city status was granted to it in 1966. Total population size is over 28,500.

Administration of the local government of Senaki municipality is located in the city of Senaki. The municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates and procedural commission, finance commission, social issues commission, infrastructure commission and, agricultural and land use issues commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebeli and the Deputy Gamgebeli. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, economic and infrastructure development service, finance service, culture, sports, education, cultural heritage protection and the youth affairs service, labor, health, social protection and IDPs service, army recruitment service and, fire fighting and rescue service.

2011 budget of the Senaki municipality is set at GEL 5,170,400, of which general administrative cost is GEL 1,192,900, defense cost – GEL 61,800, law and order and security cost – GEL 320,400, economic activities cost – GEL 1,098,100 (GEL 4,000 agriculture costs, GEL 420,000 transport and road maintenance costs and GEL 674,100 various economic activities costs), environmental protection costs – GEL 329,200 (GEL 314,200 waste management, GEL 8,000 wastewater treatment costs and GEL 7,000 various environmental activities costs) municipal service cost – GEL 304,900 (GEL 35,000 residential building blocks construction costs and GEL 269,900 outdoor lighting costs), public health cost – GEL 98,000, sports, culture, sports and entertainment cost – GEL 874,900, education cost – GEL 668,000 (with GEL 560,000 pre-school education costs) and, social protection costs – GEL 222,300.

<u>Khobi Municipality</u>. ***Khobi municipality*** is located in the western part of the west Georgia, in the center of Kolkheti Lowland. From the north the municipality is bordered by Zugdidi municipalities, from the north-east – by Chkhorotsku municipalities, from the east – by Senaki municipalities, from the south – by Lanchkhuti municipalities, from the south-west – by the city of Poti and from the west – by the Black Sea. Total area of the municipality is 676km2. It is located at the altitude 2-470m above the sea level. The municipality is abundant with hydroresources, both surface and ground waters. There are lot's of wetlands, small lakes and hot thermal waters in the municipality. Over 22% of its territory is occupied by broad-leafed forests. There are 21 territorial units in the municipalities, including 1 city (Khobi) and 20 communities with 56 villages. Total population size of the municipality is 41,300 and density – over 62 per km2. The city of Khobi, municipal centerof the municipalities is located at an elevation of 25m above the sea level. The distance from Tbilisi is 285 and from Senaki airport -15 km. Within the distance of 35km there is a Poti sea port. Total population size of the city is over 7,200.

Administration of the local government of Khobi municipality is located in the city of khobi. The municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the

Sakrebulo: mandates and procedural commission, juridical and human rights protection commission, finance-audit commission, social issues commission and economic development commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebeli and two Deputy Gamgebeli. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, economic and infrastructure development service, finance-budgeting service, culture, sports, education, cultural heritage protection and the youth affairs service, labor, health, social protection and IDPs service, army recruitment service and, fire fighting and rescue service. In addition, the is a Khobi branch of the Public Registry of Georgia, located within the municipality.

2011 budget of the Khobi municipality is set at GEL 5,170,400, of which general administrative cost is GEL 1,679,500, defense cost – GEL 92,300, law and order and security cost – GEL 313,600, economic activities cost – GEL 578,400 (GEL 310,100 agriculture costs and GEL 268,300 transport and road maintenance costs), environmental protection costs – GEL 645,200 (GEL 451,400 waste management and GEL 193,800 wastewater treatment costs), municipal service cost – GEL 410,600 (GEL 322,600 equipment procurement costs, GEL 58,500 water supply costs and GEL 29,500 outdoor lighting costs), public health cost – GEL 129,800, sports, culture, sports and entertainment cost – GEL 913,500, education cost – GEL 1,114,600 (with GEL 650,500 pre-school education costs) and, social protection costs – GEL 306,100.

Poti municipality. ***The city of Poti*** is located 330km westward from Tbilisi in an estuary of the river Rioni at its entrance to the Black Sea. The city lies at an altitude of 1 meter above sea level. From the west it is is bordered by the Black Sea, from the north – by the Khobi municipalities and the right sleeve of the river Rioni, from the south-east – by the river Kaparchina and from the south-west – by the Paliastomi Lake. The city itself is divided into the center, Nabada settlemtn, Iland and Maltakhva. Poti is surrounded by the Kolkheti National Park. Total area of the city is 65.8km^2, population size – 47,700. The distance of the city to Zugdidi is 60km to Kutaisi Kopitnari airport – 75 km.

Poti municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: juridical, mandates and procedural commission, budgeting and economic development commission, finance and audit commission, and infrastructure commission. The Sakrebulo is assisted by the Secretariat/Administration. Mayor's Office is the executive body of the self-governing city of Poti. It is headed by the Mayor and three Deputy Mayors. The office is assisted by the Mayor's administration. It consists of following functional units: architecture and construction technical oversight service, property management and transport service, financial and economic policy service, health, social protection and IDPs service, municipal service, sports service, culture and cultural heritage protection service, military affairs service, fire fighting and rescue service.

2011 budget of the city of Poti is set at GEL 16,769,200, of which general administrative cost is GEL 3,780,300, defense cost – GEL 101,500, law and order and security cost – GEL 583,900, economic activities cost – GEL 2,170,000 (GEL 176,000 municipal transport and road O/M costs and GEL 1,994,000 various economic activities costs), environmental protection cost – GEL 2,208,800 (GEL 699,000 waste management costs, GEL 1,469,800 wastewater treatment costs and GEL 40,000 various environmental protection activities costs), municipal service cost – GEL 3,700,000 (GEL 2,530,000 residential building blocks construction costs and GEL 1,170,000 outdoor lighting costs), public health cost – GEL 348,000, sports, culture, sports and entertainment cost – GEL 2,169,200, education cost – GEL 1,000,000 (pre-school education costs) and, social protection costs – GEL 707,500.

Chokhatauri Municipality. ***Chokhatauri municipality is located in west Georgia***, southern part of the Kolketi Lowland. From the west it is bordered by the Ozurgeti municipality, from the east – by the Vani municipality, from the south – by the Khulo and Adigeni municipalities and from the north – by the Samtredia and Lanchkhuti municipalities. Total area of the municipality is 822 km^2, of which about 60% is represented by uplands, hills and mountains. Total population size of the municipality is 23,000 and density – over 29 persons per km^2. Rivers Supsa, Gubazeuli and Khevistskali flow in the municipality. The region is represented by following territorial units: 1 town (Chokhatauri) and adjoining 60 villages united under the 23 communities. The administrative center of the municipality is the town Chokhatauiri, located 310 km west to the capital Tbilisi.

Administration of the local government of the Chokhatauri municipality is located in the town chokhatauri[27]. The municipal Sakrebulo is headed by the Chairman and the Deputy Chairman. There are following commissions in the Sakrebulo: mandates, procedural and ethics commission, juridical and human rights protection commission, financial-budgeting commission, spatial-territorial planning and infrastructure commission, property management and economic issues commission and social issues commission. The Sakrebulo is assisted by the Secretariat/Administration. Gamgeoba is headed by the Gamgebeli, First Deputy Gamgebeli and two Deputy Gamgebeli. The Gamgebeli is supported by the assistant. The office consists of following functional units: administrative unit, economic development infrastructure and investment promotion service, finance service, municipal property management service, juridical service, culture, sports, education, cultural heritage protection and the youth affairs service, social issue service, supervision service, local procurement and logistics service, army recruitment service and, fire fighting service.

2011 budget of the Chokhatauri municipality is set at GEL 2,689,100, of which general administrative cost is GEL 1,032,000, defense cost – 90,000, law and order and security cost – GEL 175,000, economic activities cost – GEL 22,000 (transport and road maintenance costs), environmental protection costs – GEL 101,000 (GEL 97,000 waste management and GEL 4,000 various environmental protection measures costs), municipal service cost – GEL 66,000 (GEL 63,000 outdoor lighting costs and GEL 3,00 various municipal services costs), public health cost – GEL 90,000, sports, culture, sports and entertainment cost – GEL 563,500, education cost – GEL 405,000 (pre-school education costs) and, social protection costs – GEL 144,600.

3.3 Local Territorial Units of Municipalities

3.3.1 Local Territorial Units Located in the Alazani River Basin

General

In accordance with the Georgian Organic Law on Self-Governance all municipal governments are divided into structural and territorial units. Following settlements or a group of settlements can be designated as territorial units of self-governments: i) individual settlement: village, town or a city; ii) a group of settlements, primarily, a union of several villages, called as community and, iii) a part/municipality of the settlement. Territorial units are governed by the representatives of Gamgeoba appointed by the Gamgebeli. The terms of reference for representatives of territorial units as well as the list of the territorial units are

[27] The town is not located in the Rioni Basin. However, since it is the municipal center of the municipalities, the information on the town is included in this report

defined in the Statutes of the Municipality Governments (Gamgeoba) and the statutes of the territorial units (for maps of the territorial units of the targeted river basins, please refer to annex 11).

Kakheti Region

Akhmeta Municipality. Akhmeta Municipality is divided into 15 territorial units, including 1 city, 13 communities with 59 villages and 2 villages as a separate territorial unit. These are: 1) Akhmeta; 2) Duisi community – Duisi, Tsinaubani, 3) Zemo Alvani community – Zemo Alvani, Khorbalo, 4) Zemo Khalatsani community – Zemo Khalastan, Dumasturi, Kvemo Khalatsani, Shul Khalatsani, 5) Zemo Khodasheni – Zemo Khodasheni, Atskhuri, Akhaldaba, Charekauli, 6) Magraani community – Magraani, Argokhi, Pichkhovani, 7) Omalo community – Omalo, Dano, Dartlo, Diklo, Dochu, KumelaurTa, Shenako, Shtrolta, Khakhabo, Khiso[28] 8) Odjio community – Odjio, Alaverdi, Kogoti, Chabinaani, Khorkheli, 9) Sakobiano community – Sakobiano, Bakilovani, Dedispherula, Kutsakhta, Koreti, Kvareltskali, Khevischala 10) Kvemo Alvani community – Kvemo Alvani, Babaneuli 11) Kistauri community – Kistauri, Arashenda, Akhalsheni, Akshani, Akhshnisvelebi, Ingeti, Kojori, Osiauri, Sachale, 12) Shakhvetila community – Shakhvetila, Bugaani, Vedzebi, Nadeknari, Sabu, Chachkhriali, Chartala; 13) Jokola community – Jokola, Birkiani, Omalo; 14) V. Mataani 15) V. Kasristskali

Telavi municipality. There are 26 territorial units in Telavi municipality, including several territorial units of Telavi Telavi, 22 villages and 2 communities with two villages in each. These are as follows: 1) Central Telavi, 2) Old Telavi 3) East Telavi, 4) Alazani – Central Caucasus; 5) v. Akura, 6) V. Vanta, 7) V. Kvemo Khodasheni, 8) V. Busheti, 9) v. Tsinandali, 10) V. Kondoli, 11) V. Kisiskhevi, 12) V. Nasamkhrali, 13) V. Shalauri; 14) V. Kurdgelauri; 15) V. Gulgula; 16) V. Vardisubani; 17) V. Ruispiri; 18) V. Ikalto; 19) V. Karajala; 20) V. Napareuli; 21) V. Lapankure; 22) V. Saniore (Saniore and Jugaani); 23) V. Artani; 24) V. Pshaveli community (Pshaveli, Lechuri); 25) V. Tetratsklebi 26) V. Laliskhuri.

Gurjaani Municipality. There are 23 territorial units in Gurjaani municipality, including 1 city, 3 communities and 19 villages. These are: 1) Vachnadze community; 2) V. Kalauri; 3) V. Shashiani; 4) V. Vazisubani; 5) Mukuzani community; 6) V. Velistsikhe; 7) V. Chumlaki; 8) C. Gurjaani; 9) V. Gurjaani; 10) V. Chandari; 11) V. Dzirkoki; 12) V. Vejini; 13) V. Kolagi; 14) V. Bakurtsikhe; 15) V. Kardenakhi; 16) V. Chalaubani; 17) V. Arashenda; 18) Kachreti community; 19) V. Jimiti; 20) V. Naniani; 21) V. Cheremi. Out of these settlements Kakhreti community and villages Jimiti and Naniani are located in the Iori watershed.

Signagi Municipality. There two cities and 24 villages in Signagi municipality. These are: 1) C. Sigangi, 2) C. Tsnori; 3) V. Anaga; 4) V. Asanauri; 5) V. Bodbiskhevi; 6) V. Vakiri; 7) V. Zemo Vakiri; 8) V. Zemo Bodbe; 9) Zemo Magaro; 10) V. Kvenakeli; 11) V. Mashnaari; 12) V. Nukriani; 13) V. Prasiani; 14) V. Sakobo, 15) V. Tibaani, 16) V. Ulianovka; 17) V. Phaniani; 18) V. Kedeli; 19) V. Kvemo Bodbe; 20) V. Kvemo Magaro; 21) V. Kvemo Machkhaani; 22) V. Karaji; 23) V. Dzveli Anaga; 24) V. Chotori; 25) V. Khirsa; 26) V. Jugaani. Out of these settlements, villages Zemo and Kvemo Bodbe, Ulianovka and Chotori are located in the Iori watershed part of the municipality

[28] Total population size of Omalo community is about 90 persons. In hydrological terms, Omalo community does not belong to the Alazani watershed, given two rivers Pirikita and Gometseri Alazanis separately flow into the Caspian Sea. However, the area in part of the Akhmeta municipalities and can be considered as part of the Alazani watershed in administrative terms

Kvareli Municipality. There are 11 territorial units in kvareli municipalities, including 1 city Kvareil, 5 communities and 5 villages. These are: 1) C. Kvareli; 2) V. Mtisdziri; 3) V. Balgojiani; 4) Akhalsophei community; 5) Chikaani community; 6) V. Gavazi; 7) V. Kuchatani; 8) V. Shilda; 9) V. Eniseli; 10) Sabuia Community 11) Gremi community.

Lagodekhi Municipality. There are 15 territorial units in Lagodekhi municipality, including 1 city and 14 communities covering 68 villages. These are: 1) C. Lagodekhi; 2) Matsimi community – villages: Matsimi and Rachisubani; 3) Shroma community – villages: Shroma and Kavshiri; 3) Ninigori community – villages: Ninigori, Gelati, Ganatleba, Khiza, Khizabavra, Zemo Gurgeniani and Kvemo Gurgeniani; 4) Tsodniskari community – villages: Tsodniskari, Sheerteba, Svobodnoye, Tsiflistskaro, Chaduniani and Tela; 5) Vardisubani community – villages: Vardisubani, Svideba, Mshvidobiani and Sakobo; 6) Chiauri community – villages: Chiauri, Tsiteli Gori, Heretiskari and Tamariani; 7) Kartubani community – villages: kartubani, Bolokiani, Natsiskvilari and Naindrovali; 8) Baisubani community – villages: Baisubani, Zemo Mskhalgori, Kvemo Mskhalgori and Patara Gori; 9) Kabali community – villages: Kabali, Ganjali, UzunTala and Karajala; 10) Phona community – villages: Zemo Phona, Kvemo Phona, Zemo Khechili, Kvemo Khechili and Dona; 11) Giorgeti community – villages: Giorgeti, Verkhvismindori, Pichkhibogiri, Lapniani and Gujareti; 12) Apheni communti – villages: Apheni, Phodaani, Bagdati, Onanauri, Chabukiani, Zemo Nashovari, Kvemo Nashovari and Gvimriani; 13) Areshperani community – villages: Areshperani, Kevkhiani, Khoshotiani, Zemo Bolkvi and Kvemo Bolkvi; 14) Leliani community – villages: Leliani, Baburiani, Balta, Kalkva, Namesrali, Mirskiseuli and Meore Leliani.

Dedoplistskaro Municipality. Dedoplistskaro municipalities consists of 1 city – Dedoplistskaro, 1 town - Mirzaani and 14 villages: Arboshiki, Arkhiloskalo, Gamarjveba, Zemo Machkhaani, Zemo kedi, Mirzaani, Natsariani, Ozaani, Patara Shiraki, Shiraki, Sabatlo, Samtatskaro, Phirosmani, Kvemo Kedi and Japharidze. Out of these settlements, only town Mirzaani is located in the Iori watershed part of the municipality, while the village Gamarjveba is located on the border of two watersheds.

3.3.2 Local Territorial Units in the Iori River Basin

Mtskheta-Mtianeti Region

Tianeti Municipality. There are 12 communities, including 2 towns and 84 villages in the Tianeti municipality. These are as follows: 1) Tianeti community – T. Tianeti and villages: Churchelaurebi, Mamadaanebi, Sachure and Tetrakheva; 2) Sioni community – T. Sioni and villages: Orkhevi, sajinibo, Badaani, Bochorma, Omaraani, Pichviani, Khudro and Grdzelvelebi; 3) Artani communiti – villages: Zemo Artani, Kvemo Artani, Bodakheva, Duluzaurebi, Tetraulebi, Kvernaula, Lishi, Sakhevi, Skhlovani, Kushkhevi; 4) Akhalsopheili community – villages: Akhalsopheli, Chabano, Gojiaanebi, Chiaura, Khaisho and Katsalo; 5) Zaridzeebi community – villages: Zaridzeebi, Butkchkinta, Verkhveli, Zemo Sharakhevi, Kvemo Sharakhevi, Zenamkhari, Iarajuebi, Ivliaantgoti, Lakhato, Sakrechio, Khoptsa and Jijieti; 6) Nakalakari community – villages: Nakalakari, Kvemo Nakalakari, Vedzatkheva, Doreulebi, Betsentsurebi, Magraneti and Zurabebi; 7) Djebota community – villages: Djebota, Tegeraanebi, Dzebianurebi, Lelovani and Tkhila; 8) Simoniantskhevi community – villages: Simoniantkhevi, Gorana, Nadokra, Tolenji, Meliaskhevi, Tsalugelaantkari and Chitaurebi; 9) Tushurebi communiti – villages: Tushurebi, Kakhoiani, Alachani, Tsikvliaantkari, Dzedrvalidzeebi; 10) Gulelebi community – villages: Gulelebi, Balebiskhevi, Tskarotubani, Tolaantsopheli, Trani, Siontgori, Khadoelebi, Kvernaula, Kviriaskhevi, Gudanebi and Tokholcha; 11) Chekuraantgori community – villages: Chekuraantgori, Aloti, Bokoni, Evjenti, Velebi and Dzirkhvnianebi; 12) Khevsurtsophei communiti – villages: Khevsurtsopheli, Sakrdrioni and Devenaantkhevi[29] (for the map of local territorial units of the Iori river basin please refer to annex 11).

Kakheti Region

Sagarejo Municipality. There are 26 territorial units, including 1 city and 24 villages in the Sagarejo municipality. There are 1)V. Kochbaani, 2) V. Gombori; 3) V. Ujarma; 4) V. Khashmi; 5) V. Patardzeuli; 6) V. Krasnagorka: 7) V. Ninotsminda; 8) C. Sagarejo; 9) V. Giorgitsminda; 10) V. Tokhliauri; 11) V. Manavi; 13) V. Didi Chailuri; 14) V. Kakabeti; 15) V. Kandaura; 16) V. Bogdanovka; 17) V. Shibliani; 18) V. Duzagrama; 19) V. Iormuganlo; 20) V. Lambalo; 21) V. Tulari; 22) V. Udabno; 23) V. Badiauri; 24) V. Verkhviani; 25) V. Patara Chailuri; 26) V. Tskarostavi

Gurjaani municipality. Kachreti community and villages Jimiti and Naniani belong to the Iori watershed part of the Gurjaani municipality. The village Chalaubani is located on the border between Alazani and Iori watersheds.

Signagi municipality. Iori river basin part of Signagi municipality encompasses villages Zemo and Kvemo Bodbe, Ulianovka and Chotori.

Dedoplistskaro municipality. Town Mirzaani is located in the Iori watershed part of Dedoplistskaro municipality and the village Gamarjveba – on the border of Iori and Alazani watersheds.

Kvemo Kartli Region

Gardabani Municipality. There are 17 territorial units in Gardabani municipality, including 1 city Gardabani, 2 towns and 14 village communities with 39 villages. However, only Sartichala community with around 10,500 inhebitants is covered by the Iori River Basin.

3.3.3 Territorial Units of Municipalities in the Rioni River Basin

Racha-Lechkhumi and Kvemo Svaneti Region

Ambrolauri Municipality. Ambrolauri municipality is divided into 19 territorial units, including 1 city and 18 communities with 69 villages. These are as follows: 1) Bugeuli community – villages: Bugeuli, Abanoetu, Bareuli, Gorisubani, Kedisubani and Jvarisa; 2) Velevi community – villages: Betlevi, Velevi, Kviriketsminda and Shkhivana; 3) Znakva community – villages: Znakva, Mtkiari and Saketsia; 4) Itsi community – villages: Akhalsopheli, Gori, Krikhi, Kvemo Krikhi, Shua Krikhi and Itsa; 5) Likheti community – villages: Abari, Likheti and Uravi; 6) Namanevi community – villages: Shavra, Tkhmori, Namanevi and Khonchiori; 7) Nikortsminda community – villages: Kachaeti, Nikortsminda and Kharistvali; 8) Sadmeli community – villages: Bostana, Kldisubani, Sadmeli, Gviara and Dzirageuli; 9) Skhvavi community – villages: Skhvava and Putieti; 10) Gadishi community – villages: Baji, Pataraoni, Tbeti, Kveda Shavra and Gadisha; 11) Tsakhi community – villages: Gogoleti, Zeda Gvardia, kveda Gvardia, Tsakhi; 12) Tsesi community – villages: Mukhli and Tsesi; 13) Cheliagele community – villages: Agara, Zeda Tlugi, Ukeshi, Kveda Tlugi and Cheliagele; 14) Chrebalo community – villages: Gendushi, Zemo Djokhra, Kvemo Djokhra and Chrebalo; 15) Tchvishi community –

[29] Kakheti territorial units are covered by part 3.2.2

villages: Zeda Tchvishi, Kvishari and Tchvishi; 16) Khvanchkara community – villages: Didi Chorjo, Patara Chorjo, Meore Tola, Pirveli Tola and Khvanchkara; 17) Khidikasri community – villages: Kvatskhuti and Khimshi; 18) Khotevi community – villages: Skhartali, Tskadisi and Khotevi; 19) C. Ambrolauri (for the map of the local territorial units of the Rioni Basin please refer to the annex 11).

Oni Municipality. Oni Municipality is divided into 15 territorial units, including 1 city and 14 communities with 69 villages. These are as follows: 1) C. Oni; 2) Gebi community – villages: Gebi, Patara Gebi and Gona; 2) Chiora community – villages: Chiora; 3) Glola community – villages: Glola; 4) Utsera community – villages: Utsera, Nigavzebi, Paravneshi and Nakieti; Gomi community – villages: Gomi and Jinchvisi; 5) Sakao community –villages: Khidashlebi, Majieti, Bortso and Lagvanta; 6) Gari community – villages: Gari and Tsmendauri; Sheubani community – villages: Sheubani, Lachta, Tchala, Khureti, Nigvznara, Khirkhonisi, Kristesi, Komandeli, Skhieri and Tsola; 7) Pipileti community – villages: Pipileti, Djashkva, Onchevi, Somitsi and Sorgiti; 8) Tskhomisi community – villages: Tskhomi, Bajikhevi, Ghunda, Psori; 9) Tsedisi community – villages: Tsedisi, Kvedi, Iri and Skhanari; 10) Kvashkhieti community – villages: Khvashkhieti, Zudali, Shromis Ubani, Kheiti, Bokva, KorTa and Zvareti; 11) Parakheti community – villages: Parakheti, Tchibrevi, Sharometi, Seva and Akhali Chordi; 12) Sori community – villages: Sori, Gadamshi and Tchvebari; 13) Bari community – viillages: Zem Bari, Qvemo Bari and Samtisi; 14) Shkmeri community –villages: Shkmeri, Usholta and Kharistvali; 15) V. Mravaldzali.

Tsageri Municipality. There are 19 territorial units in the Tsageri municipality, including 1 city and 18 communities with 58 villages. These are: 1) Tvishi community – villages: Tvishi, Orkhvi, Lakhepha and Qorenishi; 2) Alpana community – villages: Alpana, Adjara, Zogishi and Tsagera; 3) Sairme community – villages: Kveda Sairme and Zeda Sairme; 4) Gvirishi community – villages: Kveda Gvirishi, Zeda Gvirishi, Utskheni, Nasperi and Sanorchi; 5) Nakuragushi community – villages: Tskhukusheri and Nakuragushi; 6) Usakhelo community – villages: Usakhelo and Khoji; 7) Lailashi community – villages: Lailashi, Tabori, Gu and Surmushi; 8) Spatagori community –villages: Spatagori, Gatsoria and Gushkeda; 9) Orbeli community – villages: Orbeli, Ghadjana, Qurtsobi, Tsilamieri and Gagulechi; 10) Chkhuteli communtiy – villages: Chkhutela, Laskhana and Dogurashi; 11) c. Tsageri; 12) Lasuriashi communty – villages: Lasuriashi, Makhashi, Dekhviri and Lesindi; 13) Agvi community – villages: Zeda Agvi, Shua Agvi, Kveda Agvi and Kenashi; 14) Okureshi community – villages: Okureshi and Opitara; 15) Zubi community –villages: Zubi, Isunderi and Makhura; 16) Tsiperchi community – villages: Tsipherchi, Bardnala, Larchvali; 17) Chkmuri community – villages: Chkmuri and Qulabi; 18) Lukhvano community – villages: Zeda Lukhvano, Kveda Lukhvano and Zaragula; 19) Kveda Tsageri community – villages: Kveda Tsageri, Tchalistavi and Gveso.

Lentekhi Municipality. There are following territorial units in lentekhi municipality: 1) T. Lentekhi territorial unit - villages: Leksura, Babili, Gulida, Kakhura, Matskhvargamezuri, Melura and Kharishi; 2) Rtskhmeluri community – villages: Rtskhmeluri, Gvimbrala, Lagarvashi, Nagomari and Khvedrishi; 3) Khopuri community – villages: Khopuri, Mazashi, Nanari, Tsiplvkakia, Lamanashuri; 4) Kheludi community – villages: Kheludi, Bavari, Lesema, Mananauri, Pakhi, Tsanasi, Khacheshi and Tskhumaldi; 5) Choluri community – villages: Tekali, Choluri, Durashi, Mami, Mutdi, Skdari, Tvibi, Panaga, Shtvili, Tchvelieri and Tchvelvi; 6) Djakhundi community – villages: Djakhundi, Lampalashi, Lekosandi, Lemzagori, Luji, Mebetsi, Sasashi, Chukuli and Kheria; 7) Chikhareshi community – villages: Chikhareshi, Akhalshein, Margvishi, Makhashi, Melu, Natsuli, Shkedi and Gobi; 8) Tsana community – villages: Tsana, Zeskho and Khoruldashi.

Imereti Region

Tkibuli Municipality. Tkibuli municipality is divided into 9 territorial units, including 1 city, 7 communities with 46villages and 1 village as a separate unit. There are as follows: 1) Orpiri community – villages: Orpiri, Zeda Tchkhephi, Koka, Laphaneti, Mandikori, Naboslevi, Mukhura, Okhomira, Kveda Tchkhephi and Shukheri; 2) Gurna community – villages: Gurna, Antoria, Boboti, Kitkhiji, Kisoreti, Koreeti, Nadzva and Tsikhia; 3) Khresili community – villages: Khresili, Akhaldaba, Bueti and Gadagma Tskaltsitela, Gadmogma Tskaltsitela, Ivaneuli, Legva, Dzukhnuri; 4) Jvarisa community – villages: Jvarisa, Lashia, Lekereti, Ojola and Khorchana; 5) Sochkheti community – villages: Sochkheti, Dzmuisi, Tsutskhvati and Tsknori ; 6) Kursebi community – villages: Kursebi, Gelati and Motsameta ; 7) Satsire community – villages: Satsire, Akhalsopheli, Bziauri, Dabadzveli, Zedubani, Samtredia and Dzirovani; 8) V. Mukhuri; 9) c. Tkibuli territorial unit.

Chiatura Municipality. Chiatura Municipality is divided into 14 territorial units, includuding 1 city, 3 villages and 10 village communities with 59 villages. Of all territorial units, two are larger groups of villages consisting of two village communities each. The territorial units are as follows: 1) C. Chiatura; 2) Kvartsikhe community – villages: Kvartsikhe, Sakurtse, Biga and Rtskhila; 3) Katskhi community – villages: Katskhi, Navardzeti, Salieti, Mrdzgveti, Didi Katskhi, Etseri and Jokhoeti; 4) Vatchevi community – villages: Vatchevi, Gvitouri, Melusheeti, Jolkheeti; 5) V. Rgani; 6) V. Khreiti; 7) SarkveleTubani territorial unit: i) Sarkveletubani community – villages: Sarkveletubani, Bunikauri, Tabagrebi, Zeda Rgani; ii) Tsirkvali community – villages: Tsirkvali, Khalipauri, Mgvimeebi, Kveda Tchalovani; 8) Khvashiti territorial unit: i) Khvashiti community – villages: Khvashiti, Zeda Tchalovani, kvakhajeleti, Vakevisa and Vani; ii) Zodi community – villages: Zodi, Darkveti, Zedubani and MokhoroTubani; 9) Perevisa community – villages: Perevisa, Shkruti, Kalauri, Skindori, Tchilovani and Tsinsopeli; 10) Itkhvili community – villages: Itkhvisi, Bdjinevi and Begiauri; 11) Nigozeti community – villages: Nigozeti, Kveda Beretisa, Zeda Beretisa, Usakhelo, Gundaeti, Merevi, Tsasri and Tskalshavi; 12) Mandaeti community – villages: Mandaeti, Tkemlovana, Mechkheturi, Kbilariu and Tchkhrauli; 13) Sveri community – villages: Sveri, Tvaleti and Tskuukveti; 14) V. Gezruli.

Sachkhere Municipality. There are 13 territorial units in Sachkhere municipality, including 1 city, 1 village and 11 communities with 48 villages. These are as follows: Korbouli community – villages: Korbouli, Shmakheti, Nigvzara; 2) Sareki community – villages: Sareki, Bajiti and KvemoKhevi; 3) Tskhomareti community – villages: Tskhomareti, Mokhva; 4) Chikhi community – villages: Skhvitori, Chikha, Zeda Orguli and Dunta; 5) Tchala communty – villages: Tchala, Gona, Speti, Darkha, Drbo, Kokhia, Perevi, Jvria, Zeda Kardzmani, Tchurnali, Sinaguri, Jalabeti, Tbeti, Khakhieti and Tedeleti; 6) Argveti community – villages: Argveti, Savane, Makhaturi, Itskisi, Shalauri, Bakhioti, Itavaza and Tskhami; 7) Gorisa community – villages: Gorisa and Gamogma Argveti; 8) Sairkhe community – villages: Sairkhe, Tchorvila, Kalvata; 9) V. Koreti; 10) Jalaurta community – villages: Jalaurta and Modzvi; 11) Merjevi community – villages: Merjevi and Ivanstminda; 12) Tchalovani community – villages: Tchalovani, Khvani, Lichi, godora and Vakisa; 13) C. Sachkhere.

Tskaltubo Municipality. Tskaltubo municipality is divided into 17 territorial units, including 1 city, 4 villages and 12 communities with 46 villages. The given territorial units are as follows: 1) C. Tskaltubo; 2) V. Geguti; 3) Gvishtibiti community – villages: Gvishtibiti, Gubistskali, Ternali, Pirveli Tsaltubo; 4) Gumbra community – villages: Gumbra, Banoja and Khomuli; 5) Dgnorisa community – villages: Dgnorisa, Sachkheuri, Lekhindristavi and Tchashleti; 6) Maglaki community – villages: Maglaki and Mitsatsiteli; 7) Mekvena community – villages: Mekvena, Vanistchala, Derchi, Bentkoula, Kveda Ontcheishi and Zeda Ontcheishi; 8) Mukhiani community – villages: Mukhiani, Kveda Meskheti and Ukaneti; 9) Opurchkheti community – villages: Opurchkheti, Jimastaro, Gumati, Djoneti and Namokhvani; 10) V. Opshkviti; 11) Patriketi community – villages: Patriketi and Tkhachiri; 12) Rioni community – villages: Rioni, Zarati, Metchkheri, Kudoti, Sormoni, Tcholevi and Noga; 13) V. Sakulia; 14) V. Partskanakanevi; 15) Kvitiri community – villages: Kvitiri and Zeda Meskheti; 16) Tskhunkuri community – villages: Tskhunkuri, Khumistavi, Chuneti and Besiauri; 17) Tskaltubo community – villages: Tsaltubo, Kvilishori and Chuneti.

Khoni Municipality. There are 12 territorial units in the Khoni municipality, including 1 city, 2 villages and 9 communities with 36 villages. These are as follows: 1) C. Khoni; 2) Gordi community – villages: Kveda Gordi, Bangveti, Gamogma Noga, Gama Noga, Zeda Gordi; 3) V. Vandidi; 4) Kutiri community – villages: Kutiri, Gvazauri, Patara Jikhaishi ; 5) V. Gocha-Jikhaishi; 6) Gubistemi community – villages: Didi Gubi, Shua Gubi, Patara Gubi; 7) Kukhi community – villages: Didi Kukhi, Akhalsheni, Patara Kukhi; 8) Nakhakhulevi community – villages: Nakhakhulevi, Akhalbediseuli, Kontuati, Satsulukidzeo, Udzlouri; 9) Matkhoji community – villages: Matkhoji, Lepilie, Khidi 10) Dedalauri community – villages: Dedalauri, Besiauri, Chuneshi and Kharabauli; 11) Dzedzileti community – villages: Dzedzileti, Gelaverdi, Gvashtibi, Oragveti and Gvedi; 12) Kinchkhi community – villages: Kveda Kinchkhi, Zeda Kinchkhi, Kinchkhaferdi, Rondishi and Satsiskvilo;

Terjola Municipality. There are 18 territorial units in the Terjola municipality, including 1 city, 5 villages and 12 communities with 40 villages. These are as follows: 1) C. Terjola; 2) Alisubani community – villages: Zeda Alisubani, Zarnadzeebi, Tkhiltatskaro, Machitauri and Kveda Alisubani; 3) Bardubani community – villages: Bardubani and Satemo; 4) Godogani community – villages: Godogani, Broliskedi, Tchalastavi and Nagarevi; 5) Etseri community – villages: Etseri, Akhalubani; 6) Chkhari community – villages: Chkhari and Oktomberi; 6) Dzevri community – villages: Dzevri, Okona and Separeti; 7) Zeda Sazano community – villages: Zeda Sazano, Deltasubani, Mujireti, Skande, Shimshilakedi, Chikhori; 8) Tuzi community – villages: Tuzi, Vardigora, Tavasa, Kakabauri, Jgilati; 9) Kvakhchiri community – villages: Kvakhchiri, Odilauri and Sarbevi; 10) Nakhshirgele community – villages: Nakhshirgele and Navenakhevi; 11) Siktarqva communti – villages: Siktarqva, Chkhar-Etseri; 12) Akhali Terjola community – villages: Akhali Terjola and Boselia; 13) Rupoti community – villages: Rupoti and Telepha; 14) V. Gvankiti; 15) V. Gogni; 16) V. Tchognari; 17) V. Zeda Simoneti; 18) V. Kveda Simoneti.

Zestaphoni Municipality. These are as follows: 1) C. Zestaphoni ; 2) T. Shorapani ; 3) Dzirula community – villages: Dzirula, Didi Gantiani, Patara Sameba, Adjara, Vashpariani, Leladziseuli, Gverki, Kveda Tseva and Zeda Tseva; 4) V. Pirveli Sviri; 5) Meore Sviri community – villages: Meore Sviri and Sadguri Sviri; 6) Kvaliti community – villages: Kveda kvaliti and Shua Kvaliti; 7) Tskhratskaro community – villages: Tskratskaro, Dzlourdaneti, Kvaliti; 8) Kldeti community – villages: Kveda Kldeti, Zeda Kldeti, Tabakini, Kinoti, Alaverdi, Mtskeritsike and Tvrini; 9) V. Futi; 10) Ilemi community – villages: Kveda Ilemi and Zeda Ilemi; 11) Rodinauli community – villages: Rodinauli, Svetmagali, Tskhentaro and Ajameti; 12) Sanakhshire community – villages: Sanakhshire, Sagvine, Martotubani, Zeda Tsiplavake, Kveda Tsiplavake; 13) Zeda Sakara community – villages: Zeda Saqara and Beglevi; 14) Kveda Saqara community – villages: Kveda Saqara, Tchaltke and Argveta; 15) Dilikauri community – villages: Dilikauri and Qveletubani; 16) Boslevi community – villages: Gagma Boslevi, Gamogma Boslevi, Boslevi, Marjvena Rkvia, Martskhena Rkvia, Didtsiphela and Beglevi; 17) Kveda Sazano community – villages: Kveda Sazano, Tklapi-Vake, Shimshilakedi and Sasakhle; 18) V. Zovreti; 19) Shrosha community – villages: Shrosha, Satsumbo, Amsaisi and Satsable.

Kharagauli Municipality. There are 19 territorial units in the Kharaguali municipalities, including 1 town, 3 villages and 15 communities with 74 villages. These are as follows: 1) T. Kharagauli; 2) Bazaleti community – villages: Bazaleti, Garikhevi, Kroli and Tsipi; 3) Boriti community – villages: Boriti, Saqasria, Makatubani, Ubisa, Ereta, Vashlevi, Kvesrevi, Amashuketi; 4) V. Vardzia; 5) Vakhani community – villages: Vakhani, Serbaisi, Zedaubani; 6) Zvare community – villages: Zvare, Chrdili and Nunisi; 7) Kitskhi cummunity – villages: Kitskhi, Bori, Saqarikedi, Kitskhis Igoreti, Tetritskaro; 8) Legvani community – villages: Legvani, Marelisi, Didvake, Patara Sakhvlari; 8) Lashe community – villages: Lashe, Lashis Igoreti, Uchameti, Gverki, Khemagali; 9) Moliti community – villages: Moliti, Deisi, Bejatubani, Tchartali, Nebodziri, Kvebi, Babi, Aniula; 10) Nadaburi community – villages: Nadaburi and Golisi; 11) Sargveshi community – villages: Sargveshi, Khoriti, Sabe, Mirotsminda; 12) Sagandzie community – villages: Sagandzie, Zarani, Japarouli, Skhliti, Chkheri and Vani; 13) Partsknali community – villages: Partkhnali, Akhalsopeli, Islari and Gudumekedi; 14) V. Khidari; 15) Tskakapoteti community – villages: Tskhalaphoreti, Khoni, Lakhundara, Patara Vardzia, Chalkhaeti; 16) Tsiphi community – villages: Tsipha, Golatubani, Gudatubani, Phona; 17) V. Goreshi; 18) Khunevi community – villages: Khunevi, Gedsamania, Vertkvitchala, Bdjinevi, Vertkvila; 19) Khevi community – villages: Khevi, Tsakva, Grigalati, Tsitskiuri.

Bagdati Municipality. There are 12 territorial units in Bagdati municipality, including 1 city, 6 villages and 5 communities consisting of 16 villages. These are as follows: 1) C. Bagdati; 2) Persati community – villages: Persati and Shubani; 3) V. Saimedo Dimi; 4) V. Tsitelkhevi; 5) V. Rokhi; 6) Nergeeti community – villages: Nergeeti, Tsablaraskhevi, Alismereti, Dapenili, Tskalshua, Zeda Dimi; 7) V. Pirveli Obcha; 8) V. Meore Obcha; 8) Rokiti community – villages: Rokiti and Didvela; 9) V. Vartsikhe; 10) Zegani community – villages: Zeda Zegani, Kveda Zegani and Nebieriti; 11) V. Sakraula; 12) Khani community – villages: Khani, Kakaskhidi and Zekari.

Vani Municipality. There are 21 territorial units in Vani community, including 1 city, 3 villages and 17 communities consisting of 38 villages. These are as follows: 1) C. Vani; 2) V. Tsikhesulori; 3) Shuamta community – villages: Shuamta and Tchvishi; 4) Mtisdziri community – villages: Mtisdziri and Tsagan-Tchkvishi; 5) Mukedi community – villages: Mekedi and Zeda Mukedi; 6) Tobanieri community – villages: Tobanieri, Zeda-Etser Tobanieri, Kshubouri, Mikelephoni; 7) Kumuri community – villages: Kumuri, Maisouri, Dutskhuni; 8) Zeda Vani community – villages: Zeda Vani and Tkhenvali; 9) Gadidi community – villages: Gadidi and Onjokheti; 10) Salkhino community – villages: Salkhino, Zenobani; 11) Dikhashkho community – villages: Dikhashkho, Isriti and Tsikhisubani; 12) V. Sulori 13) V. Dzulukhi; 14) Bzvani community – villages: Kveda Bzvani and Zeda Bzvani; 15) Amagleba community – villages: Amagleba and Inashauri; 16) Zeindari community – villages: Zeindari and Shuagora; 17) Salominao community – villages: Salominao and Bagineti; 18) Pereta community – villages: Pereta and Baboti; 19) Gora community – villages: Gora and Zedagora; 20) Saprasia community –villages: Saprasia and Romaneti; 21) Ukhuti community – villages: Ukhuti, Imerukhuti.

Samtredia Municipality. There are 14 territorial units in Samtredia Municipality, including 1 city, 1 separate village and 13 communities with 51 villages and 1 town. These are: 1) C. Samtredia; 2) Bashi community – villages: Shua Bashi, Zeda Bashi, Meore Etserbashi, Pirveli Etserbashi, Kveda Bashi; 3) Gamochinebuli community – villages: Zemo Abasha, Kvemo Abasha; 4) Gomi community – villages: Dablagomi, Gommukhakrua, Gomnatekhebi Dapnari, Dobiro, Zeda Etseri, Ketilauri, Kvirike, Mtisdziri, Kveda Etseri, Tsivtskala; 5) Gormagali community – villages: Gormagali and Qvakhude; 6) V. Didi Jikhaishi; 7) Etseri community: Patara Etseri, Akhalsopeli, Gvimrala, Ketchinari, Otchofa, Jiktubani; 8) Ianeti community: V. Ianeti and settlent Kopitnari; 9) Melauri community – villages: Melauri, Mitsabogira and Khiblari; 10) Nabakevi community – villages: Nabakevi, Kvirike, Chkhenishi, Khunjulauri and Ninuakukhe; 11) Opheti community – villages: Didi Opheti, Tkhilagani, Mterchveuli, Natsilopheti; Patara Opheti and Tsiagubani; 12) Sajavakho community – villages: Sajavakho, Nigorzgva and Tchognari; 13) Tolebi community – villages:

Tolebi, Bugnara, Vazisubani, Zemo Noga, Kvemo Noga, Qoreis Ubani; 14) Ganiri community – villages: Ganiri and Tchagati.

Samegrelo-Zemo Svaneti

Martvili Municipality. There are 20 territorial units in Martvili municipality, including 1 city, 1 village and 18 communities. These are: 1) C. Martvili, 2) Abedati community – villages: Abedati, Lemikave, Leqajie and Jolevi; 3) Bandza community – villages: Bandza, Kevakhene, Lekekele and Leparatave; 4) Gachedili community – villages: Gachedili, Meore Balda, Mesame Balda, Patara Tamakoni, Pirveli Balda and Skurdi; 5) Gurdzemi community – villages: Pirveli Gurdzemi, Meore Gurdzemi and Nakhurtsilavo; 6) Didi Tchkoni community – villages: Didi Tchkoni, Ledgebe, Namikolavo Meore, Oche and Jinota; 7) Vedidkari community – villages: Vedidkari, Lepotchkhue, Makhati, Mukhucha and Orqa; 8) Kitsia community – villages: Pirveli Kitsia, Alerti, Meore Kitsia, Noga; 9) Najakhao community – villages: Najakhao, Nageberao; 10) V. Onogia; 11) Salkhino community - villages: Salkhino, Vakha, Legulordave, Leskhulukhe, Letsave, Patara Jinoti, Tsachkhuri; 12) Sergieti community – villages: Sergieti, Boboti; 13) Taleri community – villages: Taleri, Etseri, Nobulevi and Patara Oche; 14) Tamakoni community – villages: Tamakoni, Targameuli, Namokolovo Pirveli; 15) Nagvazao community – villages: Zemo Nagvazavo; Lekvantalie, Kvemo Nagvazavo; 16) Inchkhuri community – villages: Didi Inchkhuti, Lebache, Patara Inckhuri; 16) Lekhaindrao community – villages: Lekhaindravo, Nojikhevi, Stephasdabali; 17) Doshakhe community – villages: Doshakhe, Lejvanie, Lekobalie; 18) Khuntsa community – villages: Kvemo Khuntsi, Zemo Khuntsi and Letsitskhvie; 19) Nakhunao community – villages: Nakhunavo, Tsinakverkve, Tchaburta; 20) Kurzu community – villages: Kurzu, Godogani, Doberazeni, Dgvana, Saberulavo, Sanachkhebio. Of above settlements, Doshakhe community with three villages, is not located in the Rioni River Basin. It belongs to the Enguri River Basin.

Senaki municipality. These are 16 territorial units in Senaki municipality, including 1 city, 1 village and 14 communities with 60 villages. These are as follows: 1) C. Senaki; 2) Akhalsopheli community – villages: Akhalsopheli, Isula; 3) V. Gejeti; 4) Eki community – villages: Eki, Saadamio, Sagunio, Satskhitao; 5) Zana community – villages: Zana, Etseri, Saesebuo, Satkebuchavo, Sashurgaio; 6) Zemo Chaldidi community – villages: Mukhuri, Sagvichio, Siriachkoni; 7) Teklati community – Teklati, Golaskuri, Sagvaramio, Tkiri, Reka; 8) Ledzazame community – villages: Ledzazame, Betlemi, Zeda Nakalakevi, Kvauti, Legogie, Lesajie; Jolevi; 9) Menji community – villages: Bataria, Sagabeskirio, Satsuleiskirio, Sakharbedio, Skuria, Pertuli; 11) Nosiri community – villages: Shua Nosiri, Nosiri, Sabeslio, Sakilasonio, Saodishario; 12) Nokalakevi community – villages: Jikha, Gakhomelia, LebagaTure; Dzigideri; 13) Ushapati community – villages: Ushapati, Legogie, Lekokaie; 14) Potskho community – villages: Postkho, Legogie-Nasaju, Meore Mokhashi, Mokhashi; 15) Dzveli Senaki community – villages: Dzveli Senaki, Zeda Sorta, Kvarchigali, Kotianeti, Pirveli Nosiri, Sachikobavo, Kveda Sorta; 16) Khorshi community – Shua Khorshi, Didi Khorshi, Patara Zana, Saadanaio, Sagugunavo, Tsizeti.

Among above settlements, border between Rioni and Enguri river basins run through villages Zana, Etseri, Reka and Legogie. All villages listed above belong to the Rioni Basin.

Abasha Municipality. There are 16 territorial units in the Abasha municipality, including 1 city, 2 villages and 13 communities with 37 villages. These are: 1) C. Abasha; 2) Norio community – villages: Norio, Abashispiri, Ganatlebiskari, Sbokuchavo, Sagvazavo; 3) Sujuna community – villages: Sujuna, Meore Etseri, Pirveli Etseri and Tsalikari; 4) Marani community – villages: Marani, Gugunakati, Marantchal; 5) Pirveli Maisi community –

villages: Pirveli Maisi, Gautskinari, Tkhmelari, Qvishnatchala; 6) Kolobani community: Qolobano, Bulvani, Gugunakati, Patara Gezati; 7) Tkviri community – villages: Tkviri, Tsilori; 8) Naesakovo community – villages: Naesakovo, Gamogma Kodori; 9) Ketilari commmunity – villages: Ketilari, Gagma Kodori; 10) Zanati community – villages: Gamogma Zanati, Gagma Zanati; 11) Samiqao community – villages: Samiqao, Maidani;12) Gezati community – villages: Gezati, Gulukheti; 13) V. Dzveli Abasha, 14) Tskemi community – villages: Tskemi and Dziguri; 15) Ontopho community – villages: Pirveli Ontopho, Etseri, Meore Ontopho; 16) V. Sephieti;

Khobi Municipality. Out of 21 territorial units of the Khobi municipalities, only village Patara Photi with about 1900 inhebitants, v. Sagvichio with about 600 inhebitants and village Sakhorkio with over 40 inhebitants and the village Satchotchuo with over 300 inhebitants under the Tchaladidi community belong to the Rioni river basin. They are very close to the Rioni inflow into the Black Sea.

Chkhorotskhu municipality. Only the village Akhuti of the Akhuti community with over 1000 inhebitants is located in the Rioni river Basin.

Guria Region

Chokhatauri municipality. In the Chokhatauri municipality only following settlements are located in the Rioni Basin: Zemo Kheti community covering v. Gantiadi and Gogouri, Kokhnari community: Tkhilagani with about 300 inhebitants, Tsipnari with about 300 inhebitants and Nakaduli with about 200 inhebitants and, Sachamiaseri community with villages Kvemo Kheti, Kalagoni, Mamulari and Chometi with a total of about 1000 inhebitants.

Lanchkhuti Municipality. Rioni Basin boundaries run through very small area of Lanchkuti municipality on its east edge and there is no settlement there.

4.0 PRESSURES AND IMPACTS ON THE NATURAL RESOURCES

4.1 Water Resources

4.1.1 Pressures on Water Quantity

General. The quantity of water in rivers is affect by both anthropogenic and natural factors. Among anthropogenic factors, the most influential are water withdrawals and engineered river diversions and dams, etc. The main natural factors are river basin area and rainfall, which may vary seasonally and across years. Climate change adds additional uncertainty about future flow regimes.

In Georgia, historically, waters of Alazani, Iori and Rioni River Basins have been intensively used for domestic, agriculture, industrial and hydropower generation purposes. One should discern two periods in characterizing the dynamics of water use, Soviet period and post-Soviet period. During the Soviet period (especially the 1970s and 1980s) water uses were high, especially for various economic uses, but after the break-up of the Soviet Union, withdrawals dropped dramatically due to the Overall decline in the Georgian economy. Pressures on rivers of Georgia were reduced at that time. Currently, however, the Georgian economy is gradually recovering, and while its structural composition is far different from that of the Soviet period, economic growth will presumably lead to the increase in water use levels by economic sectors.

Studies show that the climate change has already affected basic climate conditions of Georgia that are the major determinants of the river flow regime. Moreover, climate projections indicate that the pressures from climate change will continue to exist and will result in significant changes in air temperature, precipitation and river run-off. More specifically, findings of the Second National Communication of Georgia under UNFCCC report that in East Georgia, droughts and strong winds have become more frequent and intense, mean annual temperature has increased by 0.5-0.7^{0}C, and precipitation has decreased by 5-10%. In West Georgia, mean annual temperature has increased by 0.2^{0}C -0.4^{0}C and precipitation has decreased by 8-13%. Absolute minimum and maximum temperatures have also demonstrated a tendency towards warming during both summer and winter. Local differences within the West Georgia have also been found. While the annual sums of precipitation demonstrate an overall decreasing tendency in Western Georgia (average value), in Poti (the Black Sea coast) and Lentekhi (mountain zone), a small increase is still observed. With regard to future climate projections, in accordance with regional climate model PRECIS and statistical program MAGICC/SCENGEN, by the end of the 21st century, average annual temperature will increase by 4.1^{0}C and precipitation will decrease by 9-13%, with the highest change expected in summer season. In Western Georgia, a temperature increase of 3.5^{0}C and precipitation decrease of 6% are expected (for more details on climate change pressure and impacts on the ecosystems and resource base of Georgia please refer to annex 14).

Alazani River Basin[30]. In the Alazani River Basin, water resources are used for domestic, irrigation, power generation and industrial purposes. In accordance with 2009[31] data of the Ministry of Environmental Protection and Natural Resources, in total 724.81 mln m^3 water was abstracted from water bodies of the basin, of which 12.36 mln m^3 (~1.7%) was groundwater abstraction and 712.45 (~98.3%) mln m^3 – surface water abstraction. Water was taken from 69 water objects. At present, hydropower is the largest water use sector, followed by the domestic water supply sector. More specifically, in 2009 629.4 mln m^3 was used for power generation, 9.94 mln m^3 – for domestic water supply and 5.87 mln m^3 – for irrigation. Rivers Alazani, Lopota, Bursa and Samkurastskali are used for hydropower generation, groundwater – for water supply and R. Alazani, Stori and Ilto – for irrigation. It is noteworthy to mention that current volumes of water abstractions and consumptions are more than 2.5 times higher relative to late 80s and more than 3.7 times higher relative to 90s and early 2000s. Besides, current water use structure differs from that of 80s, 90s and early 2000s. More specifically, while in 80s, 90s and 2000s the largest share of total water use was accounted to the hydropower sector as it is now, followed by irrigation sector and domestic sector, irrigation sector now contributes the lowest share which is 2.5 times less than that of 90s and 2000s and more than 3 times less than that of 80s.

[30] Since January 2008 water users in Georgia are not required to acquire separate water use permits/licences. However, they are still obliged to fill out forms providing basic information about the use of water resources each year, including information about water user (a physical person or an organization), monthly abstraction amounts, amounts of water intake by types of water use, information on providing abstracted water to other users (if applicable), water discharge (indicating type of treatment before discharging), discharge of contaminants (actual amounts and allowed limits). Water users are reporting the information on source of water abstraction (indicating water body or the other water user from whom the water was received). Distance from river mouth, but not exact geographical coordinates are provided by water users. Each year WRPD produces the set of reports with information on water use from the previous year summarized by administrative municipalities, rivers, types of water use, etc. Water Resources Protection Division of The Ministry of Environment Protection of Georgia collects, stores and analyses information on water use in Georgia. For the purpose of this report we have selected data for 2009 which were the most recent and the most complete.

[31] Data are based on 2009 annual water use statistics of the Ministry of Environment. The data include only those water uses that submitted their reports to the Ministry.

In 2009, the largest water abstraction happened from the R. Alazani amounting to 588.31 mln m^3, of which 577.89 mln m^3 was an abstraction directly from the river Alazani and 10.42 mln m^3 – from Alazani filtrates. Out of this amount, power sector use was the largest among various water uses and amounted to 496.51 mln m3. Industrial water use was minimum and amounted only to 750,000 m^3 in 2009. In total, 56 registered objects abstracted water from the R. Alazani in 2009, including 6 water supply systems, 1 hydropower plant and 1 irrigation system (for more details on water abstractions please refer to tables 1,2 in annex 12).

In terms of geographic distribution of water abstractions, the largest abstractions occurred in the upper reaches of the waters of the Alazani River Basin, in Akhmeta and Telavi municipalities. In 2009, there were 27 registered water users that abstracted 691 mln m3 water from Alazani in the upstream areas, with 688.83 mln m3 surface water and 1.69 mln m3 groundwater abstractions. Major abstractions were made by the irrigation systems with an amount of 463.34 m3. Of this, 4.07 mln m3 water was used by Lopota hydropower systems, 5.84 mln m3 by – irrigation systems themselves, 9.17 mln – by fisheries and 1.16 mln m3 – by drinking water supply systems. A major portion of water abstracted by irrigation systems was transffered to the HPPs located in the middle course for hydropower generation. Hydropower plants themselves abstracted 219.24 m3. Water for domestic use was abstracted mostly from aquifers through the wells. There was also significant abstraction on the river Samkuristskali and the water was used by Khadori HPP in Akmeta municipalities.

In the middle reach of the Alazani covering Gurjaani, Kvareli and Lagodekhi municipalities there were 25 registered water users that abstracted water from Alazani, Bursa, Apheni and Kabali in the total amount of 29.64 mln m3, of which 23.3 mln m3 was the amount of the surface water abstraction to be used for hydropower, fisheries and industrial purposes. Drinking water was abstracted from ground water. Hydropower plants themselves abstracted 21.05 mln m3 from the R. Bursa and 388.92 mln m3 was transferred to them from Lower Alazani Canal.

In the lower reach of the Alazani covering Signagi and Dedoplistskaro municipalities there were 3 registered water users that abstracted 3.9 mln m3 water, primarily for domestic uses from the R. Alazani filtrates through the wells.

Thus, by analyzing above information it can be concluded that the highest pressure on the waters of the Alazani basin are in the upstream areas. The waters of the r. Alazani are the most utilized, followed by the waters of the r. Samkhurastskali. Rivers Bursa and Lopota are also highly utilized. The hydropower sector is the largest water user that receives water from own abstractions as well as through the transfer from irrigation systems.

<u>Iori Basin</u>*.* In the Iori Basin, in accordance with 2009 official data of the Ministry of Environment, water withdrawals were made from the R. Iori and Sioni reservoir. In total, 260.95 mln m3 water was abstracted from natural water bodies, of which 179.68 mln. m3 water was taken from the R. Iori, 2.1 mln. m3 – from Iori filtrates and 78.85 mln. m3 – from the Sioni reservoir. Surface water was abstracted by Upper and Lower Samgori main irrigation canals (“Iori M”, LLC). Out of total amount, only 1.92 mln m3 was used for irrigation purposes and the rest was transferred to the HPPs. Water taken from the Sioni reservoir was used by the Sioni SHPP.

Thus, in the Iori Basin, the major pressure was on the Iori river and the water was mostly used by upstream SHPP, followed by downstream HPPs and irrigation systems irrigating lands of areas of Kvemo Kartli region (for more details please on water abstractions please refer to the tables 3,4 in annex 12).

Rioni River Basin. In the Rioni Basin, water resources are used for domestic, power generation and industrial uses. In accordance with official statistics of the Ministry of Environment, in 2009 total of 16,275.79 mln m^3 water was abstracted in the basin, of which 74.03 mln m^3 water was abstracted from groundwater sources and 16,201.94 mln m^3 – from surface waters (for more details on water abstractions please refer to tables 5,6 in annex 12). Abstractions have been undertaken by 198 registered water users to use water primarily for domestic and power generation purposes. The largest abstractions happened from the R. Rioni amounting to 8,997.34mln m^3, of which 8,950.85 mln m^3 was the amount abstracted from the river Rioni and 46.49 mln m^3 – abstracted from its filtrates. Of total water abstracted, the energy sector consumed 8,950.13mln m^3 and the industry – only 950,000 m^3 of technical water. Total number of registered water users was 52 in 2009, including among others 19 water supply systems, 3 HPPs and 1 irrigation system.

Total of 12.48 mln m3 water was abstracted from the R. Kvirila in 2009. Out of this amount, 6.19mln.m3 was used for domestic consumption and, 5.12 mln m3 – for industrial consumption. There were 49 registered organizations that abstracted water from the river, including 8 water supply systems, 4 manganese extractions and processing companies.

Total of 104.74 mln. m3 water was abstracted from the R. Abasha in 2009, predominately for hydropower generation.

From the reservoirs water abstractions happened primarily for power generation. Three reservoir are used for this purpose: Gumati, Shaori and Tkibuli.

Regarding the water abstractions per geographic locations, they were as follows:

- In the upstream areas of the Basin, where Racha-Lechkhumi and Kvemo Svaneti region is located there were 38 organizations that abstracted water from the rivers: Rioni, Lajanura, Shareula, Ritseula, Tsivi Tskali, Lukhunistskali and Shaori reservoir. In total 1,335.09 mln m3 water was abstracted, out of which 1,330.90 mln m3 was abstracted from surface waters. The largest water user was the hydropower sector – 1,329.96 mln m3. Groundwater water abstractions amounted to 14.17 mln m3 used primarily for drinking water purposes.
- In the middle to lower reaches of the River Basin, where Imereti region is located there were 153 registered water abstraction entities abstracting water from the rivers: Rioni, Tskhenistskali, Ogaskura, Tskaltubostkali, Sulori, Kvirila, Khanistskali, Tsablarastskali, Cholaburi, Tkibuli, Skipi, Tskhara, Dzurtsa, Dzirula, Chkherimela, Rikotula, Jruchula and from the reservoirs of Shaori, Gumati and Tkimuli. In 2009, total water abstractions from natural water objects amounted to 1,4826.75 mln.m3, of which water abstractions from surface waters amounted to 1,476.632 mln. m3. Major water users were hydropower and irrigation. Abstractions from groundwater sources amounted to 42.07 mln m3 and the water abstracted from these sources was used primarily for meeting the domestic needs.
- In the middle-low reaches of the Basin, where Samegrelo municipalities: Abasha, Senaki, Martvili, Khobi, Guria and the city of Poti – Rioni river delta area are located water abstractions were carried out by 11 entities in 2009. Total water abstractions amounted to 113.9 mln m3. Out of this amount, 104.5

mln m3 was abstracted from surface waters and 9.43mln m3 – from groundwaters, predominantly for potable water supply.

Thus, by analyzing the 2009 MoE data on water abstractions and uses, it can be concluded that the largest pressures on the waters of the Rioni river Basin have happened in the upper-middle reaches of the basin with water abstractions amounting to 14826.75 mln m3 in Imereti region and 1,335.09 mln m3 in Racha-Lechkhumi and Kmemo Svaneti regions. Surface waters of the R. Rioni were utilized the most, followed by waters of the R. Abasha. The largest water users, similar to other pilot basins, were the medium to large HPPs and potable water supply systems, followed by the industrial facilities concentrated in Imereti region.

4.1.2 Pressures on Water Quality

Alazani River Basin. The major point sources of pollution within the Alazani basin are domestic sewerage systems. Most of the urban areas are covered by centralized sewerage systems, with little exception. None of the systems covers the entire municipal areas, and on average, their coverage rate does not exceed 50%. Only two municipal systems in the basin cover a maximum of 70–80% of the town. Existing sewerage systems are outdated and their designed capacity is much lower than is required. None of the systems has wastewater treatment plants, except for the city of Telavili. Currently, this plant is non-operational and sewage from urban areas is directly discharged either on agricultural lands or into the River Alazani and tributary rivers. Rural areas are not covered by centralized sewerage systems at all.

As for the industrial wastewater discharges, wastewater loads are significantly reduced compared with those of the Soviet period due much lower number of currently operating enterprises and much lower capacities of these facilities. However, the absence or the obsolescence of wastewater treatment technologies might offset the situation. Unfortunately, the system of effluent monitoring and control is practically absent. Industries are obliged to conduct self-monitoring, which is not done through measurements, but based on calculations using industrial input and output parameters. Nor does an environmental inspectorate measures effluent discharges. Therefore, data on effluent discharges are very approximate and are derived from technological parameters. In accordance with estimates, in recent years major pollutants of the Alazani river are BOD, suspended solid and oil products discharged by domestic sewage, urban and agriculture run-off.

At present, food production and processing is a leading branch of the industry in Kakheti region, with wine production contributing over 75% to the total food production. More than 50 wine factories are located in the middle part of the Alazani basin. Wastewater with high BOD content as result of dissolution of natural sugars in the water is discharged into Alazani canal and Alazani tributaries. In Gurjaani, Telavi and Kvareli there is a production of Brandy. Grains and flower production is another type of food production industry in the region. In the past, the absolute majority of such industries had mechanical and biological wastewater treatment plants, which currently do not work and as a result, the wastewater from wine factories is discharged directly to the river/storm water channels/municipal sewerage systems, or directly to the ground surface. As for the mini factories of lemonade and creameries, their designed capacity is very low and they are mostly located in private houses. Hence, wastewater is discharged into the sewerage systems of municipalities or in the nearest storm water channels.

Regarding the non-food industries, a number of wood processing industries operate in Telavi producing parquet and furniture as well as in Akhmenta. There are also small metal processing, plastic and glass industries. Mining industries that are also sources of pollution are considered in detail below.

In total, 646 mln m3 wastwater was dischaged into the water bodies of the Alazani river basin in 2009, of which 629.21 mln m3 was clean water discharged by the hydropower sector and 11.58 mln m3 – untreated wastewater (for more details on wastewater discharges please refer to tables 7 and 8 in annex 12).

In the upstream sections of the basin, wastewaters were discharged by 38 registered water users primarily, in the rivers: Alazani, Matsantsara, Turdo, Kisiskhevi, Samkuristskali, Stori, Duruji, Ilto, Didkhevi and Lopota. In total 226.54 mln m3 wastewater was discharged in both surface waters and the relief. Discharges into the surface waters amounted to 225.21 mln. m3, of which clean wastewater was 219.24 mln m3, untreated wastewater – 7.27 mln m3 and mechanically treated wastewater – 20.23 thousand m3. The largest amount of wastewaters was discharged by hydropower plants (219.21 mln m3), followed by industrial facilities (6.36 mln m3). Sewage amount was the smallest (959 thousand m3).

In the middle reaches of the Alazani river basin wastewaters were discharged by 31 registered water users predominantely into the rivers Alazani, Instoba, Avaniskhevi, Buyrsa, Chagurgula, Ulgansu, Lagodekhistskali, Tschartliskhevi, Apheni, Chelti, Phaphriskhevi and the Lower Alazani Irrigation canal. In total, 416.53 mln.m3 wastewater was dishcarged, of which 414.67 mln m^3 was discharged into the surface waters and the remaining amount on the surface. Of total waste water discharged into the surface waters, 409.97 mln m^3 was clean water, 6.56 mln m3 – untreated wastewater and 2.4 thousand m3 mechanically treated water. Shares of total wastewater discharges by various sectors were as follows: hydropower – 409.96 mln m3, sewerage systems – 4.09 mln m3 and industries – 2.47 mln m^3.

In the low reach of the River Basin 7 registered water users discharged wastewaters into the waters and surface relief of the basin. Wastewaters were predominately discharged into the river Alazani and the Lower Alazani Irrigation Canal. In total, 3.4 mln m3 untreated wastewater was discharged, of which 695 thousand m3 was discharged into the surface waters. The largest amount of wastewaters was discharged by sewerage systems.

Among diffused sources, the most significant ones are agriculture and urban run-off. Agricultural run-off is quite high, because the main part of the Alazani Basin covers large agricultural areas. Currently, the majority of irrigation systems are outdated and high amount of water (within the range of 40-50%) is lost from damaged channels. Besides, there are secondary and tertiary irrigation water channels in the private lands of the farmers, from where nutritional and chemical contaminants are washed down into the River Alazani or tributary rivers.

In accordance with official statistics the total amount of mineral fertilizers used in Kakheti region was 30,100 (with 7,525 tons of average annual value) in 2006-2009, of which 25,600 t (over 85%) accounted for nitrogenous fertilizers. In total, 87,900 ha (with 21,975 ha average annual treatment value) of annual croplands and 21,200 ha (with 5,300 ha average annual treatment value) perennial croplands were treated by the mineral fertilizers in 2006-2009. This figure for pesticides was 36,700 ha for annual croplands (with 9,175 ha average value) and 289,400 ha for perennial croplands (72,350 ha with average figure). Compared to the use of fertilizers and pesticides of 1980s, these figures are much lower and it can be assumed that current decreased loads of fertilizers and pesticides result in higher quality of agriculture drainage water.

Besides, such hazardous pesticides as chlorogenic or silver-containing pesticides and triazole group herbicides aren't used anymore in Georgia and use of phosphororganic insecticides significantly decreased as well. The use of organic fertilizers has also dropped by over 14% across the country, but they are still used in high quantities (about 0.5 million tons annually), thus waters might be polluted from various harmful substances and microorganisms through application of manure.

Along with agriculture run-off significant non-point sources of pollution are legal municipal waste disposal and illegal dump sites. Wastes in municipal areas are disposed on specially arranged landfills (so-called polygons) that do not meet minimum health and environmental requirements. As usual, there is no practice of separation of hazardous wastes (e.g. industrial and medical wastes) from municipal and non-hazardous industrial wastes, nor does any utilization or treatment of wastes happen. Waste disposal sites are not lined up with impermeable layers and there are also no drainage systems arranged there in order not to allow for contaminants to leach into the soil and ground waters. Most of existing landfill sites have no defensive borders and warning signs and are not properly maintained. Roads to the waste disposal sites in most cases are in poor condition and the equipment for waste collection and disposal is out of date in many cases. Although the waste collection has recently improved in urban areas (Telavi, Signagi, Lagodekhi, Kvareli, Gurjaani, etc), and some of the cities allotted new lands and fenced them for waste disposal (e.g. Dedoplistskaro[32], Kvareli, Lagodekhi, etc.) the problem of waste disposal and utilization is very acute at present. In rural areas villagers chaotically dispose household solid wastes in the storm water channels, irrigation channels and in the nearest riverbeds. Local governments do not have waste management strategies and plans, including the database of waste inventories showing numbers and composition of wastes. The recovery of waste collection fees is only at the rate of 10 to 20%. In rural areas, there is no waste collection fee system introduced.

For many years since the break-up of the Soviet Union, abandoned ware houses of obsolete pesticide stock-piles were one of the significant non-point sources of pollution. Such stores existed in Telavi, Signagi (Tsnori) and Dedoplistskaro municipalitiess. Local people had easy access to these sites and could open the packages or drums of chemicals. As a result, in many places the substances were scattered all around the store houses and mixed with soils. In total, in Kakheti over 230 tons of obsolete pesticides with about 65% PoPs content (heptachlore) were identified in these store houses during the PoPs inventory of 2004-2005 under the UNDP/GEF project: "Preparation of the POPs National Implementation Plan under the **Stockholm Convention**". In 2007-2010 the government with its own and donor resources collected all these pesticides, packed and buried temporarily at Aigluja hazardous waste disposal site near Rustavi, Kvemo Kartli region. It is planned to export and eliminate these pesticides under the new UNDP/GEF PoPs pesticide project (for the maps of PoPs pesticide inventories please refer to figures 1 and 2 in annex 12).

In addition to above, open-pit mining operations for extraction of non-metal mineral resources also pose a threat to the waters and ecosystems of the basin. These activities are discussed in detail below.

Iori River Basin. In accordance with 2009 MoE data, 13 registered water users discharged wastewaters in the Iori Basin. In total, 65.74 mln. m3 wastewater was discharged, of which 65.57 m3 was discharged into the

[32] Dedoplistskaro has been granted an environmental impact permit for construction of the new landfill. However, concrete actions have not been taken so far.

surface waters and 0.17 mln m3 – to the surface relief. 64.77 mln m3 was discharged by the Irrigation company “Sioni -M” in both R. Iiori and in Tbilisi reservoir without any consumption through a transit. Total amount of untreated sewage discharged from centralized sewerage systems amounted to 0.9 mln m3 and that of industrial wastewaters – 0.08 mln m3. Of this amount only 0.004 m3 was mechanically treated. Wastewater discharged occurred mostly in Tianeti and Sagarejo municipalitiess (for more details on wastewater discharges please refer to tables 9 and 10 in annex 12).

Regarding the quality of wastewaters there is no effluent monitoring in the country. In accordance with the MoE estimates, following substances were discharged into the Iori in 2004: surface active Substances (surfactants) - 5.85*106 kg, oil products - 1,000 kg, BOD - $111 \cdot 10^3$ kg and suspended solids – 176 t. These data are calculated values, based on production figures. The Ministry of Environment of Georgia assesses the river’s ecological and chemical status as “good”. Azerbaijan confirms that there is little human impact on the river.

Rioni River Basin. In the Rioni Basin, major pressures on the water bodies are imposed from points sources of pollution, including municipal and industrial wastewater discharges especially, in the middle to low reaches of the basin where agglomeration of Kutaisi and Zestaphoni and the city of Poti are located with high urban population density and concentration of industries there. In addition, pollution from non-point sources, including that from drainage waters and leachates from waste disposal sites, open-pit mining operations and old industrial sites (brownfields) is pretty significant.

In accordance with the MoE 2009 wastewater discharge statistics, total discharges into the Rioni river basin amounted to 16,242.95 mln m3, of which 16,228.91 mln m3 wastewaters were discharged into surface water bodies and 13.03 mln m3 – on the surface relief (for more details on wastewater discharges please refer to tables 11 and 12 in annex 12). Out of the total wastewaters discharged into the surface waters only 2.19 mln m3 was treated through primary (mechanical) treatment, 0.21 mln m3 – partically treated through primary treatment and 38.28 mln m3 untreated. In total, 52.3 mln m3 untreated wastewater was discharged in both surface waters and the surface relief of the basin in 2009. The largest portion of wastewater (16,188.23mln m3) discharged into the surface water was the clean water used primarily by hydropower sector. The largest amount of the wastewaters was discharged into the Rioni, followed by the amount discharged into the Tkibuli and Abasha. The highest discharges of untreated or practically treated wastewaters happened in Rioni, followed by discharges into Kvirila, Tskhelistskali, Budja and Tskaltubostskali.

As for the wastewater discharges per regions and municipalities, the largest discharges in the amount of 14,800.93 mln m^3 occurred in Imereti municipalities, followed by Racha-Lechknumi and Samegrelo-Zemo Svaneti municipalitiess. Both clean and polluted water discharges were the highest in Imereti region. In Racha-Lechkhumi, the largest portion discharged into the water bodies was clean water used by the hydropower sector. Overall, the city of Kutaisi has contributed that largest share to the total amount of untreated or partially treated wastewater discharges, followed by Chiatura, Tkibuli, Samtredia and Tskaltubo. In Racha-Lechkumi municipalities, Ambrolauri and in Samegrelo – Poti contributed the highest share to the total untreated waste water discharges.

In the upstream area of the basin there were 15 registered entities that carried out wastewater discharges into the surface waters primarily into the waters of Rioni, Lukhunistskali and Tskenistskali. The total amount of wastewater discharges was 1,333.44 mln m3, of which 1,330.88 mln m3 was discharged into the surface waters and the rest – on the surface relief. Total of 333 mln m3 was untreated wastewater and 1.1 mln m3 – mechanically treated wastewater. The rest (1,329.9 mln m3) was clean water discharged from hydropower sector. Wastewater discharges from the centralized sanitation systems amounted to 3.35 mln m3, of which 0.8 mln m3 untreated wastewater was discharged into the waters of Riioni, Tskhenistskali and Krikhula and 2.54 mln m3 untreated wastewater – on the surface relief.

In the middle to lower reaches of the River Basin 182 registered organizations carried out wastewater discharges into the waters of the rivers: Rioni, Tskhenistskali, Ogaskura, Tskaltubostskali, Sulori, Kvirila, Khanistskali, Tsablarastskali, Tskaltsitela, Cholaburi, Tkibuli, Chkhara, Dzursa, Dzirula, Chkherimela, Rikotula and Tkibuli reservoir. Total amount of wastewater discharges from registered water users was 14,799.95 mln m3, of which 14,789.46 mln m3 was discharged into the surface waters and 10.48 mln m3 – on the surface relief. Untreated wastewater amount was 43.91 mln m3, partially treated – 202,000 m3 and fully treated through primary treatment – 2.08 mln m3. The rest was the clean water returned into to water bodies by hydropower sector. Sector contribution to the total wastewater discharges was as follows: Sewerage systems - 42.07 mln.m3, industrial facilities – 12.62 mln m3 and hydropower plants – 14,746.21 mln m3.

Major stationary sources of pollution represented mostly by old Soviet industries are concentrated in the middle to lower reaches of the Rioni Basin. These are Zestaphoni ferro-alloy plant, Chiatura manganese processing plant, Kutaisi paints and electrical equipment plants, Poti Ship Repair Plant, etc. They have outdated technologies and therefore are highly polluting industries. In addition, there are a number of small to medium-size food, textile, leather, wood, paper industries there that in a sum pose the pressures on the basin. Furthermore, development of Kutaisi and Poti free industrial zones although will bring new industries in the region, in aggregate will increase the pressures on the Rioni River Basin. In addition, it is planned to construct 300 MW thermopower plant in Tkibuli, which will use local coal as a fuel. It is known that the coal is high ash and sulfur content and without consideration of strong environmental safeguards (e.g installing high efficiency scrubbers), there will be high emissions of sulfur dioxides into the atmosphere that might create a regional problem of acid rains increasing sulfur loads on soils and ecosystems of the Basin.

In the low reaches of the Rioni Basin there were 34 registered water users that discharged wastewaters into the waters of Rioni, Tekhuri and Abasha rivers. In total 108.55 mln m3 wastewater was discharge, of which amount of clean water was 104.51 m3 and untreated wastewater 4.04 mln m3. Domestic wastewater discharges amounted to 3.02 mln m3, industrial wastewater discharges – to 21.52 thousand m3 and hydropower wastewater discharges – 104.51 mln m3.

In terms of non-point sources of pollution, there is practically similar situation in upper, middle and lower reaches of the basin. Legal and illegal waste disposal and dump sites pose high threats to the waters and land resources of the basin. It is estimated that about 2000-2,200 m3 solid household waste is generated in the cities and towns of the upstream portion of the basin that are disposed on legal and illegal landfills without any treatment or directly dumped into river beds. Landfills themselves do not meet minimum health and environmental standards. They are overloaded, unfenced or partially fenced, insolated from the soil, having no drainage tranches or captures. Open combustion of waste is a common phenomenon. In the middle to lower reaches, where Imereti municipalities is located, annual volumes of solid household wastes generated are about 191,650 m^3. The region has 11 landfills, of which 10 are legal, with total area of 71.5 ha, and 1 illegal in Zestaphoni. The similar situation exists in Samegrelo-Zemo Svaneti municipalities. Total amount of waste generation equals to 203,270 m3 there. All the municipalities in the basin, except for Martvili have legal landfills that regardless of their legal status do not meet minimum environmental and sanitary standards. In Martvili, the illegal dumpsite is located on the bank of the R. Abasha, In Abasha municipalities the legal site is located between the rivers of Abasha and Rioni affecting both rivers and, in the city of Poti the landfill is located in the mouth of the r. Rioni and is one of the major sources of pollution. Some 180,000 m3 all types of wastes are disposed annually on the landfill. Furthermore, two fish plants produce organic wastes in the city, of which one of the plants dumps the waste directly into the River Rioni. From other plant, the waste is transported to the city landfill. However, because of the deplorable state of the landfill, waste brought there eventually ends up in the River Rioni anyway.

Another significant diffused source of pollution is old industrial sites (brownfields) and accumulated there significant amounts of industrial wastes. These wastes are abandoned without any care. In the upstream areas of the basin, such industries were arsenic and barite processing plants on the rivers of Jejora, Lukhunistskali, Tskenistskali and Kordulashi. More specifically, in the village of Iri, located in the river gorge of Jejora, left tributary of the R. Rioni, Oni municipality there were barite mines together with primary processing plant. The earthquake of 1991 has destroyed both the plant and the mines, in which the ore was extracted. Barite production has never been renewed since then. It was planned to construct a factory of polishes and paints on the base of the barite plant. The building and its infrastructure were constructed, but the factory has never started operation. At present, the factory is totally destroyed. Waste of barite, scattered on the territory, is still being washed into the river. Close to the village Iri, upstream the river Jejora, in the urban-type settlement of Kvaisa, South Ossetia, lead, tin and quartzite mines together with primary processing plant were functioning in the Soviet period. On the basis of the information obtained from the population of adjacent territories, it became known, that the primary processing plant is not functioning at present, though the River Jejora is still being polluted with wastes washed into the river. Furthermore, in the village of Uravi, located in the gorge of the R. Lukhunistskali, right tributary of Rioni in Ambrolauri municipalities, there was an arsenic mining and processing industry functioning there from 1933 through 1997. Currently, this industrial site with a total area of 0.2 m^2 is full of industrial wastes, including mine tailings. in Uravi plant ores from Lukhumi arsenic mines were processed. In these ores arsenic is contained in the form of auripigment (As_2S_3) and realgar (As_4S_4). In the plant, arsenic products mainly, tin(Sn)arsenic acid was produced. 98-99.5% of the salt of tinarsenic acid is $SnHAsO_4$, which, after being mixed with special additives, is used as a medicine for minor livestock and poultry. Amount of tin used for one ton of product exceeded the accepted norm by 67 kilograms. Tin was disseminated in the environment both in the form of a final product and in the form of a solution of the bivalent salt of tin. At the same time, because of the violation of the technological norms in the process of ore processing, arsenic was not extracted totally. The remaining ash contained As_2O_3. This toxic compound (water soluble) was polluting air, ground (in the form of dust) and ground waters. Consequently, the Racha plant was contaminating the environment with approximately 101 kilograms of arsenic and 67 kilograms of tin per every single ton of tin (Sn) hydro-arsenate produced by it. In addition to the ore mines, processing plant and a number of minor storage facilities, there was a large tailing storage facility, so-called sarcophagus in the village. That storage was used not only for storing hazardous substances produced by the plant but also for storing various toxic chemicals imported from various regions of the Soviet Union. The concrete sarcophagus's total area was about 400 square meters. Currently, this facility is destroyed and rain and river waters as wash out contents of the sarcophagus out to the river. Local population has no information as to what kinds of substances were deposited the cemetery. On the whole territory of the plant, a specific, sharp smell can be felt, being especially intense in the vicinity of the sarcophagus. The local population frequently uses construction wastes scattered on the site, which are most probably dangerous to the human health. Livestock has an free access to the area and graze there. Cases of the fall of cattle are frequent. According to the village dwellers, at least 5 to 6 cattle die per year out of contamination. Kids also have easy access there, since the area is unfenced. There is another old arsenic mining site in village Tsana (Koruldashi area), located in the Tskenistskali river basin, Lentekhi municipalities. The mine and primary processing and burning facilities operated there in 1936-1992. The site is located in a 4-5 km distance from the village. Currently, the facility is completely destroyed and remains are scattered all over the territory of 4-5 ha. In addition, to the local arsenic, in the past, solid wastes of polymetallic concentrates imported from Russia (Novosibirsk) were processed in Tsana. The concentrate contained arsenic in the form of As_2O_3 together with highly toxic components of the first and second class – Hg, Sb, Cr, Bi, which highly dangerous to the human health. In the process of refining the concentrate, some part of these components was evaporated into the atmosphere, while some part staid in the by-products and the wastes. Solid wastes of concentrates were placed in barrels. In course of time, these barrels were damaged (their corrosion started) due to natural climatic conditions and the content of the barrels was let outside. Because of the violation of technical parameters in the process of processing solid wastes of polymetallic concentrates, arsenic was not extracted totally. The remaining ash contained As_2O_3. This toxic compound (soluble in water) entered all environmental medial, including air, soil and ground waters. In Lentekhi municipalities, close to the village of Mele, about 1.5 kilometers away from it, in Dzugharishi area in the riverbed of the Tskhenistskali River, arsenic brought form Tsana underwent further processing. Arsenic primary processing plants of Koruldashi and Dzugharishi composed one integral complex. currently, the plant is totally destroyed, remains of arsenic (ash left after processing) are scattered on the adjacent territories (area of 0.01 square kilometers). Toxic chemicals pollute the river and also pose danger for the livestock of local population. Several dozens of cattle have died because of grazing on the contaminated territory. The population has tried to fence this territory with their own private resources in order to prevent the livestock from accessing the territory.

In addition to old mining sites, there are a number of small to medium-size inoperable saw mills in the upper and middle reaches of the basin where significant amounts of saw dust are accumulated, polluting rivers and creating danger to the fish as well. Such plants are in Oni, Lentekhi, Kharagauli, Chiatura, etc.

On-going mining operations of ferrous and non-ferrous metal are also significant threats to the natural resources of the Rioni basin, including water resources. For instance, there are about20 manganese mines in Chiatura municipalities of the Imereti region. Of total number, 11 are open-pit mines and 9 – underground mines. Sixteen of the twenty mines are located in tributary watersheds north of Kvirila River and 4 are located south of the River.

Abandoned storage facilities with stock piles of obsolete pesticides in the Rioni Basin, which in accordance with PoPs inventories conducted in 2004-2005 consisted of about 65% PoPs, were significant sources of water and land pollution. There were more than 20 small store houses in the basin, with 9 of them located in Imereti region containing obsolete pesticides in the amount of 10 tons.

Furthermore, former Soviet military bases also should be mentioned. There is one abandoned Soviet military base, located in the village of Tchaladidi of Khobi Municipalities. That was an air defense artillery division equipped with zenith rockets. Rocket fuel mélange was stored there. In 2002 this substance was taken away from the territory. However, there is a belief among local population that the base had its underground communications, whose state is unknown. An investigation of the territory might be necessary, since Soviet air defense military bases always had underground communications. Unfortuantely, there is no technical and engineering documentation kept in Georgia since it was handed over to Russia (for more details please see the map of pollution sources/hiotspots in the Rioni basin, figure 15, annex 15).

With regards to agriculture run-off and river pollution from it, it is considerably low compared with that of Soviet period, due to lower rates of the use of agrochemicals attributed to increased prices of fertilizers and pesticides as well as reduced agriculture activities. In accordance with the official statistics, mostly nitrogenous mineral fertilizers are used for treating agriculture lands. More specifically, in 2006-2009 the total amount of fertilizers used in Racha-lechkhumi and Kvemo Svaneti region was very insignificant not exceeding 3.4 thousand tons of total amount and 0.85 thousand tons of average annual amount; Of this, over 82% were nitrogenous fertilizers. Total area of annual croplads treated with mineral fertilizers was over 27 thousand ha with about 6 thousand ha area treated annually (70% of total area of annual crop lands). The total area of perennial croplands treated by fertilizers was over 3 thousand ha with about 0.9 ha treated annually on average (30% of total area of perennial croplands). In Imereti region, total use of fertilizers was 64.7 thousand tons with 16.18 thousand tons of annual average use. Of total amount, about 94% were nitrogenous fertilizers. Total of 147.1 thousand ha of annual crop lands were treated by mineral fertilizers (predominantly, with nitrogenous ferilizers) with 36.78 thousand ha average annual treatment value. Total area of perennial croplands treated with mineral fertilizers was 9.6 thousand ha, with about 2.4 thousand ha average annual treatment. In Samegrelo-Zemo Svaneti region, total use of mineral fertilizers was 43.9 thousand tons, with 10.98 thousand tons of average annual use. Of total amount, over 97% were nitrogenous fertilizers. Regarding the areas of treatment, total of 122.8 thousand ha of annual crop lands and 18.3 thousand ha perennial croplands were treated by mineral fertilizers, with 30.7 thousand ha and 4.58 ha average annual treatment respectively. It is noteworthy to mention, that for last several years in Georgia and especially in Samegrelo region, agriculture suffers considerably from the parasite insect – American Butterfly. So-called wet fog method is used to control the pest. Following chemical compounds are used: Decis, Karate Zeon, Valsamba, Arrivo, Valsaciper, Fastrack, Alpack. The scale and the intensity of the use of these substances are so high that it will indubitably affect the state of the water in the River Rioni.

Apart from the permanent settlements, rivers of the River Rioni basin are negatively affected by resorts existing in these regions. Infrastructure of some of them has been totally destroyed. In case of the resort Lebarde on the River Tekhura in Martvili municipalities. Some of them are still functioning, though not at full capacity. Such are, for example, resort Sairme in Baghdati municipalities (on one of the tributaries (the River Tsablarastskali) of the River Khanistskali), Shovi in Oni municipalities (on the River Tchontchokha) and Utsera in Oni municipalities (on River Rioni). Their communal services (dumpsites, sewage) do not meet minimum environmental standards.

4.1.3 Impacts on Water Quantity

Alazani River Basin. Unfortunately, given the absence of comprehensive system of water cadastres (including water balances), existence of lax system of water quantity monitoring and absence of integrated river basin planning, it is difficult to assess the impact of various water uses on the water flow regime. In addition, it is difficult to assess the water supply-demand balance and its impact on the water budget.

In the past, there were 6 hydrological gauging sites in the Alazani river basin, 4 on r. Alazani, 1 on r. Stori and 1 on r. Instoba. Only the sites on Stori and Intsoba measured both water discharge and level. The rest recorded only water level. Currently, only 1 hydrometeorological site measuring only water level is operated by the NEA on r. Alazani (Shakriani). There is also 1 meteorological station in Telavi and 2 meteorological posts: 1 in Dedoplistskaro and 1 in Lagodekhi (for more details please see the figures 5 and 6 in annex 13).

Regardless of above, it can be said that with the current level of economic development and the amount of available water resources, water demands by various sectors are more or less met and there is no conflict among them over water allocations, nor does among upstream and downstream users. At present, the hydropower sector is the largest water user and irrigation sector without any conflict transfers necessary amount of the water to it. Hydropower plants return clean water to the river bodies. It should be mentioned that river run-off in the lower reaches of the R. Alazani, during the period of 1996-2005 has increased from 104 to 111 m3/s compared with the period of 1955-1970. This corresponds to the average growth of the water discharge by 1-2% per decade. Thus, currently there is no significant water shortage in Alazani river basin to meet demand for water use. However, with the growth of economy, including agriculture and industrial sectors, 24-hour provision of potable water to the population, which is under the nearest plans of the government and as well, taking into consideration adverse impacts of the climate change (increased temperature, decreased precipitation, reduced river run-off, enhanced desertification, increased frequency and intensity of droughts, etc) the demand for various water uses, including irrigation, hydropower and industrial water use will increase that might be hardly met due to the decrease in available water resources. In addition, the conflicts between various water use sectors, as well as between upstream and downstream users might emerge, especially during the droughts, which are expected to become more frequent and severe. However, the Second National Communications of Georgia under the UNFCCC has not predicted a water shortage to hinder keeping the water supply-demand balance. The study forecasted 8% reduction of annual river run-off within 90-year time horizon till 2100, compared with the 30-year average river run-off of the second half of the 20th century (1951-1980). This, according to the SNC modeling results, won't have a serious impact on water availability, even with 50% increase in irrigation water demand and consumption levels. Regardless of this, decreased water resources, decreased annual precipitation (by 1.5%) and increased annual mean temperature (by 5^0C) will significantly raise an already existing water shortage for crops (e.g. winter wheat and sunflower) and pastures (for more details please see tables 3 and 6 in annex 14).

As for the impact of the man-induced catchment alteration and river regulation on water and sediment flow regimes, there are no significant river alteration schemes in the basin, therefore, there are no large impacts on water system of the basin. However, in general, even small reservoirs have localized impacts on downstream ecosystems and sometimes create danger to nearby population. For example, Cheremi reservoir that was put into operation in 1982 for irrigating agricultural lands of several villages twice created serious danger to the v. Velistsikhe population, one in late 80s and another in 2010. The bottom of the reservoir where the spillway is built is filled with sediment and there are frequent cases that the water rises to the level causing inundation of immediate surroundings. The reservoir needs clean-up and construction of bank reinforcement structures.

<u>Iori River Basin</u>. Similar to the Alazani river basin, it is very difficult to judge about the impacts of current water uses on the water quantity of the Iori basin, given unavailability of relevant data and information. In the past there were 2 hydrometeorological posts on the r. Iori measuring only water level, 1 in V. Lelovani, 277 km from the mouth and another in V. Orkhevi 262 km from the mouth. In addition, there was a hydrological post on the Sioni reservoir. At present, only 1 hydrometeorological post on Sioni reservoir and 1

meteorological post in t. Tianeti are operational. Only meteorological parameters and water level are measured on the site (for more details please refer to figures 5 and 6 in annex 13).

Regardless of above, based on the analysis of past and current water use data it can be said that the pressure and thus, the impact on the basin's resources is significantly reduced especially, from irrigation sector due to the low capacity of the systems as well as due to the reduced agriculture water demand. Therefore, at present supply-demand balance in the basin is maintained and water allocation among sectors is done without any water use sector experiencing the shortage in it. More specifically, the largest amount of water is consumed by SHPPs and the water is supplied to them through both own abstractions and transfer from irrigation systems. Waters used by HPPs are almost fully returned to the river. Traditionally, major pressures on the river system were put by downstream users: Upper and Lower Samgroi irrigation system, which at present work with lower capacity (e.g. at up to 70% of designed capacity). However, in the future with the rehabilitation of Samgori irrigation systems as well as with the growth of population and economy, including agriculture and industry in the areas of Kvemo Kartli region and Tbilisi, negative impacts, including water shortage will increase in the basin. Water shortage, which is 30% of total annual flow during low waters will be particularly acute in downstream semi-arid and arid areas of Dedoplistskaro municipalities. In addition, conflict among various water users can arise. Furthermore, future adverse impacts of the climate change on water resources of the Iori River will deepen the water shortage. More specifically, in accordance with the SNC, annual mean temperature increase by 5.1^0C, annual precipitation increase by 1% and annual river run off decrease by 11% is expected within next 90-year horizon. With this river run-off decrease and major downstream water users' demand increase by 10%, there will be a serious water shortage from January through April (1-5 mln m3) and from the second half of August through November. With the demand increase by 30% and 50% the shortage will exist during the entire period of the calendar year (for more details please refer to table 4, annex 14).

As for the alteration of the river and sediment flow through river regulation, it should be mentioned that the largest negative impact on water resources is posed by Dalis-Mta reservoir that was built for irrigating agricultural lands of Georgia and Azerbaijan. But the construction of relevant irrigational system in Georgia as well as in Azerbaijan was not carried out. As a result, the water reservoir has lost its function and at present only inactive storage capacity – 40 mln m3 is filled with water. Dali Reservoir has caused significant damage to riparian forests in the lower flow of the R. Iori, by restricting these territories from spring floods. That process is being aggravated by intensive use of water resources of the R. Iori, and the water discharge from its lower part does not now exceed 4-6 m3/s. For instance, according to 1943-1954 observational data, the mean annual discharge of R. Iori reached 10.7m3/s in its upper part, and 17.4m3/s in its lower part, in Dedoplistskaro municipalities. During the period of 1986-2004, after the construction of 2 large reservoirs and a number of irrigation systems, the mean annual discharge of the river in its lowest part dropped to 2.6m 3/s, while the runoff in the river head remained virtually unchanged. The underground water resources of the are also scarce and their Overall amount does not exceed 4.5 – 5.0m3/s, that is, 5 times less than in the neighboring region of Alazani Valley.

Rioni River Basin. Similar to the situation in Alazani and Iori River Basins, current hydrometeorological monitoring is significantly declined in the Rioni Basin. In the past, there were 15 hydrological gauging sites in the basin, 6 on r. Rioni, 2 on r. Tskenistskhali, 1 on r. Lajanuri, 2 on r. Kvirila, 1 on r. Dzirula and 1 on r. Tekhuri. There was also a post on the Lake Paliastomi. Only gauging station located on the r. Kvirila measures both water discharge and level. The rest measured only water level. Currently, only 6 hydrometeorologcal posts are operational, of which 2 are located on upper reaches of Rioni, 2 on r. Kvirila, 1 on r. Tekhuri in V. Nokalakevi and 1 on r. Rioni in Poti. In addition, there is one regional meteorological station in Kutaisi and 1 meteorological post in Shovi (near river source of Rioni) (for more details please refer to figures 5 and 6 in annex 13).

Regardless of above, some conclusions on the water use pressures and impacts can be made by analyzing current and past water abstraction and consumption patterns. Namely, although, the total amount of water abstracted and consumed is much higher in the Rioni Basin than in the Alazani and Iori River Basins, this figure is by far below the water abstraction levels of the Soviet period, due Overall economic decline and decrease in water demand by household, industrial and irrigation sectors across the country. To have a clear picture of the order of magnitude for water use decrease, one can compare water use figures of 80s and 2000s. For instance, total water withdrawal declined from 4,600 mln m^3 in 1985 to 1,621 million m^3 in 2005. Of this, Industrial water withdrawal for 2005 was estimated at 208 million m^3, while in 1985 this figure was 1,542 mln m3. Thus, it can be concluded the pressures and the negative impacts from water abstractions and consumption are reduced in the Rioni Basin. Rivers of the basin are characterized by high water flow and water resources are abundant there. Therefore, there is no water deficit in the region. Hence, the water budget of the Rioni Basin can accommodate much more water abstractions and consumption.

Regarding the impact of the climate change on the water and sedimentation flow of the basin, information is available only for upper course of the river Tskhenistskali (Lower Svaneti), upper course of the R. Rioni and for the Rioni Delta and Black Sea Coastal Zone.

In the Lower Svaneti, located within the upper course of the r. Tskenistskali basin, last decade an increase in annual precipitation by 10% and annual mean temperature by 0.6^0C has been observed compared with the data of 1955-1970s. This process is reflected in the glacier retreat, determining relevant changes in the river runoff[33]. According to topographic surveys carried out in 1953-1958, twenty small glaciers were detected in the basin of the R. Tskhenistskali, with a a total area of 12.5km^2. Among them, the most significant is the Koruldashi Glacier that currently undergoes the process of a retreat. Direct observations undertaken during 1965-1990 revealed that the rate of the retreat of the Koruldashi Glacier varied from 2.0m/y to 4.6m/y, making on average a retreat of 3.4m annually. Due to the absence of measurements since 1990, results of a cooperative survey of the Central Caucasus glaciers, performed by researchers from the Reading and the Moscow State Universities, have been used to assess the conditions of the glaciers of the r. Tskenistskali basin. According to the findings of the study, based on the analyses of satellite images of 1985-2000, it was determined that in the examined period, the mean rate of the glaciers retreat was equal to 8m/y, and that the area covered by glaciers decreased by 6-9%. The assessment showed that for the past half-a-century, the total area of glaciers in Kvemo Svaneti might decreased by 25%, and their total volume reduced from 1.2km^3 to 0.8km^3, which corresponds to the present stock of water in them, equal to 700 million m^3. The projected rise in temperature by 2050 may result in the total disappearance of glaciers in Kvemo Svaneti that will have

[33] As to the resourses of underground water, their average value in Kvemo Svaneti reaches 86m3/c, which exceeds 3.5 folds ground water resources of the artesian basin in the neighboring Racha-Lechkhumi region. The underground water resources significant sources for formation of the river runoff. According to the results of a special study, the share of underground water discharge in the river runoff in this region varies in the range of 20-40%, making 30% on the average.

a significant impact on the river regime of the Tskenistskali basin. Furthermore, under the SNC project, a change in the river run-off of the Tskhenistskali upper course waters by 2100 has been estimated taking into consideration predicted values of annual temperature and precipitation. It was concluded that about 9% reduction of the Tskenistskali run-off in the whole upper course of the river might happen by the end of the current century (2070-2010), with the highest reduction (41%) to happen in summer time. However, the model used by the project didn’t take into consideration glacier feeding parameter and with its inclusion in the model the results may be different (for more details please see the table of R. Tskhenistskali runoff change prediction due to climate change, table 5, annex 14).

In the Rioni Delta there is a trend of an enhanced accumulation of sediments carried by glacier-fed rivers, caused by intensive enrichment of river sediment with moraine materials originated in the process of glacier retreat. Activation of sedimentation processes is clearly manifested in the coastal line, where the mouth of R. Rioni new branch (Nabada) is located. The branch (sleeve) has intruded into the sea by about 150 meters; this branch has developed its delta with islands similar to the old (historic) mouth, significantly exceeding the last one. The silting of the river bed by glacier sediment reduces the river bed carrying (discharge) capacity especially, during floods and, its inclination in an area affected by eustasy. This problem, first of all, is most urgent for settlements disposed around the upper part of this river section (e.g. Patara Poti, Chaladidi, Sabazho, Sagvamichao, Sakorkio, Sachochuo, etc.). A significant part (20-30%) of the lower portion of this segment is occupied by the Kolkheti National Park and other protected areas, which under the joint action of eustasy and river bed silting processes, have been flooded several times and seriously damaged. The impact of sedimentation on the river bed in this segment is very high.

Lower reaches of the R. Rioni (HPP dam – Samtredia portion) includes riverine territory located in a zone of rare floods of the river (P<5%), which is spread upward along the river, from the water distributing unit to the upper limits of the eustatic blocking up. The river here flows into the bed, restricted by the earth dams, and its inclination does not exceed 1.0‰. About 40 densely populated settlements are located in this segment, supplying Poti with agricultural products and a labor force. One of the river branches joins the Lake Paliastomi by a canal cut through the left bank dam. Its level in the past rose to such an extent that it created a serious damage to Poti. At present, the destroyed dams have not been repaired at a sufficiently reliable level, so that even 5% probability floods could overflow them. Eustasy in this segment is the highest and its relative value has reached 0.7m by the end of the last century. The reason for this is that it has the highest rate of tectonic sinking (C=0.56m/century) of the entire coast, with its relative value reaching 0.7m/ ac entury. This relative eustasy seriously reduces the river bed carrying capacity, conductivity and conveyance, as the rise in sea level decreases the inclination of the river, and in this way accelerates the silting of the river bed by moraine sediment. Since 1925 (after the beginning of observations) an increase of R. Rioni backwater curve heights up to 0.9m during the spring floods has been recorded. During such events the sea level is higher by 0.20-0.25m, compared to the average value, and its length grows almost two fold. Accordingly, this drastically decreases the capacity of river bed and the reliability of earth dams along the river banks. This means that floods, which were not dangerous to Poti in 1920s, at present, seriously endanger the city. This phenomenon is especially dangerous for the city of Poti, as it is standing 1.5-2.0m below the level of the R. Rioni.

Regarding the change in the water flow of the R. Rioni attributed to the climate change, its increase by 26% in the upper reaches is expected till 2050 and decrease by 36% is expected by 2100 compared to the 2050 projected level. Predictions of the river run-off have been conducted through application of two models, which gave different results, one of them predicting the run-off growth by 2100 in contrary to its decrease by 2050. However, if we take into consideration anticipated decline in annual precipitation in western Georgia, decrease in water discharge seems to be more realistic. It should be mentioned that this forecast does not incorporate the variable of the glacier feeding of the runoff that might make corrections into the predictions.

As for the man-induced river alteration and its impact on the river and sediment flow, water reservoirs built mostly for hydropower generation on the rivers of the Rioni Basin have significant impacts on river hydrodynamics and the river system as a whole, especially on downstream areas and deltas. For instance, Gumati water reservoir built in the lower reaches of the Rioni Basin on the River Gumati is highly silted and its active volume is decreased by 77%. During the first 10 years of its operation its capacity has been declined by 70%. Before the dam and the reservoir the river run-off is 13mln m3/y and after the regulation – 12 mln m3/y. Sediment flow rate before the regulation is 7.59 Mt/y and after the regulation – 3.72 Mt/y. Thus, the ratio between natural and regulated sediment run-off is 2. This has an impact on delta formation that in the past was the most influenced by the river sediment run-off. Currently, the sea (sea waves, eustatic sea level rise, surges) impact is becoming stronger that accelerated the receding of the delta.

The Lajanuri reservoir built in the upper course of the R. Tskhenistali Basin is also highly silted and its active volume has been decreased by 35% during 13 years of operation and in addition landslides and mudslides periodically damage the adjacent settlements.

Currently, there are preparatory works on-going for construction of Namakhvani HPP cascade that will be located between Ladjanuri and Gumati HPPs in Tsageri and Tskaltubo municipalities. ESIA was released in April 2011. The project is of large-scale that will have significant impacts on the quantity of the Rioni river.

The first upper stage of the Namakhvani HPP scheme is Tvishi HPP of 100 MW installed capacity and 386 mln kwh average annual power generation that will use the river Rioni fall between 360 and 310 m above the sea level that is an area between villages Tvishi and Alpana, Tsageri municipality. The total area of the watershed of the Rioni River before the dam is 3,425 km^2. The power plant will be located near the concrete gravity dam. Construction tunnel will be used as derivation tunnel lateron. Other structures of the HPP are water intake, powerhouse, 220 kV electrical cabin and downstream spillway chamber. The crown of the concrete dam will be situated at 361.50 m level and will form the reservoir with 13.1 and 11.3 million m^3 maximum and minimum capacities and 1.8m^3 active (useful) volume. Total surface area at maximum water is 0.97 km2. Water level at normal accumulation level is 360 m a.s.l. and the minimum level – 357 m. The dam height is 56.5 m and, it consists of spillways and solid parts. The spillway is 54 m long. Its width is 50 m. The bottom of the dam will be located in the alluvion and in the central part deepens down to 306.00 m level. The spillway consists of three sections, each 14 m long and its maximum capacity is 4,400m3/s. The dam is designed to pass maximum flow in case of 0.1% provision, i.e. 1425 m3/sec considering that the flow rate of water passing through the power plant is 336 m3/sec. In order to regulate the upstream water level, 14-15.3-15.0 flat paired locks will be installed in the spillway.

The second and the third stages of the cascade will be located in the low reaches of the Rioni watershed. The Namakhvani HPP will have 250 MW installed capacity and 941 GWh average power generation. Total volume of the reservoir is 156 mln m3 and useful volume - 52.0 mln m3. Normal water level is 230 m and total surface area - 4.9km2. For power generation the river Rioni fall between 310.00 m and 292.00 m levels will be used. The arch-type dam height will be 111 m with a designed flow rate at 2,350m3/s and the area of the reservoir at maximum water level – 4.95 km2. The bottom outlet will have 848.88 m3/s maximum capacity at 280 m asl and the water intake – 366m3/s. Spillway capacity is designed at 4,000m3/s

The third step includes HPP, dam and reservoir in the area of Zhoneti village of Tskaltubo municipalities with 100 MW installed capacity and 354 GWh annual average power generation HPP, 31 m high and 2,3500m3 design flow rock fill dam and 1.25km2 surface area water reservoir. Water level varies between 232 and 226 m a.s.l. Total volume of the reservoir is 12.5 mln m3 and minimum volume – 6.5 mln m3. Active volume is 6.0 mln m3. The bottom outlet maximum capacity is 2,798m3/s, water intake capacity – 416 m3/s and the spillway capacity – 4,000 m3/s.

The electricity produced by the above HPP scheme will be transferred to Zestaphoni sub-station through 55km 220kV transmission line that will follow Imereti corridor. The pressures on the vegetation cover, terrestrial and avia fauna will be high during the construction phase, while during operations phase the pressures will be from electrmagnetic fields created by the current flowing in the lines and cables.

In accordance with project pre-feasibility study and the ESIA, due to the high turbidity and sediment flow of the Rioni planned reservoirs will be filled in with significant amount of sediment over the time. The sediment load in Tvishi reservoir will be 12mln m3 after 5 years of its commissioning and it will be filled in with sediment by 92%. In case of Namakhvani reservoir, sedimentation load will be 104 mln m3 after 19 years of plants' commissioning and after 25 years the reservoir will be filled with 125.1mln m3 sediment, which is 80% of total reservoir volume. However, synergetic effect of the cascade is that Tvishi reservoir will trap sediment and prevent downstream reservoir for further silting and similarly, Namakhvani reservoir together with Tvishi reservoir will prevent Zhoneti reservoir from excessive silting for 10-20 years. The reservoir sedimentation will put pressures on river hydrology and hydraulics and will enhance river bank erosion, flooding of downstream areas and the loss of sea shores due to the shortage of sediment. Furthermore, there will be impacts from the Namakhvani project on regional climate by affecting the relative humidity and air temperature.

Regarding the cumulative effects, Namakhvani HPP scheme together with existing Rioni cascade scheme and, the greenfield 70.6 MW capacity 357 GW/h average annual power output Alpana HPP will significantly alter river hydrology by damming, river diversion and water storing. This will affect the seasonal water flow and prevent the river from floods. Coupled with the pressures of the climate change pressures put on the river system by above hydroprojects will have significant impacts on the Rioni basin in the project site area and in the delta.

The estuary of the river Rioni near the city of Poti will be threatened by the reduction of sediment load. The project pre-feasibility study has showed that construction of Namakhvani cascade will create about 300-400 thousand m3 sediment shortage annually in case of 320m3/s water flow of the River in the Poti area (sediment load will be reduced to 1 million m3. However, river sediment carrying capacity will be enhanced from the river to the city). The delta area is already suffering from coastal erosion and loss due to the both anthropogenic interventions and eustasy coupled with sea level rise to the the global warming. More specifically, there are two sleeves flowing into the Black Sea that form the iland called "Bolshoi" where the part of the city is located. After the river diversion and Rioni's confluence with the river Nabada the sediment and land formation has stopped in the old estuary, where the sea beaches are intensively washed out.

4.1.4 Impacts on Water Quality

Alazani River Basin. It is very difficult to judge about the current water quality status of the Alazani river basin and the impacts of untreated wastewater discharges on it. Recent water quality data on the rivers of the basin are very scarce and are hardly representative due to diminished water quality monitoring network. Only two water quality sampling points (Shakriani on Alazani River and one point on Duriji river) are operated in the basin by the National Environmental Agency under the Ministry of Environment, which cannot give a representative picture of the water quality of the basin (for more details on surface water quality sampling points please refer to figure 2 in annex 15). The most representative and valid data, according to NEA experts exist for the period of 1984-88, reflecting maximum pressures on water resources from economic sectors. By that time there were 9 sampling points, 3 on river Alazani, 1 on river Stori, 1 on river Didkhevi, 1 on river Duruji, 1 on river Lagodekhi. And, 1 on Alazani irrigation canal[34]. During that period, major constituents in the waters of Alazani Basin were biogenic substances (nutrients): NH_4, NO_2- and NO_3-, phenols, oil products and copper. Almost every year of observation, trace concentrations of pesticides, specifically DDT, have been detected 2-3 times a year. In most cases, concentrations of organic compounds, namely, chloroganic substances varied from 3 to 36 mg/l. Salt contents varied from 60 to 700 mg/l. The maximum salt content was observed in summer period (low flow) and the minimum – during high flows. The relation of common ions to different seasons is significant. Their concentrations are characterized by seasonal fluctuations. Increase of sodium and potassium concentrations was also observed during low flows, characteristic of winter periods. High content of biogenic substances as well as existence of pesticides in surface waters of Alazani basin may be explained by pollution from return flow from cultivated lands and livestock farms. Pollution by phenols, oil products and copper was due to the urban runoff and effluent discharges from some industrial activities.

In addition to regular monitoring of surface waters, an intermittent monitoring of groundwaters was conducted from 1970 through 1990. In Alazani river basin samples were taken from 150 boreholes. Nitrates, nitrites and hydrogen sulfide (H_2S) exceeded the maximum permissible concentrations in the groundwater of the Kakheti region attributed to the leakage from sewerage systems, draining of pollutants from cattle breeding farms, agriculture lands and chemicals storage facilities.

Currently, sampling of surface water is conducted periodically on a manual basis (approximately 30 times per year). About 50 physico-chemical parameters are measured. There is no monitoring of groundwater quality. Exceedances of maximum allowable concentrations (MACs) are the most observed for biogenic substances, e.g. ammonia, nitrite, phospates. For instance, ammonia MAC (both Georgian MAC established for public health and EU limit value) exceedances were recorded each year during the period of 2005-2009. Samewise, Georgian fish water MAC and EU limit for nitrite were exceeded each year from 2005 through 2010. EU phospate value was also exceeded each year. Ammonia exceedances were 2-3 folds (for Alazani river water quality data please refer to annex 15). High content of biogenic substances (nutrients) in surface waters of the Alazani basin is caused by untreated wastewater discharges as well as by agricultural run-off. At the

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[34] 1. river Alazani, Villige Birkiani, Kakheti 5 km above Birkiani; 2. Alazani, Villige Chiauri, Kakheti 1.25 km west of Chiauri, 30 m above the bridge 1957-2000; 3. Alazani, Villige Zemo-Keda Kakheti 8 km below Zemo-Keda, near the water-post; 4. Stori, Villige Lechura, Kakheti 0.26 km above Lechura, 16 km above the outflow; 5. Didkhevi, Villige Artana, Kakheti 5 km above Artana, near the water-post; 6. Duruji, Town Kvareli, Kakheti 1 km west of Kvareli, 8.6 km above the outflow; 7. Lagodekhi, Lagodekhi Reserve, Kakheti 1 km above Lagodekhi, near the water-post; 8. Alazani Channel, Kondoli, Kakheti 7 km east of Kondoli, 4.5 km below channel-head; 9. Alazani Channel, Zemo-Kedi, Kakheti 3.5 km north of Zemo-Kedi

lowest reaches of the river, on the Azerbaijan side, in the waters of the river Alazani (Ganykh), concentrations of phenols exceed norms 5-7 times, metals – 6-8 times and oil products – 2-3 times. These might me an impact of urban run-off from densely populated urban areas of Kakheti as well as minor oil extraction activities.

Iori River Basin. For Iori river basin, recent surface water quality data are absent. During the Soviet period, there were 4 sampling points 2 on Iori river and 2 on reservoirs. The river monitoring points were as follows: 1) V. Lelovani point, Kakheti 140 m below Lelovani, 80m below the inflow of river Kusno; 2) V. Dalidag point, 0.2 km above V. Dalidag. Both points were closed in 90s. Two points at the lakes were as follows: 1) Sioni Reservoir in T. Sioni and 2) Tbilisi Reservoir in Tbilisi. Intermittent sampling was conducted on both sites. Apart from this, groundwater monitoring was conducted in Alazani and Iori-Shiraki Artesian basins, where samples were taken from 150 boreholes. In late 80s, groundwater contamination of these basins by nitrates, nitrites and hydrogen sulphide was detected; Furthermore, monitoring of groundwaters of Marneuli-Gardabani artesian basin was conducted and the contamination of groundwaters by ammonia, nitrates, nitrites, pesticides, etc. were detected.

Currently, none of the points is operational. In 2009-2010, under the EIA for the Tbilisi landfill, irrigation water samples have been taken for a number of parameters (e.g. biogenic substances, heavy metals, organics) from Zeda Samgori Irrigation Canal that is supplied with Iori water from upper reaches. The quality of water was in line with MACs. This indicates on lower anthropogenic pressures on the waters of the basin in upstream areas. However, on the middle to lower courses of the river there is an impact from densely populated urban areas of Gurjaani, Signagi, manifested by higher than MAC concentrations of phenols, metals (2-3 folds), oil products and sulphates (up to 2 folds) on Azerbaijan segment of the Basin that can be attributed to the urban run-off and some minor oil extraction and processing activities on Gare Kakheti Plateau.

Rioni River Basin. During the Soviet period there were 24 surface water quality sampling points on the rivers of the Rioni Basin. Of these, 7 points were on r. Rioni (T. Oni, V. Namokhvani, C. Kutaisi, C. Poti, T. Samtredia, V. Sakochakidze), 3 on r. Tskhenistskali (V. Khidi in Imereti, V. Ludgi in Imereti and the mouth), 2 on r. Kvirila (T. Chiatural, T. Zestaphoni), 2 on r. Djordjola (Kvaisi, Soth Ossetia, V. Iri), 1 on r. Dzirula (V. Ceva), 1 on r. Chkherimela (V. Orjonikidze, Imereti), 1 on r. Tkibuli (C. Tkibuli, Imereti), 1 on r. Khanistskali (T. Bagdati), 1 on r. Ogaskura (C. Kutaisi, Imereti), 1 on r. Lukhuni (V. Uravi), 1 on r. Gubistskali (mouth), 1 on r. Tekhuri (T. Senaki), 1 on r. Lagoba (T. Samtredia) and 1 on r. Abasha (V. Sagvazao). Systematic sampling was conducted on 9 points. On others only intermittent monitoring was carried out[35]. There was 1 sampling point on

[35] Rioni, Town Oni Racha 0.5 km above Oni, 2.2 km above the bridge, 1989; Rioni, Villige Namokhvani Racha 0.3 km below Nmokhvani, 1954; Rioni, Kutaisi-1 Imereti 0.5 km above the town Kutaisi, 1983; Rioni, Poti-1 Megrelia 0.8 km above south mouth of Rioni, 1973; Rioni, Poti-2 Megrelia 3.25 km above Poti, 0.15 km below sluice, 1973; Djordjola, Kvaisi- South Ossetia Kvaisi, 0.96 km above the bridge, 1974; Rioni, Samtredia-1, Imereti In Samtredia, 4.5 km above Ochapa inflow, 1983; Kvirila, Town Chiatura Chiatura 12.6 km above Chiatura, 1940; Kvirila, Town Zestafoni Imereti 2.4 km above town Zestafoni, directly by the bridge, 1940; Dzirula, Villige Ceva Imereti 0.2 km below Ceva, 0.4 km above the railway bridge, 1973; Chkherimela, Ordjonikidze-1 Imereti 0.16 km above Ordjonikidze, near the water-post, 1965; Tkibuli, Tkibuli-1 Imereti In Tkibuli, 50 m below Shaori Hydrostation, 1967; Khanisckali, Bagdati-1 Imereti 50 m above Bagdati, 1965; Ogaskura, Kutaisi-1 Imereti In Kutaisi, 3 km above the bridge, 1967; Djordjola, Villige Iri Kartli 0.4 km below Iri, 0.16 km above the inflow, 1978; Lukhuni, Villige Uravi Racha 50 m above Uravi, 0.8 km above the bridge, 1987; Gubisckhali, mouth Imereti 0.4 km above the mouth, 1988; Rioni, Sakochakidze Imereti In Sakhochakhidze, on ferry level, near the water-post, 1938; Tekhura, Tskhakaia-1 Megrelia 0.25 km above Poti, 0.8 km above the mouth of Rioni, 1987; Ckhenistskali, Khidi Imereti In Khidi, 0.5 km below the stream inflow, 1967; Lagoba, Samtredia-1 Imereti 3.57 km above Samtredia, 1988; Tskhenistskhali, the mouth Megrelia 1 km above the outflow, in Pirveli Maisi, 1988; Abasha, Villige Sagvazavo 43 Megrelia 3.8 km below Sagvazavo, 5 km below the water-post, 1988; Tskhenistskhali, Ludji Imereti 1.6 km below Lurdji, 138 km above the outflow, 1989

Paliastomi lake as well. Currently, there are 13 active river monitoring points in the basin – 6 on r. Rioni (Oni, 2 in upstream and downstream areas of Kutaisi, 2 in Poti, 1 in V. Chaladidi before Poti), 1 on r. Jejora (V. Iri, Oni municipality) 3 on r. Kvirila (upstream and downstream of Chiatura, C. Zestaphoni), 2 on r. Ogaskura (upstream and downstream of Kutaisi) and, 1 on Tskenistskali (mouth). There is also 1 monitoring point on Lake Paliastomi (for location of current water quality sampling points in Georgia please refers to figure 2 in annex 15).

In addition to surface water quality monitoring, there was a periodic monitoring of groundwaters until 90s. Samples were taken from groundwaters of Racha-Lechkhumi and Kvemo Svaneti, Samegrelo and Tskaltubo-Argveti-Dzirula Artesian basins. In Racha-Lechkhumi and Kvemo Svaneti increased levels of pollutants were detected only in 5 springs that were contaminated with iron, boron and nitrates; In Samegrelo-Zemo Svaneti samples were taken from 79 boreholes that showed water contamination by ammonia, nitrates and nitrites as well as by iron and manganese ions and phenols. In Imereti samples were taken from 6 springs and 47 boreholes that showed contamination by biogenic substances, phenols, etc. In addition, samples taken from the water sources within Kutaisi region, showed groundwater contamination by heavy metals.

Recent water quality monitoring data (2005-2009) show lower than Georgian MACs for BOD_5 for every river and location. Values for this component are exceeded in Lake Paliastomi for 2008-2009, attributed mostly to the pollution of waters by the rivers flowing from Ajara and Guria. High concentrations of the nitrite were recorded for every year, 2-3 times exceeding the EU limit and Georgian MAC for fish, particularly in the donwstream areas and the river mouth. The values for ammonia were also very high, exceeding Georgian MAC and the EU limit 2 folds and more every year in the lower reaches and the river mouth. High concentrations of ammonia and nitrites were atributed to the untreated wastewater discharges from sewerage systems and industrial facilities as well as to the agriculture run-off. Concentration of manganese was high in the river Kvirila attributed to the discharges and runoff from industrial processes, which have led to considerable damage to the ecosystems of these rivers (for more details enclosed see the figures of water quality parameters in the waters of the Black Sea Basin please refer to figures 3-10 and 14-15in annex 15).

An independent monitoring conducted under the Finish supported Rioni River Basin monitoring project in 2008, has shown high acidity of the river Rioni near Poti landfill and high concentration of manganese (3.09 mg/l) in r. Kvirila before Chiatura.

Another independent study of environmental quality of the streams of the Rioni basin in the middle course was conducted jointly by the Georgian National Center for Disease Control and Public Health and the Science and Technology Center, Ukraine under the financial assistance of USEPA and USDoS in 2009-2010. Air, water, both surface and ground and, stream sediment samples were taken in April 2009, September 2009 and June 2010. A total of 79 environmental samples were collected. Sampling sites included 5 public water supply springs/well (Grudo, Monasteri, Lejubani, Gagarin draw well, Sakurglia), 7 points on the Kvirila River and it's tributaries and, from the effluent of manganese enrichment plant. Sediment samples were collected in April and September 2009 at five locations along the Kvirila river and its tributaries, including the point on Kvirila river near the village of Sareki, the Jruchula River, the point of Kvirila River near the confluence with Shuqruti Gele, point on Kvirila before the manganese enrichment plant and, downstream the plant the Kivirila near the village of Tiri (for the map of the sampling points please refer to figure 14 in annex 15).

Samples were analyzed at the following laboratories : Scientific-Resarch firm “Gamma”, the NCDC, NEA and US EPA lab in Denver , CO. Water samples were analyzed for selected metals (Na, K, Al, Ni, Co, Cd, Mn, Fe, Cu), selected anions (nitrate, chloride, Sulfate), common parameters (pH, temperature, specific conductance, dissolved oxygen, alkalinity, hardness, salinity), biochemical oxygen demand, chemical oxygen demand and microbiological constituents (coli form e-coli).

Out of 5 samples taken from rural drinking water supplies, samples of three systems (Grudo, Monasteri and Lejbani) were contaminated by coliform bacteria. Ecoli was present in all samples and exceeded 4 cpu/100 ml in samples from Grudo and Monasteri village supply systems. Specific conductance in samples from the Monasteri water supply exceeded 700 µs/cm. Concentrations for dissolved Mn, Fe, and Ni exceeded the Maximum Allowable Concentration (MAC) in samples from the Gagrin draw. Total end dissolved concentration for the metals in samples from the five public drinking water supplies were also high as as in the case for groundwater samples. These water supplies are not reliable from the epidemic point of view.

Surface water samples were collected from upstream to downstream areas of r. Kvirila watershed at following 7 locations: 1) Kvirila near the village of Sereki, 2) Jruchula (a right bank tributary of the kvirala River, 2) DarkveTi Gele, right bank tributary of the Jruchula River), 4) Kvirila near the confluence with Shuqruti Gele (a left bank tributary), 5) Rgani Gele (a right bank tributary to Kvirila RIver), 6) Kvirila before the Central Keeping Factory, and 7) Kvirila River near the village of Tiri. The discharge from the manganese processing facility happens in Kvirila River between the Shuqruti strem and the Rgani strem confluence.

The laboratory analysis has showed MAC exceedances (MAC for Mn is 0.1 mg/l and, for Fe – 0.3mg/l) for Mn and Fe in all surface water samples. Concentrations of total Mn and Fe exceeded the MAC 12.6 and 40.6 times, respectively in the samples taken from the Darkvetis Gele. Concentrations of total cobalt and total nickel slightly exceeded the MAC in the samples from Darkveti. Specific conductance (electric conductivity), measured in units of siemens per centimeter exceeded 1500 µs/cm. Concentrations of the total Mn were less than the MAC in the Jruchula River, however total Fe concentrations exceeded the MAC 8.6 times. Concentrations of total Mn and Fe exceeded the MAC 2.1 and 55 times in samples taken from the Shuqruti Gele together with specific conductance amounting to 1,090 µs/cm. Samples from Rgani stream exceeded the Mn MAC by 5.4 times and the MAC for Fe – by 70.3 times. Total content of Mn and Fe exceeded the MAC 14.1 and 8.3 times in samples taken from the Kvirila before the manganese processing plant. Concentrations of total manganese and iron in samples taken from the Kvirila River after the industrial facility were higher and exceeded the MAC for Mn and Fe 14.7 and 45.3 times respectively. Manganese loads in the Kvirila River are dominated by suspended manganese.

Concentrations of dissolved metals in samples from the seven surface water locations were below the MAC except for dissolved Mn in samples from Darkveti Gele and the Kvirila River near the confluence with Shuqruti Gele. Concentrations of dissolved Mn increased at Darkveti from April 2009 (1.26 mg/l) to September 2009 (2.4 mg/l) to June 2010 (6.6 mg/l). Specific conductance and alkalinity were also high at this location, which facilitates the transformation of the manganese into soluble form in water. The manganese is not easily soluble metal and transported as suspended particles as well as the iron.

In accordance with the Sanitary Rules 2.1.5.001-01 “Sanitary Rules and norms on Protect Surface Water Against Pollution” the high total manganese concentrations in the Kvirila river before and after the CKF as well as Darkveti Gele would be classified as water contaminations in “extremely high degree”.

Analysis of samples taken from effluent discharges of the Peroxides Enrichment Factory, “Perophi” (PEROF) has showed concentrations for total Mn ranging from 0.85 to 7.62 mg/l/, concentrations of dissolved Mn ranging from <0.2 mg/l to 0.34 mg/l and; concentrations of dissolved Fe ranging from 0.2 to 0.68 mg/l. A single sample (April 2009) was analyzed for total Fe and the concentration was 18.36 mg/l. Thus, the discharge from the enrichment factory contains high level of total Mn and Fe but low level of dissolved Mn and Fe. The total concentrations for the other metals were below the MAC.

Regarding the river sediment content, Mn concentration in sediment samples taken from the Kvirila River before and after the enrichment plant was high, ranging from 80,000 to 95,000 ppm. The content of Fe was also elevated, varying from 24,000 to 35,500 ppm. Nickel concentrations in the sediment samples collected from all five locations exceeded the MAC (4.0 ppm), with 290 ppm value reported for the sample taken from Kvirila before the plant and with 250 ppm value reported for the sample taken near the village Tiri. Sediment samples collected from the same locations in September 2009 had similar nickel concentrations. In addition later samples contained high amounts of Co, Cd and Cu. In Georgia, there are are no MACs for surface water sediment. If we use the metal MACs for soil than we can say that Kvirila bottom sediments before and after the manganese enrichment plant fall under the "highly polluted soils" category, whereas Shukruti Gele and the Jrujula River bottom sediment – under the "slightly polluted soils." Such metals as nickel, cobalt, cadmium and copper are associated with the manganese ore, while iron and aluminum are in negative correlation with those elements.

Thus, the study has showed high concentrations of common manganese and iron along the entire reach of the Kvirila River. The 15-fold exceedance of the Mn MAC has been recorded below the managese enrichment plant. Waters of Darkveti, Shukhruti and Darkveti rivers have been also contaminated with total manganese, with from 2 to 12-fold exceedance of the MAC and with toal iron, with from 8 to 55-fold exceedance of the MAC. Iron and manganese in the Kvirila River have been mostly represented as suspended particles. There have been very small amounts of dissolved metals of Mn and Fe in the waters. It can be concluded that the major sources of manganese and iron pollution of the Kvirila River are effluent discharges from manganese (peroxide) enrichment plant, tailings and waste rocks of manganese ore disposed on the floodplain areas of the Kvirila River; Kvirila tributaries – Shukruti and Darkveti streams. River bottom sediments have been also heavily polluted by manganese and associated to it the metals, particularly, nickel. More specifically, Kvirila River bottom sediments upstream and downstream of the manganese enrichment plant have contained high concentrations of manganese and iron, while bottom sediments of Shuqruti Gele and the Jrujula River have relatively low concentrations of these metals. Nickel concentrations exceeded the soil MAC in all sediment samples and have been high before and after manganese enrichment plant ranging from 290 ppm to 250 ppm.

Regarding the drinking water quality, waters from Grudom Monasteri and Ledjbani rural drinking water systems contained high ecoli counts and samples from Grudo and Ledjbani – high nitrate concentrations. Dissolved ferrous metals of Mn, Fe and Ni exceeded maximum allowable concentrations in samples from Gagarin well. However, it is not clear whether or not this is attributed to the high background levels occurring from natural ores or from the leachates from mining sites or from both of them.

There are also some baselines studies of environmental quality of Kvirila river and its tributaries carried out under the EIA processes for manganese enrichment plants from 2008 through 2010 by the scientific-research firm “Gamma” that has also showed significant pollution of the r. Kvirila and its tributaries by manganese, iron and suspended solids (for more details please refer to the table of results of water quality analysis of the r. Kvirila and its tributaries, table 1, annex 15).

As it was mentioned before, store houses of obsolete pesticides, where 10 tons of chemicals with about 65% of PoPs pesticides were stored in Imereti region, imposed threats to human health and environment. Although the chemicals have been collected, re-packed and stored in temporary disposal site outside Rioni Basin, surrounding soils and both ground and surface waters might be contaminated by these chemicals. During the inventory of POPs conducted in 2004-2005, samples were taken from ground and surface waters. In Rioni basin, three samples taken from the r. Rioni before Kutaisi, after Samtredia and at Sakochakidze gauging site showed water contamination by heptachlor and DDT and all five samples taken from the ground waters – contamination by heptachlor. 2 out of 15 samples taken from fish (mullet, Rioni River at Poti; and bullhead, Kaparchina River) showed contents of heptachlor.

4.2 Land Resources

4.2.1 Pressures on Land Resources

General. Pressures on land resources of Georgia are imposed by both natural and anthropogenic factors. Among the natural factors, wind and water erosion, natural disasters including landslides, mudflows and floods and the climate change contribute greatly to the land degradation. Among anthropogenic factors various land uses, including agriculture, urban and industrial land uses put pressures on the quantity and the quality of land resources. More specifically, inproper agriculture practices (intensive land cultivation, over use of agrochemicals, intensive irrigation, slope ploughing, use of monocultures, use of low till/no till technologies, overgrazing, etc), intensive urban development and industrial, including mining activities affect greatly land resources.

In general, erosion affects about 1 mln ha of total agriculture land in Georgia, including 300,000 ha arable land and 700,000 ha pasture land. This is about 33% of total agriculture lands (~ 3mln ha); 11 percent of agriculture land is affected by acidity; 7-8 percent – by waterlogging due to the improper land drainage; over 5% – by excessive potassium and nitrates, and about 7% - by salinity.

Alazani River Basin. As it was discribed in above chapters, Alazani river basin is predominantely a rural area with agriculture being a leading sector of economy. Viticulture, crop production and livestock raising are the major branches of agriculture there. Although some new crops are introduced in Kakheti region, e.g. olive, kiwi, etc. traditional crops, like grapes, wheat and barley are cultivated most widely.

During the Soviet period, agriculture lands, consolidated under large collective farms of state ownership were intensively treated with pesticides and mineral fertilizers. In addition, large areas were irrigated in Kakheti region. Due to the oroclimatic peculiaries, arid and semi-arid areas of Kakheti region could not be cultivated without any irrigation. Thus, pressures on the land resources were inserted from intensive use of chemicals, including PoPs pesticides, application of unsustainable land management practicies, including soil compaction by heavy machinery, intensitve irrigation and, overgrazing.

After the break-up of the Soviet Union, large-sized collective farms seased to exist and up to 1 ha were given to each farmer under their private ownership. The post-Soviet drastic economic turn-down caused the decline in all economic activities, includuing agriculture activities. Farmers didn't have resources to buy agrochemicals and the central system for import and distribution for these chemicasl has also diminished. Therefore, the use of agrochemicals has reduced dramatically, e.g. utilization of fertilizers has dropped from 240-250 kg/ha in late 1980s to only 10 kg/ha in 1994 and 40 kg/ha in 2005.The use of pesticides has declined more than the use of fertilizers. Total annual imports of pesticides in accordance with official statistics amounted to 3,500-3,800 tons in 1998-2007 and to 1,000-1,300 tons in 2007-2009, while in 1980s the total consumption was about 30,000-35,000 tons annually and the vast majority of pesticides were imported. Currently, among agrochemicals the most widely used are less toxic nitrogenous fertilizers and the manure. However, their overuse can cause soil salinization and acidification. The use of manure similar to the use of other fertilizers has dropped in the country from 3.5 mln tons to 0.5 mln tons. However, the amount is still significant and soils might be polluted by various substances, including salts of heavy metals as well as by microorganisms.

Regarding the irrigation, many systems stopped functioning due to the electricity shortage or absolesence of the systems. Those, which are currently operational work at lower capacities due to the reduced irrigation water demand. Therefore, the pressures from the use of agrochemicals and irrigations have declined. However, they have already damaged vast areas of agriculture lands in the Alazani valley.

Meanwhile, the state due to the lack of finances was unable to implement land reclamation activities, including erosion prevention and mitigation measures. Hence, decrease in total area of cultivated agriculture lands and increase in low productivity and eroded lands has happend. This trend is maintained nowadays.

Regarding the livestock raising, cattle, pig and sheep breeding are very important branches of the agriculture. There is a growning trend of sheep breeding in Akhmeta, Dedoplistskaro, Sagarejo, Lagodekhi and Signaghi municipalitiess. Intensive grazing on sub-alpine and alpine meadows is a common practice in the region[36]. There are frequent cases of illegal grazing of livestock in sub-alpine and alpine zones of the Tusheti National park and a conflict between the villagers and the park administration about this issue arise from time to time.

At present, the pressure on land resources among others is imposed by the forest cutting. Before the Rose revolution, there was a large-scale illegal forest cutting all over Georgia for export and fuel-wood consumption. Currently, illegal cutting for export is completely eliminated. However, local population still extensively uses wood for fuel. In particular, former collective farm forests designated as forests of local importance are under the high pressure. Among them are the wind breaks, which are of utmost importance for semi-arid and arid areas of Kakheti region. For instance, in Dedoplistskaro municipalities over 1,770 ha was covered with wind breaks in late 80s to protect arable lands from wind erosion. Howeever, due to the power crisis the majority of protective forests were cut down. Currently, through assistance of the GTZ restoration of these wind breaks is undergoing. It is envisaged to rebuild 1,500 ha of wind-shields (pressures and impacts on forest resources are discussed in more detail below).

[36] In Sagerjo for instance there are 30,572 heads of cattle and 117,777 heads of sheep; In Tusheti for instance, about 1000 families live either permanently or seasonally. In accordance with the Tushetian shephards, about 60-70% of families keep on average 300-400 heads of sheep. Some of the families keep even up to 2,000 heads.

Along with above pressures, the quality of land resources is affected by leachaters and drainage waters from waste disposal and dump sites, open pit mining operations and urban surface run-off as well as by sewage and industrial watewater discharges on the surface relief.

Until recently, obsolete pesticide store houses created significant threats to the waters and soils of the region. Over 230 tons of old pesticides with more than 65% of PoPs content were stored there or mixed with soil. Recently, the government has moved these pesticided together with a part of contaminated soils to the temorary storate facility. In addition, total of 55 Soviet-made transformers were registered during the 2003-2004 PoPs inventory, of which two were found to be PCB containing with about 4.8 tons of PCB. The transformers are pretty outdated and leakage could happen from them. Or, once discarded those transformers would create a danger to the soils and ground waters in the areas of their disposal.

Active geodynamic processes as well as unfavorable hydrometeorological events, including landslides, mudflows, droughts, hail, floods that are frequent phenomena in Alazani river basin affect significantly the state of the land resources within the targeted territory.

In general, the east and the south-east part of the Alazani river basin (Southern Slopes of the Greater Caucasus) where Kvareli and Lagodekhi municipalities are located is classified as high risk and hazard zone of flash floods (for more details on floods please refer to figures 1-3 in annex 13). The r. Alazani itself does not directly threaten settlements but the tributaries do in areas where the runoff concentration time is around 30 minutes. (The concentration time is a hydrological term, which means the time period between the rain stated water running on the surface gets into the river bed from the most distanced point of the watershed). Both left and right banks of the Alazani river basin are classified as high mud-flow prone areas. Following cities and towns as well as surrounding villages are under high risk of mud-flows: Akhemta, Telavi, Gurjaani, Sagarejo, Signagi, Kvareli and Lagodekhi (for more details please refer to the map of the mud-flow prone areas of Georgia, figure 4, annex 13) catastrophic landslides are characteristic to Kvareli, Sagarejo, Signagi and Lagodekhi municipalities. Floods and mud/stone flows are specific to the left-side tributaries, with sources from the North on the Caucasus slopes; Mud and stone flows - to the right side tributaries, where river beds are dry most of the time, take their sources on the slopes of Tsiv-Gombori Mountains as a result of rainstorms.

Since 2004, geodynamic processes have become much more active relative to the background levels. 2009 and 2010 were the years with extreme activity of the landslides and mudflows. One of the major causes for these processes were heavy rains. In 2010 total percipitation in Kakheti significantly exceeded the multi-year mean value.

Among various municipalities of Kakheti region, Sagarejo and Sighnaghi municipalities followed by Lagodekhi are the most susceptible to landslides. High frequency and intensity of these processes are attributed to the presence of easily degradable molassic rock strata contained in the Gombori mountain range, as well as to the seismo-gravity. Throughout the target territory, the process of soil degradation is aggravated by rock avalanches and rockfalls, which are primarily typical for steep-slope mountains composed of rocky strata (such as the Caucasus mountain slopes on the border of the region). The target region is located in a seismically active area, where periodically occurring earthquakes instigate the development of rock avalanches and rockfalls.

In ***Sagarejo municipality*** due to the presence of the rock strata with a low resistance to the processes of erosion and denudation, as well as due to the moderately continental climate landslides are very frequent and intensitve. Furthermore, the area is characterized by high seismic activity (8 on the Richter magnitude scale), which also augments the development of rock avalanches and rockfalls.The Gombori mountain range, located within the Sagarejo municipality, represents one of the most complex regions of Georgia in terms of the development of landslide processes.

In Sighnaghi municipality, within the boundaries of the south-eastern part of the Gombori ridge, landslide, debris flow, lateral erosion and gullying are active and are the most prevalent along the right bank of the Alazani River. Inundation due to excessive flooding takes place in separate municipalities. Seismic activity plays a major part in the development of landslide processes. In the town of Sighnaghi, landslides are active on the northern slopes of the Dabakhani and Tavgatekhila ravines, as well as on the Nukriani-Sighnaghi and Sighnaghi-Bodbe road segments. Highly active debris flow processes are typical to the major part of the valleys and ravines developed on molassic sediment. For instance, debris flow in the Riv. Anagi valley (right hand tributary of the Riv. Alazani) originates at erosive-gravitational slope, characterized with severe erosion and landslides. When the debris flow is composed of mud and rocks, its sedimentary deposit generally occurs once a year and amounts to hundreds of cubic meters of debris. When the debris flow consists of water and rocks, its sedimentary deposit generally takes place bi-annually and amounts to hundreds of cubic meters of debris. The ravine passing through the village of Vakiri also generates significant debris flows, which mainly consist of mud and rocks. The flow of debris generally occurs on a bi-annual basis and the amount of debris reaches hundreds of cubic meters. Lateral erosion instigated by rivers, as well as inundation events caused by flooding take place throughout the entire territory of the municipality. A particularly complicated situation prevails on the right bank of the Riv. Alazani, along the Georgia-Azerbaijan border, where the riverbed is characterized by meanders. Due to the easily erodable rock layer composition of the flood-plain zone, the river produces intensive lateral erosion along its right bank, as a result of which, in some areas the river cuts through its bed in a linear manner.

Gullying processes are principally typical to the south-western part of the Sighnaghi municipality. These processes also occur on the Katar-Keli mountain range, in the Naomari valley, on the Pirukughma mountain range, and on the mountains of Mlashe and Kachalmta, as well as their adjacent territories. As a result of processes, the degree of damage to lands is so high that almost 25%-30% become unsuitable for use.

Debris flows are more or less present in the Dedoplistskaro municipality, mainly as gully–type deposits. Sedimentation of numerous ravines by debris occurs approximately once a year in the volume of several thousand cubic meters. Along with planar erosion, gully erosion is widespread in the municipality.

Of the natural hazards occurring on the territory of the Lagodekhi municipality, debris flow and severe, catastrophic floods should be highlighted in particular. Debris flows are generally widespread over the southern slope of the Caucasus mountain range. As a result of flooding, the inundation of riverside territories generally takes place in the lower areas of the municipality – along the left bank of the Riv. Alazani and on the middle and lower sections of its left estuaries (Kabali, Ninoskhevi, Lagodekhiskhevi, etc.). Riverbank erosion mainly occurs on the southern slope and foothills of the Caucasus, where these processes damage coastal areas along all rivers. It should be noted that the territory of the Lagodekhi municipality is characterized by high seismic activity (9 on the Richter magnitude scale). Within the boundaries of the municipality, almost all river basins on the southern slope of the Caucasus create favorable conditions for the creation and development of mud-flows.

In terms of mudflows, the entire southern slope of the Greater Caucasus is mud-flow prone area. There are numerous dry beds of rivers that create mudflow basins there. The largest mudflow basin is the r. Duruji basin, where ***Kvareli municality*** and in particular, the city of Kvareli is located. The basin is spread on the central part of the southern slope of the Greater Caucasus. High frequency and intensity of these processes are caused by the contrast climate conditions, complex relief and specific lithological composition of the sedimentary rocks. The high inclination of river valleys and intensive erosion of sediments is the necessary condition for the development of mudflows. The river (26 km) in the upper course flows in the narrow gorge composed of sand-stones. In the middle-course the canyon is relatively wide and is composed of alluvial-delluvial deposits. In the lower course, proluvial-delluvial deposits become stronger (500 m tick) and are represented by finer particles. Total area of the alluvial fan is 95 km2. The river basin was formed in the Tertiary period. Its geologic composition is: 1. clay shale, the structure of which is represented by fine grains with insertions of low thickness sandstones and shale; 2. sandstones; 3. Carbonaceous clays; 4. Upper Jurassic and Lower Cretaceous (chalk) period sediments, which emerge on the surface as massive limestone sequencing with sandy and mergel shale and breccia limestone; 5. Quaternary or Neogene layer represented by terrace and riverine delluvial and prolluvial sediments. It is known that permanent mudflow area consists of 20 km2 in the Duruji basin and the total voume of solid matter amounts to 500 mln m3. As a result of geodynamic processes about 1 mln m3 solid matter is washed down to the river annually and for one medium-intensity mudflow the total volume of sediment is 300,000-640,000 m3.

Recently, mudflow processes became extremely frequent and intence on Tsiv-Gombori range that create high danger to the city of Telavi. Therefore, the area has been reclisifed by the NEA as being at extremely high risk and hazard of mudflows. 20 years ago the reventment structure were built that well-protected the city of Telavi. However, it now needs rehabilitation. Otherwise, the city will be endangered mudflows.

Climate change is another natural factor greatly affecting the natural resource base, including land resources and ecosystems of the Alazani river basin. It has already imposed serious pressures on Kakheti region and in particular, in Dedoplistskaro municipality. Mean air temperature during the last decade (1990-2005) has increased by 0.6^0C in comparison with the mean air temperature of the second half of the 20th century (1955-1970) there. The same trend is observed for absolute maximum temperature that from 32.7^0C has increased to 34.8^0C (by 2.1^0C), indicating on intensification of droughts in the region. As for the precipitation, although the multi-year averages show an increase by 6%, there is about 27-13mm decrease in monthly precipitation in summer period and 9-15mm increase during the spring period that also indicates on intensification of droughts in the region. Moisterizing conditions have also worsened in the period from April through July and desertification climate potential measured as a temperature of air 2m above the ground and a temeratura of soil 2 m under the ground has increased up to 6 folds for air temperature and over 4 folds for soil during the summer time and the early fall. This indicates on the acceleration of desertification process in the municipality. Furthermore, there is a clear trend of reducing the wind speed during the last decade. Frequency and intensity of droughts, recurrance rate of which is over 20% in the municipalities, has increased as well. More specifically, in the last decade average duration of drought (60 days) has increased by 22%, compared with the mean value of 1952-1979 (49 days). The frequency of drought has also increased from an average of 0.7/y to 0.9/y. This trend has been become especially evident in the last decade (1998-2007), when 17 cases have been observed during 10 years, resulting in the growth of drought frequency up to 1.7/y, and the raise in mean annual duration up to 72 days. The fequency of powerful winds with 30 m/s or higher velocity has also increased since 1980s.

In accordance with recent predictions made under the SNC, above trend of aridization will be maintained wthin next 90-year period. Namely, annual mean air temperature increase by 4.6^{0}C reaching 15.4^{0}C, maintaining of annual sums of precipitation at the present level (606 mm) and a slight decrease (about 3%) in relative humidity, with unchanged wind speed is expected by 2100. This in turn will aggrevate the watering/wetting regime in the region and raises its desertification potential. The above-discussed anticipated significant changes in climate elements are likely to affect the water resources, ecosystems, and different sectors of the economy.

Iori River Basin. In Iori river basin, the largest pressures on land resources are put in middle to lower reaches. In the middle course there are densely populated urban and rural areas with prevailing urban and agriculture land uses.

In general, the basin similar to the Alazani river basin is predominantly agriculture based area. Upper reaches of the basin are not densely populated and thus, there are no large areas of agriculture lands. Middle to lower reaches of the region are shared by the Gurjaani, Signagi, Sagarejo, Dedoplistskaro and Gardabani municipalities. Large agriculture areas are stretched there. While viticulture is a major branch of agriculture in Gurjaani and Sagarejo municipalities, wheat, barley, oat and sunflower production is very significant in Dedoplistskaro and Signagi municipalities.

In Dedoplistskaro municipalities, where very dry climate prevails and soils are infertile, lands including mountainous areas were irrigated intensively during the Soviet period. Slope irrigation accelerates the erosion and the wash out of the soil. Gypsum and clay is brought down to the plain and the vegetation cannot recover. In order to irrigate lands at an altitude of 500-600 m, electric pumps were used, which were very ineffective means for irrigation. Although, most of such practices are no more applied, the vast areas of lands became severely eroded and non-usable for agriculture.

Livestock breeding is the most widespread economic activity in semi-arid areas of Gardabani, Sagarejo, Signagi and Dedoplistskaro municipalities. The area is well-known for its winter pastures for sheep. Here almost 40% of the land is occupied by such pastures. Nomadic sheep breeding is a traditional activity there. Shepherds from various regions of Georgia, including those from Kvareli, Dusheti, Telavi, Kazbegi, Tianeti, Akhmeta (predominantly Tush Sheppard) graze their sheep in winter time. Most of the pastures are owned privately and rented to the shepherds for a long-term period. Thus, shepherds do not have much interest to follow sustainable grazing practices. It is not efficient for shepherds to keep less than 300 heads of a sheep and the optimum income is received when one owns/keeps 700-1000 heads of sheep. Each of the plot of the pasture is about 300-350 ha. Recently Arabs and Iranians have expressed their interest in Tushetian sheep and purchased significant amount of sheep last several years (e.g. about 200,000 heads of the sheep were exported to Iran in 2010). During the first two yeas of the export of the sheep, Overall amount of sheep heads in Georgia has declined from 603,000 in 2008 to 402,000 in 2009, since there was no special care to compensate the number of exported heads of the sheep by newborns. In total, 90,000 heads of sheep and about 5,000 heads of cattle are grazed in Shiraki winter pastures. While during the Soviet period, fodder was given to sheep as a complementary food, currently sheep feeding only through grazing is practiced that poses additional pressure on pastures. Furthermore, due to the plowing of transitional pastures, grazing season in winter pastures has been prolonged for additional two months that also increased the pressure on the pastures. During droughty seasons shepherds graze their sheep even in floodplain forests. In addition, illegal grazing in protected areas is a problem. If the grass is better in areas not designated for grazing within the Vashlovani National Park, shepherds from Tusheti who graze about 39,000 heads of sheep, ignore the boundaries and graze their sheep in areas with better grass. Furthermore, there is a common practice by shepherds to burn and even plough pastures in order to stimulate the grass growth that completely destroys the topsoil of pastures.

In addition to unsustainable grazing practices, cutting of wind breaks by shepherds and villagers for fuel wood affects the quality of pastures greatly, since the area is prone to winds that remove topsoil from the pasture lands.

Apart from unsustainable agriculture practices, pressures on the land resources of the region are imposed by densely populated urban areas of Gurjaani, Sagarejo, Signagi and Dedoplistskaro that pollute the soil by run off from urban areas, waste disposal sites and open mining operations. There are a number of oil and gas fields in Sagarejo and Dedoplistskaro municipalities that also impose pressures on the land resources. Furthermore, sewage and wastewaters from a number of industries and sanitation systems are discharged either in storm water canals or directly on the surface relief.

Mudflows and landslides are widespread phenomena in Tianeti, Sagarejo and Signagi municipalities (for more details on natural disasters please refer to annex 13). The Gombori mountain range, located ***within the Sagarejo municipality***, represents one of the most complex regions in Georgia in terms of the development of landslide processes. The most frequently landslides and debris flow occur around the summit zone of the Gombori mountain range and along the sloping inclines of river valleys. The massive development of slow-creeping landslides takes place in these areas. The deformation depth of this type of landslides reaches 50 meters. They are frequently provoked by the activity of strong earthquakes. It should be noted that there have been at least 22 incidences of 6-8 magnitude earthquakes on the Gombori mountain range and adjacent territories over the last five years. Within the Sagarejo municipality, the area of land occupied by such landslides encompasses 15 km^2. It is noteworthy that the formation of all rivers, valleys, and erosive ravines on the southern slope of the Gombori mountain range has been caused by landslide and gravitational processes, as well as by complex shapes of the relief. in areas of distribution of molassic deposits, virtually all valleys and ravines are characterized by very high debris flow activity. According to the level of damage caused by debris flows and their activity, the segment of the Gombori mountain range located within the Sagarejo municipality has been designated as an area of the highest risk for debris flows. One of the most substantial sources of debris flows is the Tvaltkhevi River, the one-time sedimentary output of which at times exceeds 100,000 m^3.

As mentioned above, along with debris flow processes, on the Iori Plateau gully erosion is widespread. Lateral erosion generally occurs along the foothills and accumulation plains, and along the rivers of Iori, Chailuri and other small rivers. High flood plains, as well as the first upper terraces of flood plains are eroded.

In Signagi municipality, gullying, debris flow and lateral erosion are generally prevalent along both banks of the Iori River and on the Iori Plateau. Riverbank erosion also takes place along both banks of the Riv. Iori (within the boundaries of the Iori Plateau).

Similar to Alazani river basin , climate change significant natural factor greatly affecting land resources and ecosystems of the Iori River Basin (details are described in Alazani part).

Rioni River Basin. In Rioni basin, the largest antrhopogenic pressures on land resources are posed in middle to low reaches of the basin predominantely from agriculture, industrial and urban development as well as from man-induced catchment and river flow alteration activities. Geodynamic processes, including landslides and mudflows are determining natural factors for soil erosion and land degradation in the upper reaches of the basin and, the floods and climate change – in the lower reaches of the basin (for more details on natural disasters please refer to the annex 13).

In terms of geodynamic processes, landslides and mudflows are widespread phenomena in Racha-Lechkhumi and Lower Svaneti as well as on Upper Imereti Plateau (Imereti upland). In accordance with the Ministry of Environment these processes have become more frequent and intense since 2000. They impose high pressures on the environment and the economy of the region. Morpho-geologic and climate peculiarities of the region together with seismic activity predetermine high frequency of landslides and mudflows here. In particular, 6 sections in Lentekhi municipality, 4 sections in Tsageri municipality, 5 sections in Ambrolauri municipality and 3 sections in Oni municipality are the most susceptible to landslides and debris flows. Racha-Lechkhumi syncline depression is extremely affected by landslides that develop as surface landslides. In terms of types of movements, landslide flows are typical to the areas near villages Tola and Gendushi; slides – to the areas near villages Bugeuli and Djoshkha and; lateral spreads – to the areas near villages Chorjo and Znakva. Landslides develop along the slopes in Oligocene-Miocene, late Jurassic and alluvial-delluvial deposits. On Upper Imereti Plateau, landslides are formed in alluvial-delluvial sediments.

The surrounding areas of the Okriba settlement in Imereti between the river basins of Rioni and Tskenistskali, are highly affected by landslides that develop in Cretaceous porphyries and Cimmerian deposits.

Kolketi foothills located to the north of the Kolkheti Plain between the rivers of Enguri and Tskenistskali are also significantly affected by landslides, though at lesser extent than Okriba area. Landslides here develop as lateral spreads.

Moderately affected area is the northern slope of Adjara-Imereti range, where landslides develop in volcanogenic delluvial deposits.

As it was discussed above in the part 5.1.1, climate change induced sea level rise and tectonic sinking of the land as well as man-induced river and sediment flow alteration put high pressures on the coastal area of the Black Sea.

Similar to other pilot basins, current pressures from the use of agriculture chemicals and extensive cultivation of arable lands are reduced due to the overall decrease in agriculture activities. Nowadays, nitrogenous mineral fertilizers are common widely used, which are much less toxic than chlororganic pesticides used in the past. However, due to the widespread phenomena of American butterfly in Samegrelo and parts of the Imereti regions, the pesticides are extensively used there through air spraying.

There are high pressures on land resources from densely populated Kutaisi-Zestaphoni agglomeration and the sea port Poti where major industries and urban infrastructure are concentrated. Hence, surface run-off from urban areas, drainage waters from waste disposal sites as well as wastewater discharges from sewerage systems and industries on the surface relief impose pressures on the condition of land resources.

Furthermore, a numerous small to medium scale open-pit mining operations on-going almost everywhere of the basin, pose threats to the surrounding land resources. The highest pressures are imposed to the land resources from manganese open-pit extraction in Chiatura and nearby settlements. Hazardous wastes generated by Zestaphoni ferro-alloy plant, Chiatura manganese enrichment plant, many small-size ferrous metal production plants operating in various settlements of Imereti (e.g. Terjola, Samtredia, etc) also are the sources of soil pollution by heavy metals and unintentional PoPs (PCDD/PCDF – dioxines/furanes). For instance, in the Tchiatura manganese enrichment plant that has been modified and put into operations in 2009, about 20,000 tons of waste rock and 12,000 tons of slag are generated. Rock wastes are then transported to the open-pit mine, while dehydrated slag to the slag disposal area.

In Georgia, in late 80s the second largest polluter by dioxines and furanes was ferrous and non-ferrous metal production industry, after uncontrolled combustion processes and, contributed about 17% to the total emissions of these PoPs. Currently, metal industries together with pulp, paper, wood processing industries, both operating and non-functioning/abandoned ones might be potential sources of soil contamination by PCDD/PCDF.

Many of Soviet-made transformers and capacitors, still in use in power distribution systems contain PCBs that are another group of PoPs. PCBs were used as lubricants or conductors in electricity transmission and distribution systems. Total of 424 potentially PCB containing transformers were detected during 2003-2004 PoPs inventory in Racha-Lechkhumi and Qvemo Svaneti, Imereti and, Samegrelo-Zemo Svaneti regions, of which 199 were located in Samegrelo-Zemo Svaneti and 161 – in Imereti. Among those, only 20 pieces of equipment contained PCBs, 8 in Imereti, 6 in Racha-Leckhumi, 2 in Poti and 4 in Samegrelo-Zemo Svaneti. Total amount of PCB containing and PCB contaminated oil was estimated at 152 tons, of which 90 tons were found in Imereti, 46 tons – in Poti, 18.4 tons – in Samegrelo-Zem Svaneti, 17.1 tons – in Lechkumi and Kvemo Svaneti and 16 tons – in Racha. Once discarded these equipment will create a danger to the soils and ground waters. In addition, those transformers and capacitors, which are in poor condition (e.g. corroded) and the leakage happens from them, pollute the nearby environment.

Finally, as it was described above in water resources part 5.1.1, abandoned arsenic mines in Racha-Lechkumi through the surface run-off and leachates contaminate soils and groundwaters of nearby territories with highly toxic substances.

Old Russian military base in Samegrelo has also to be studed for its underground communications system in order to find out whether or not toxic chemicals or toxic chemicals containing equipment are kept there.

Furthermore, construction of large-scale Namakhvani HPP cascade and Alpana 70MW HPP project will impose significant pressures on land resources of the project area and low reaches of the Rioni basin. More specifically, total construction site is 1,743.13 ha, of which 924.71 ha will be under the reservoirs and river banks, 677 ha – by roads, 900ha – by industrial facilities and 511 ha – by main engineering facilities. Total of 296.94 ha of agriculture lands (vineyards, hayfields, pastures, etc.) and 261.44 ha of forested areas of Tsageri, Tskaltubo and Tkibuli municipalities will be flooded by the project.

4.2.2 Impacts on Land Resources

General. Impacts of natural and anthropogenic pressures on land resources of target territories are manifested as land degradation that includes desertification, erosion, loss of soil fertility, soil salinization, bogging and soil contamination. This problem causes reduction of land and agriculture productivity, ultimately leading to economic losses and the poverty.

Alazani River Basin. Land degradation in the forms of soil erosion, salinization, bogging, desertification and contamination is a large-scale problem in the Alazani river basin. Natural disasters, climate change and unsustainable agriculture and natural resources management practices are the major factors for land degradation here. For instance, in the Basin several hundreds of ha of lands are facing desertification in the municipalities of Signagi, Sagarejo and Dedoplistskaro and thousands of ha are eroded in almost all municipalities. The municipal context of the myriad of land degradation problems is as follows:

In Dedoplistskaro municipality, out of total area of plough lands (47,040 ha), 3,300 ha are slightly eroded by water erosion, 1,800 ha - medium-eroded and 200 ha - heavily eroded; winter pastures -64,084 ha; slightly – 3,794 ha, medium – 5,889 ha, heavily – 1,797 ha; Furthermore, nearly 20,000 ha is affected by wind erosion. Windbreaks and field protection strips making up 1,770 ha in the past are almost entirely destroyed and about 5,000 there is heaviy degraded.

over the last 10-15 years, as a result of the activation of gully and planar erosion processes up to 40 hectares of agricultural land of the villages: Zemo Machkhaani, Zemo Keda, Samtatskaro, and Arkholoskalo have become unsuitable for use. These processes have been more actively developed in uninhabited areas, where hundreds of hectares of land have virtually been transformed into badlands. Within the boundaries of the target territory, shallow landslides of small areas, as well as the inundation of riverside territories are less common. In particular, as a result of periodical deluges at the downstream areas of the rivers of Alazani and Iori, as well as at the estuary of the Mingechavir reservoir, approximately 50 hectares of land are left underwater.

In Signagi municipality, out of total area of plough lands (37,019 ha); by wind erosion are slightly eroded 6,200 ha, medium eroded - 3,000 ha and, strongly eroded – 500 ha; Out of total area of pastures, including winter pastures (47,895 ha), slightly eroded are 9,056 ha, medium eroded – 12,841 ha and strongly eroded – 5760 ha; Out of total area of hayfields (5,200 ha); slightly eroded are 2,300 ha and medium eroded – 2,900 ha. Furthermore, 9,000 ha of lands are eroded by wind and 20,000 ha are salinized.

Villages Anagi and Vakiri located in Signagi municipality are highly vulnerable to landslides and soil erosion that damage agriculture lands and roads (for more details on natural disasters please refer to annex 13). In Anagi, debris flow happens bi-annually. Water erosion as well as inundation events caused by flooding also cause significant damage to the agriculture lands. For instance, over the last 10 years, up to 20 hectares of agricultural land (mainly gardens and vineyards) has been eroded due to erosion processes triggered by rivers passing through the villages of Dzveli Anagi, Vakiri, Kvemo Machkhaani, Bodbiskhegi, and Jugani. Twenty-five hectares of agricultural land are within a high-risk zone. Right bank of the Riv. Alazani, along the Georgia-Azerbaijan border, where the riverbed is characterized by meanders is highly susceptible to water erosion that poses a serious threat to hundreds of hectares of agricultural land. More specifically, over the last 10-15 years, up to 50 hectares of agricultural land has been eroded in the areas between the villages of Samtatskaro, Arkhiloskalo, and Tsiteli Sabatlo. Moreover, in numerous areas, the Alazani River makes attempts to cut through the rectilinear riverbed, which can cause hundreds of hectares of land area to become unsuitable for use. One of these areas is located near the village of Tsiteli Sabatlo, where the meander neck has been narrowed down to several meters in width. Considering the fact that alluvial sediments, which are easily susceptible to erosion, take part in the geological composition of the territory, the breaching of the meander neck is expected to occur in the not too distant future. As a result, up to 300 hectares of land will be transferred to the left bank of the Riv. Alazani, as it has already occurred on the adjacent territory of the village of Erisimedi. Gullying processes typical of the south-western part of the Sighnaghi municipality cause such damage to agriculture lands that almost 25%-30% of area becomes unsuitable for use.

In Lagodekhi municipality, out of total area of plough lands (24,971 ha), by water erosion slightly eroded are 100 ha and medium eroded – 300 ha; Out of total area of pastures (14,179 ha), slightly eroded are 1,670 ha, medium eroded – 8,300 ha and heavily eroded – 2,190 ha. Furthermore, out of total area of forested lands (35,478 ha), 117 ha are heavily bogged; Hundreds of ha of agricultural lands are turned into badlands due to flooding and debris flow.

Erosion processes cause considerable damage to summer pastures in Lagodekhi municipality. Riverbank erosion is prevalent to a lesser degree in residential areas and adjacent territories (e.g. severe erosion in the vicinity of the village of Ninigori induced by the Ninoskhevi River). Intensive lateral erosion can be noted along the Riv. Kabali, as well as its numerous branches, especially on the territories of the villages of Zemo Khechili, Kvemo Khechili, Karajala, Ganjala, and Dona. Over the last 10 years, up to 15 hectares of agricultural land has become unsuitable for use in the aforementioned villages.

Land slides (debris flows), so frequent and intense in Lagodekhi municipality cause considerable damage not only to agricultural lands, but also to the topsoil, various engineering communication devices, and pose a constant danger to residential areas. Debris flow significantly increases during the period of snowmelt, and torrential rains, which promotes the development of severe floods. The Kabali river in particular is known for its intensive creation of debris flows, which are primarily composed of water and rocks. This material is deposited 2-3 times a year and the amount of deposited debris amounts to approximately hundreds of thousands of cubic meters. Debris flows cause considerable damage to the villages of Zemo Khalichi and Kvemo Khalichi as well as the agricultural lands adjacent to them. Moreover, the river of Baisubani deposits debris composed of water and rocks 2-3 times a year. The amount of deposited debris ranges between 50 to 100 thousand cubic meters, which deals considerable damage to agricultural lands located in the vicinity of the villages of Mskhalgori and Baisubani, and, primarily, causes severe land degradation. Debris flows are also typical of the Ninoskhevi River, which deposits debris composed of water and rocks in the volume of over several thousand cubic meters on an average of 2-3 times a year. The debris flows induced by the Riv. Ninoskhevi cause substantial damage to agricultural lands adjacent to the villages of Khizabavra and Gurgeniani. In addition, the rivers of Shromiskhevi and Lagodekhistskali should be noted. These rivers pass directly on the territory of lower Lagodekhi, and the debris flows produced by them are mainly composed of water and rocks, and, infrequently, of mud and rocks. Their deposit occurs 2-3 times a year in the volume of several hundred thousand cubic meters. These debris flows pose a threat to lower Lagodekhi and significantly damage agricultural lands and topsoil. The Riv. Matsimi Ravine is noteworthy for its severe debris flows, which are mainly composed of water and rocks, and seldom of mud and rocks. The deposit of the debris takes place 2-3 times a year and its volume ranges between 50 and 100 thousand cubic meters. The debris flows originating in the ravine of the Matsimi river considerably damages agricultural lands and topsoil. The development of landslide processes takes place in the upper areas of the rivers of Kabali, Ninoskhevi, Shromiskhevi, and Lagodekhistskali. The landslides are generally creeping and creeping block types; they are essentially shallow and their area reaches tens of hectares. Active landslides can be noted on the northern periphery of the town of Lagodekhi, as well as on the right erosive slope of the Lakoskhevi River (right estuary of the Riv. Kabali). The depth of these landslide bodies equals 10-15 meters; the width exceeds several hundred meters, while the length ranges between 1 and 2 kilometers. The process of topsoil degradation on the territory of the municipality is enhanced by inundations caused by severe flooding and lateral erosion induced by rivers. During severe floods, the Alazani River inundates not only the flood-plain, but also the first terrace above the flood-plain, as a result of which several thousand hectares of agricultural land is left underwater. An especially difficult situation prevails on the territories adjacent to the villages of Leliani and Tchabukiani, as well as along the rivers of Kabali, Tchiauri, and Ninoskhevi (the villages of Eretiskari, Tsiteli Gora and other areas). During severe floods, hundreds of hectares of agricultural holdings are inundated, which contributes to topsoil degradation.

In terms of mud-flows, these processes are very active on the southern slopes of the Greater Caucasus (Kvareli municipality) and on Tsiv-gombori range (Telavi municipality). They damage agriculture lands and pose high threat to the urban and rural population. During the last 100 years there were 40 catastrophic mud-flows in the river Duruji basin that caused the death of 200 people. Earthquaqes that have happened last years have siginificantly weakened the stability of mud-flow prone slopes.

2010 was the year of extreme intensification of mudflows and landslides. Under the high risk of these processes are: Gombori section of Tbilisi-Telavi road, Akhmeta-Tianeti road and the villages: Gombori, Kbadze, Shakhvetila as well as settlements of the Gurjaani municipality. Now landslides develop in areas, which in the past were not prone to them. For instance, in 2010 the landslide destroyed several houses in the village of Manavi, Sagarejo municipality.

Water erosion is widespread phenomena in the Alazani river basin, followed by wind erosion dominating on the left bank of the river. On average, through water erosion about 60-70 tons of topsoil per hectare is lost in East Georgia. Nitrogen loss is about 23-24%. Loss of the topsoil depends on the slope size, soil type and structure, humus content, precipitations, etc. On high slopes erosion processes are more easily developed and reach their maximum during catastrophic floods, landslides and mudflows. Snow melting also causes water erosion. The loss of minerals is higher for the arable lands, followed by perennial croplands. On pastures and hayfield the loss of the minerals is minimal. In the r. Alazani, about 8-9 mln tons of sediments are washed down annually.

In Signagi and Dedoplistskaro municipalities, hundreds of hectares of lands are lost due to river bank erosion. The boundaries of these municipalities, coinciding with the national border of Georgia with Azerbaijan go along the r. Alazani. The river bed is developed in highly erodible alluvial sediments. This causes segmentation of the river bed and development of large diameter menders with 3-50m height steep slopes. These slopes are permanently eroded and during the high waters erosion processes are extremely intensified. The land mass is carried down to the meanders. That’s why within the 190km zone tens of hectares of highly fertile lands are lost and within the menders of 8-12 width of the right bank is washed out annually. Many flood plains and the lower terraces are washed out in the meanders as well. Currently, under the intensive erosion process is the Jumaskuri section and if no measures are taken in near future many Georgian territories may fall within the boundaries of Azerbaijan.

Along with river erosion, irrigation erosion is also widespread in the Alazani river basin, since the large areas of agriculture lands are irrigated there. In this case erosion is caused by improper design of the system (length of irrigation tranches, water discharge rate, etc) leakages and water losses. On average, 80-100 tons of topsoil is lost as a result of irrigation erosion.

Another impact of intensive irrigation as well as of naturally occurring high groundwater table is soil salinization and bogging. The scale of this problem is significant, with 8,000 ha or 1/5th of total area (40,000 ha) of agriculture lands being affected by it.

In particular, ***the right bank of the basin***, which historically was under intensive irrigation is affected by soil salinization. This area is a part of the Alazani artesian basin and, is characterized by soils high content of chloride – sulfate salts (2%), exceeding an acceptable limit of toxicity for cultivated lands. Within the mentioned section of the right bank of the basin, at various depths pressure groundwater aquifers are found, where the depth of ground waters varies within 1.5-6.0m. Close location of ground waters to the land surface and intensive irrigation are major reasons of swamping or soil salination. Salt content in the ground waters is quite high and varies within 3.0-12 g/l. Dominant types of ground waters are sulfate-sodium, chloride-sulfate, magnesium-calcium and, sulfate-chloride-sodium.

Similar problem of soil salinzation and bogging exists ***on the Iori Plateau***, characterized by continental and marine sediments of Agchagiul-Apsheron age with low water content and sporadic spreading of ground waters. Ground water levels are located at 10-20 m and deeper. Ground waters are of hydrocarbon-sulfate or sulfate-chloride sodium-calcium types. Their mineralization is pretty high reching nearly 15 gr/d. Thus, the melioration condition of the topsoil cover, with respect of soil-ground salinizatio, is unfavorable and as a result of improper irrigation the ground water levels increase and saline soils become even more salinizated.

In Signagi municipality, salinated soils and partly bogged areas are found on the Alazani Plain – along the right bank of the river Alazani. Flat-surfaced plain, adjacent to the right bank of the river Alazani represents the first terrace above the riparian forest, the surface of which is elevated from the river bad by 5-10 meters and passes to alluvial fan (cone) towards the south periphery. The primary reason for soil salinization and swamping here is close location to ground surface of ground waters, developed in the alluvial-prolluvial pebbles of the first terrace above the riparian forest. According to the data of long term ground water observations, on the south peripheral strip of the Alazani plain, adjacent to the north-east slopes of Gombori range, the depth of ground waters varies within 3-20 meters, and in the central part of the plain it doesn't exceed 0.5-1.0 m, which preconditions the formation of swamped areas. In the east part of the plain the location of ground waters under the influence of the river Alazani is deeper – 1.5-6.0 m. Average annual amplitude of fluctuation of the level doesn't exceed 1.5 m. This is due to the fact that annual precipitation doesn't exceed 300 mm, whereas evaporation norm makes 700 m. Mineralization of ground waters of the rights bank of the river Alazani increases towards the river flow. To the north of the settlement Tsnori and within Milari steppe, their salt content is within the range of 2-12 g/l. According to chemical composition, these waters are sulphate-sodium, chloride-sulphate manganese-calcium, sulphate-chloride sodium and hydrocarbonate-sulphate-chloride sodium-manganese type. It is natural that rocks, containing ground waters of such high mineralization and soils, developed on them, are salinated. The area of spreading of salinated soils here exceeds 20,000 hectares. Content of salts in top soil exceeds 1.5-2.0%. Bitsobi and salinated soils are mainly salinated with sulphates and chlorides; one can also meet the plots with sodium salinization. Due to intense salinization, use of the territory for tillage and sowing is impossible and it is suitable only for low-productivity pastures. It should specially be mentioned that on the subject territory, beginning from Tsnori settlement up to riparian forest of the river Alazani, continental rocks of the so-called “Alazani series” of Aghchagil Apsheron age, contain high-pressure ground waters. The piezometric surface of high-pressure horizons is located higher as compared with ground water surface. In such conditions flow of high-pressure waters to the ground water horizon through upstream filtration is inevitable. Ground waters, experiencing hydrostatical pressure from below, permanently maintain high levels despite the seasons of the year. At the same time, aeration zone is represented by clayey ground, in which the surface of capillary elevation is in permanent contact with top soil, which leads to intense under-ground evaporation and constant accumulation of soil salt in the conditions of dry and hot climate characteristic for the municipality.

In Lagodekhi municipality, there are very large areas of bogged soils that is a result natural climatic and hydro-geological conditions specific to the municipality. These plots are located along the left bank of the river Alazani, at a distance of about 4 km from Azerbaijan border, in the form of almost uninterrupted strip. On the major part of the plain, the level of groundwaters, contained in Quaternary alluvial sediments (pebbles, conglomerates, sands, sandstones and clay) varies from 0.4 m to 13.0 m. The inclination of ground water surface coincides with the relief inclination (from the north-west to the south-east). The coefficient of water permeability of the horizon varies from 10 to 300 m^2/day. The ground waters, connected with these water-bearing horizon, are fresh (general mineralization – 0.2 – 0.5 g/l); hydro-carbonate calcium-magnesium type dominates. Discharge of the water-bearing horizon in the form of down-flowing springs occurs on the left bank of the river Alazani, causing bogging of separate plots from place to place. The reason of soil bogging is not only the discharge of the aquifer in the form of down-flowing springs. Significant role in the development of this process is played by pressurized waters, circulated in deep layers of Quaternary horizon, which are connected with the pressurized horizon, developed on the left bank of the river Alazani. There is a close hydraulic connection between the pressure groundwaters with ground waters of shallow circulation. The discharge zone of the artesian basin (or pressurized horizon) near the river Alazani is the strip adjacent to the Alazani plain. Discharge-recharge occurs in the form of up-flowing springs, through the so-called “hydrogeological windows”, as well as through relatively water-resistant upper layers. Permanent upper movement of artesian ground waters and flowing into the groundwaters predetermine high ground water table, which finally brings about soil water logging. Part of swamps dries during the hot season of year, but even at that period the depth of deposition of ground waters doesn’t exceed 0.5 m, i.e., annual amplitude of fluctuation of levels is insignificant varying from 0 to 0.5 m. Thus, this area needs intensive drainage in order to recover the top-soil and ensure discharge of the water into the river Alazani.

In Dedoplistskaro municipality, soil salization is also a problem, caused by the natural conditions of a dry climate. However, artificial regulation of water regime through the construction of Dali reservoir has also affected the salt content of soils and accelerated the soil salinization.

In the lower courses of the Alazani river basin, water erosion caused by the irregular gravitational flow of water from artesian wells drilled for drinking water and for small-scale irrigation poses serious problems to lands resources. As a result of water flow tens of kms of deep ravins (5-30m) are developed that are characterized by accelarated rate of erosion. This in turn results in the loss of fertile lands and the destruction of local roads. Such ravins exists in villaged Pirosmani and Samtatskaro.

On the right bank, where there is a dry climate with semi-arid ecosystems wind erosion within the very short period removes 3-5 sm of the topsoil that causes high damage and sometimes full destruction of fall crops.

In addition, soil transferred by the wind fills in irrigation systems, reservoirs, etc and brings about economic losses to the population. In the lands eroded by winds cereals give 25-50% less harvest.

Land erosion and degradation also happen from open-pit mining operations for limestone extraction that are on-going in Dedoplistskaro municipality as well as from extraction of marble on-going in Telavi municipality.

In terms of soil contamination, unfortunately currently there is no land quality monitoring in Georgia. Historical data are also very sporadic and do not give a representative picture of the past state of the land resources in the Alazani river basin. Only based on current pressures on the land resources, assumptions can be made about the potential pollutants. First of all, it should be noted that use of pesticides, including organochlorine and zinc and copper containing pesticides has been dramatically reduced in Georgia and therefore, we can assume that pollution of land resources by these chemicals is also reduced. At the same time, it should be mentioned that there were several store houses of obsolete pesticides in Telavi, Signagi and Dedoplistskaro municipalities where about 235 tons of pesticides were stored until last year. In 2003-3004 soil sampling was conducted in surroundings of Tsnori (v. Achinebuli) store house and the results of analysis showed soil contamination by heptachlor and α, γ-hexachlorobenzene (for more details on PoPs-Pesticide sampling please refer to figure 1 in annex 15). Although, currently almost all obsolete pesticides from Kakheti region are moved to Kvemo Kartli there is still need for site investigation and remediation. In addition, care should be given that no construction permits are given before it is verified that the contamination does not exceed safe levels. Consequently, the location of all former pesticide stores should be collected centrally and local authorities should take this data into consideration when approving building permits. Further, soil limit guidelines for POPs and other contaminants needs to be developed and enforced as a part of any land re-use applications.

Soils might be contaminated by PCB oils in areas where PCB oil containing or contaminated Soviet transformers and capacitors are located. Out of 55 transformers studied during the inventory of PoPs, only 2 were identified as PCB containing with about 4.8 tons of PCB. The sites should be visited in order to define whether or not those transformers are still in use and whether or not their condition is good, in order to avoid leakeage of PCB oil and subsequent soil contamination.

Surrounding lands of municipal waste disposal sites might be contaminated by various harmful substances including dioxines and furances, heavy metals as well as by various microorganisms, etc.

Discharges of untreated municipal and industrial wastewater on the surface relief pollute the soils by nitrogen, organic matter, heavy metals, etc. Furthermore, urban surface run-off (storm and drainage water) pollute soils with phenols, heavy metals, including lead.

Iori Basin. Major impacts of the pressures on land resources in the Iori basin are manifested as soil erosion, salinization, bogging, desertification and contamination.

Semi-arid and arid areas widely spread in the Iori river basin are highly eroded and desertified due to both natural phenomena and man-made impacts. These areas are as follows: ***Shiraki, Eldari, Iori, Taribana, Naomari, Ole, Jeiran-Choli valleys, ridges and plateaus dividing them and the biggest part of southern slope of Kakheti Range***. Desertification zone starts from an altitude of 300-400 m. In Dedoplistskaro municipality it has already affected 119,000 ha, in Signagi – 46,000 ha and in Sagarejo – 47,000 ha.

In Sagarejo municipality, for instance, out of total area (30,054 ha) of plough lands, slightly eroded by water erosion are 5,000 ha, medium-level eroded - 2,600 ha and, heavily eroded - 1,100 ha. Forest areas eroded by water erosion make up 220 ha; Out of total area of pastures (56,460 ha) slightly eroded are 2,340 ha, medium-level eroded – 3,620 ha and, heavily eroded – 1,290 ha; out of total area of natural hayfields (1,563 ha), slightly eroded are 121 ha, medium level eroded – 173 ha and, heavily eroded – 69 ha. Furthermore, total area of lands affected by wind erosion makes up 12,000 ha and that of bogged lands – 242 ha.

Wind erosion is very intense **in Dedoplistskaro and Gardabani section of the Iori basin**. In total, over 100 ha pough-land is heavily eroded due to the winds in arid and semi-arid areas of Georgia, including Dedoplistskaro, Sagarejo and Gardabani municipalities.

Gully erosion is widespread phenomena ***in Sagarejo, Signagi and Dedoplistskaro municipalities***. It gives rise to the development of badland relief. Over the past 10 years, up to 150 hectares of agricultural lands have been eroded in Sagarejo municipality through gully erosion. As a result of flooding, inundation (and in some cases, swamping) processes have taken place in the villages of Manavi, Tokhliauri, and especially in Iormughanlo. In recent years, on the territory of the latter, due to the impact of floods and, partially, as a result of the leakage of water from irrigation channels, an area of up to 100 hectares of land has been swamped. This has caused the salinization of topsoil, low crop-yield from adjacent agricultural land, and the damaging of residential houses.

In Signangi municipality, on Iori plateau gully erosion over last 10 years, caused degradation of 140 hectares of agricultural lands so as they became unsuitable for use. Inundation events caused by excessive flooding periodically occur on the territory of the so-called “Shorakani”, where hundreds of hectares of agricultural holdings are flooded. The principal cause of inundation is both the swelling of rivers, and the breakdown of existing irrigation systems.

In Dedoplistskaro municipality, although the majority of mechanical irrigation systems, irrigating lands at an altitude of 500-600 m above the sea level in the past are non-functional at present, have already damaded vast areas of agriculture lands through intensive slope erosion.

Another significant problem of land degradation in the basin is a soil primary and secondary salinization and, bogging. This phenomena is recorded in ***Sagarejo, Signagi and at a lesser extent, in Dedoplistskaro municipalities***. More specially, in Sagarejo municipality salinated soils are spread as numerous small patches of land on Iori Plateau and on both banks of the of the river Iori. Soil salinzation here is determined by climatic conditions of sharply negative balance of humidity, which, together with lithological properties of the land, is considered as the factor, facilitating the rimary salinization of soils. Hydro-geologically, on these territories Neogene sediments dominate, in which clays prevail, facilitating the development of capillary process and act as additional factor of soil salinization. Water exposures, related to Neogene sediments, occur extremely seldom. Insignificant outlets of sulphate waters with increased mineralization (up to 5 g/l) are connected only with sandstones and partly conglomerates. Although quite thick crust of exhaustion is developed in Neogene sandstones and conglomerates, they are practically waterless, which is conditioned by sharply negative balance of damping of the territory. The depth of ground waters on the most part of territory exceeds 20 m, only on small area of meadow black, salinated soil (which is developed at the confluence of the river Iori and periodically active river Lakbe), the depth of circulation of ground waters doesn’t exceed 2.5 – 3.0 m; and the annual range of fluctuation of levels is within 1 m.

Landslindes and debris flows being so frequent in Kakheti section of the Iori River Basin, cause high damage to the settlements, infrastructure and economy of the region by affecting hundreds of hectares of agriculture lands (for more details on natural disasters please refer to annex 13). As it was discussed above, in Sagarejo municipality there there is practically no place on the Gombori ridge unaffected by debris flows or not at risk. Over the last 10 years, the volume of debris flow material accumulated by the river Tvaltsveri along the outskirts of the town of Sagarejo exceeded 700 thousand m3. Consequently, the Tvaltkhevi River poses a serious threat to the city of Sagarejo and its adjacent territories. Furthermore, the Antoki River causes great damage to the agricultural lands of the village of Antoki, as well as to the main village road. The amount of material deposited during the maximum discharge of water from the aforementioned ravine comprises tens of thousands of cubic meters. Heavy debris flows are typical of the rivers of Khashmiskhevi, Manaviskhevi, Patardzeulkhevi, Chailuriskhevi, and Kandauriskhevi. The one-time deposit of debris flow material by each of these rivers separately amounts to 15-20 thousand cubic meters. Hundreds of hectares of agricultural land, especially, slopes intended for vineyard-growing, are covered by debris flow material. In numerous ravines on the Iori Plateau, debris flows occur on a comparatively smaller scale, generally in the form of gully deposits.

In Signagi municipality, debris flows is prevalent on the Iori Plateau and together with gully erosion is affects large areas of agriculture lands.

Landslides ***along the slopes of the Gombori mountain range and their adjacent territories*** have a significant impact on the process of land degradation and lead to the damage of smallholdings, residential houses, and other structures.

Land erosion and degradation is also caused by extraction of clay and limestones in Sagarejo municipality and oil extraction in Sagarejo, Dedoplistskaro and Gardabani municipalities.

As for the pollution of land resources, similar to the Alazani river basin, land contamination by agrochemicals might be insignificant at present due to the application of low amounts relative to 80s. Moreover, pesticide use is very insigificant comared to the use of fertilizers.

Soils of downstream areas of Iori basin might be polluted by phenols, heavy metals, surfactants, etc. due to the urban and storm water run-off from urban areas of Sagarejo, Signagi, Tsnori and Dedoplistskaro.

Discharge of untreated sewage and wastewaters from mining and processing (clay extractiona and brick production, limestone extraction, etc) activities on the surface relief might be a source of soil pollution by nitrates, ammonia, heavy metals, bacteria and various parasites.

Soil layers of waste disposal sites and surrounding areas might be contaminated by various hazardous chemical substances, including salts of heavy metals, organics, dioxines and furans as well as by parasite microorganisms.

Oil and gas extraction activities in Sagarejo (Ninotsminda and Patardzeuli, Manavi oil fields), Dedoplistskaro (Shiraki, Taribana oil fields) and Gardabani municipalities (Sartichala oil and gas fields) cause pollution of lands by oil products (impacts of mining and oil and gas extraction activities are considered in more detail below)

Soils around former pesticide store houses in Tsnori and Dedoplistskaro might also be polluted by pesticides, predominantly by heptachlor and α, γ-hexachlorobenzene that was detected during the2003-2004 inventory of PoPs.

Rioni River Basin. In the Rioni Basin impacts on land resources from both anthropogenic and natural factors are high.

As it was mentioned above, Racha-Lechkhumi and Kvemo Svaneti as well as Upper Imereti Plateau are extremely affected by the landslides (for more details on natural disasters please refer to annex 13). Recently these processes have been intensified causing high damage to local natural resources, ecosystems, population and the economy. As a result of these processes, many settlements have been fully abandoned including villages Kldis Ubani and Sartki, while in other villages population size has been significantly reduced due to migration (v. Bareuli, Didi Chorjo, Pirveli Tola, Gendushil Djoshkha, etc).

Intensification of the landslides is at large caused by active seismic processes and heavy rainfalls. For instance, in April 2003 heavy rains brought about landslides in one of the ravines of the R. Rioni that significantly damaged the property of local population. The landslide was moving in the ravine slowly (0.4-0.5 km/day) within the three-day period and was carrying 500,000 m^3 solid matter. The total area affected by the landslide amounted to 49,000 m^2. The weight of the land brought by the landslide was $1.2 * 10^6$ tons.

In March 2005, heavy rains and snow melting caused development of the large-scale landslide in the area of the v. Gendushi. The landslide originated at the source of the r. Lashigele. At the same time, as a result of slope erosion the river bed of the Aska river has moved to the west by 40 meters that brought about new landslide on the right bank of the river on the territory of the v. Djoshkha. Thus, the two villages became threatened by large landslides. Such processes have been happened in these villages several times, given they are built on landslide and mudflow cones. In the upper part of the v. Gendushi a large mass of the landslide has activated all old sediments deposited by previous landslides that complete destroyed the stable slope of the left bank. Currently, the lower reaches of the river basin are continuously affected by small-scale landslides and in case of heavy rainfalls catastrophic landslides and mud-flows might develop. Gendushi landslide sedimentary body starts at the upper reaches of the r. Lashigele catchment, comprising the bottom of the southern slope of Gvelistavi-Sakalmia ridge. The ridge is composed of lower cretaceous limestone and carbonaceous clays. Techtronic fault parallel to the ridge is spread on the south slope and morphologically is manifested as a steep gravitational slope. There are permanent gravitational processes along the fault forming strong colluvion – a permanent source of mudflows and landslides. South to the tectonic fault, Oligocene-lower Miocene carbonaceous clays located in the central strata of quartz sands are found that gradually replaced by interchangeable rows of Miocene clays and sandstones. Geological composition of Gendushi and Djoshkha areas is tertiary deposits. In the areas of tectonic faults there is a maximum discharge of karst waters that causes permanent watering of landslide prone slopes and development of new landslides.

Last year as a result of heavy rains more than 30 settlements were threatened by mudflows and landslides in Racha-Lechkhumi and Lower Svaneti region. Tens of houses have been damaged or destroyed, large sections of the roads have been damaged and 1 person died. In Tsageri municipality in March percipitation reached 205 mm and as a result of 3-4-day heavy rainfalls catastrophic mudflow has developed in the basin of the r, Lajanuri. Almost half of the village was covered by the mud-flow mass. The population was evacuated from the village. In September-October the mudflows have recurred. Unfortunately, implementation of river bank protection measures are hindered by the complete silting of the Lajanuri reservoirs by the solid matter.

In Ambroluari municipality, Tchkvishi, Quishkheti, Joshkhkha, Tola, Chorjo, Dzirageuli, Khimshi, Tsesi, Saketsia, Jvarisa, Bugeuli, Kldisubani village have been threatened by landslides and overflooding of R. Rioni. At the border of the villages of Jvarisa and Bugeuli lateral landslide has developed that caused development of the large-scale mudflow.

In Oni municipality, the debris flow has blocked the 111th km segment of the Kutaisi-Shovi road which was closed for several days. The debris flow has developed in the middle of the right slope of the r. Rioni in so-called "Sori Deposits" of Jurassic period. Furthermore, in June and August of 2010, landslide instigated mudflows developed on both slopes of the Shoda-Kedela ridge. The largest damade was caused by the mudflow developed on 19 June in the r. Bdgviora gorge that destroyed more than 10 cottages of the resort Shovi, bridge connecting the road to Shovi and threatened the population of the village Glola.

In mid June this year, several bodies of landslides and mudflows that have developed as a result of heavy rains and rain showers killed 6 people, damaged central road, restaurants, private houses and farm lands in Kharagauli municipality of Imereti region.

Low reaches of the Rioni River Basin, including areas below Kutaisi, Rioni Delta and coastal zone are high flood-prone areas and are extremely vulnerable to them. Floods there incur serious damages to local population, infrastructure and the resource base. For instance, by the end of 1986 December air masses from south-west caused heavy rains. The snow cover depth reached 4-5 m on the south slopes of the Great Caucasus in the third week of January 1987, significantly exceeding the average values. Rain showers then brought about intensive snowmelt. As a result, the water level in the rivers has increased abruptly (4-5 m in a few hours) and rivers of Enguri and Rioni have started to convey extremely large volumes of water. River Rioni has exceeded its earlier historical maximum water discharge and reached s 4.850 m3/s. As a result, over 200 km2 of the Kolkheti plain has been inundated that brought about death toll of 150 people, material damage in the amount of USD 700 mln, including destruction of 3,150 houses, 2,150 various infrastructure objects, 16 km railway lines, 1,300 km roads and 1,100 km power transmission lines.

In the river mouth of Rioni, there is constant land erosion and the loss of the coastal area. This is caused by combination of sea level rise, tectonic sinking of the land and alteration of the river and the sediment flow. More specifically, the area is located within the tectonic zone of the Caucasus fault and is characterized by high rate of tectonic movements along the coastal zone. The rate of sinking of coastal area in Poti-Supsa segment is the highest amounting to 4.0-5.6 mm/y. At the same time, Black sea level rise is a part of the fluctuations of the global oceanic level caused by climate change. Observations on the Black Sea showed that constant sea level rise started in 1923-1925 and was proceeding with a rate of 2.5 mm/y. The absolute raise of the Sea Level reached 18 cm in 1998 and the relative raise, which is a level of raise against the coast, at some places reached 50 sm. The relative eustasy is the highest in Poti-Rioni delta section and reaches 7.6 mm/y. This means that Poti area within the last 70-80 year has sunk by 0.52 m against the Lake Paliastomi and the r. Rioni. River bank protection structures built to protect the city against flooding and inundation by the r. Rioni and L. Paliastomi, are no more effective means to protect the city. This is proved by the catastrophic floods of 1987 and 1997 on the r. Rioni. The Poti beach has been washed out. The sea receded by almost 0.9 km and took away almost 600 ha of the beach. This process is so intensive that poses high threat to the road built on Maltakhva-Supsa segment.

Contrary to the land sinking, in the Rioni Delta there is a process of an enhanced accumulation of sediments carried by glacier-fed rivers, caused by intensive enrichment of river sediment with moraine materials originated in the process of glacier retreat. This causes the silting of the river bed by glacier sediment that reduces the river bed carrying capacity especially, during floods and causes inundation of the area of Patara Poti, Chaladidi, Sabokuchao, Sagvamichao, Sakorkio, Sachochuo, etc. River bed silting process together with the estasy causes frequent inundation of a significant portion of the Kokheti National park.

Furthermore, construction of a number of regulating dams and reservoirs on the Rioni Basin, has caused reduction of the river and the sedimentation flow at the river mouth that has affected formation of the delta. The latter in the past was the most influenced by the river run-off. Currently, the sea impacts through esustsy, surges, etc. became stronger, causing the retreat of the delta and the loss of the land area.

The large-scale dam-based regulating Namakhvani HPP cascade that will be built within 4-year period starting from 2011 will have significant impacts on land resources of the project area as well as on low reaches and the delta of the Rioni River. following concrete impacts are expected from the project: alination of land, including agriculture land[37]; flooding of private land plots that will require resettlement of 279 people in downstream areas (Tskaltubo municipality); flooding of f Kutaisi-Alpana-Mamisoni highway pass on the right bank and local roads, requiring re-routing of these roads; woodstock removal during 4-year construction period around the reservoirs, etc. Initially it was designed to have two-step scheme that was supposed to flood vineyeards in Tvishi are producin the high quality wine “Tvishi”. Therefore, it was changed to three-step scheme. Furthermore, dam seismic safety measures should be taken into consideration given the location of the project site in high seismic activity area (maximum magnitude M=7.0). During the construction phase naturally occurring landslides and mudflows will be intensified, but according to the draft ESIA they are of local nature. The are of the highest sensitivity is the most upstream – the toe of the village Korenishi. This area is of 2km length and needs some landslide protection measures.

In terms of land contamination, there is no regular soil quality monitoring carried out in Georgia at present. However, based on economic trends and levels of current pressures on land resources, it can be assumed that agriculture lands now are in better state than during the Soviet times, due to the decreased loads of agrochemicals. However, the use of organic fertilizers is still high and the land resources can suffer from salinization, acidifaction, and pollution by heavy metals and microorganizms.

Furthermore, discharge of untreated wastewaters from sanitation systems and industrial facilities on the surface relief pollute land resources by heavy metals, biogenic substances, microorganisms, etc. Contamination of soils by PoPs, heavy metals, microorganisms, etc. occurs from urban surface run-off and draining of waters from waste disposal sites.

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[37] Land area alienated in Tskaltubo municipality amounts to 1.81% of total land fund of that municipality, in Tsageri it amounts to 0.51% and in Tkibuli municipality only 0.08%. Construction will affect 202 farm plots in Tsageri and Tskaltubo municipalities and over 90 private land plots. People from following villages will need a resettlement: Vanishala, Mamatsminda, Molekura, Namakhvani, Sakire and Mekhvena in Tskaltubo municipality, while some villagers in Alpana, Derchi, Zogishi and Tvishi will lose agriculture lands.

The quality of soils around old and operational mining sites is presumably poor. For example, abandond arsenic ore mines in Racha-Lechknumi probably contaminate the soils with heavy metals. It has to be also assumed that the soils around manganese quarries concentrated in and around the city of Tchiatura are in very poor state, polluted from

Surrounding soils of small ware houses of obsolete pesticides where about 10 tons of chemicals were stored in environmentally unsafe manner might be still polluted with PoPs. For instance, a number of samples that were taken from the soils nearby obsolete pesticide store houses in Imereti (Zestaponi, Samtredia) showed soil contamination by heptachlor, α, γ-hexachlorobenzene and DDT. In addition, old Soviet trasformers and capacitors with 152 tons of PCBs still in use in almost all municipalities of the Rioni basin are the pollution sources for PoPs PCBs. These chemicals need proper handling and disposal/elimination and the contaminated sites – remediation.

4.3 Landscapes and Biological Resources

4.3.1 Pressures on Landscapes and Biodiversity

Alazani River Basin. In the Alazani river basin, pressures on ecosystems and biodiversity are put by both anthropogenic and natural factors.

Among anthropogenic factors, unsustainable natural resource management and agriculture practices, including unsustainable pasture management, unsustainable use of plants and animals (illegal hunting, fishing, intensive logging, including illegal logging etc.) as well as tourism and infrastructure development activities put large pressures on the basin's ecosystems and biological resources. At a lesser extent, industrial activities also pose the threat to the biodiversity.

In upstream areas, where Akhmeta municipality (including Tusheti PAs) and the part of the Telavi municipality are located hunting is the greatest threat to the biodiversity. It is practiced by local population, government officials, including border police and sports hunters. Such species as bezoar goat, tur, bear, roe deer, red deer, wild boar, chamois, etc. are the most hunted animals. Meanwhile, some of these species are locally endangered and rare in Georgia. For instance, the wild goat inhabits only Tusheti and Pirikita Khevsureti areas of the country.

In Tusheti, traditionally there was a trophy hunting of wild goat, tur and red deer that was considered as a sacred ritual. Any trophy was sacrificed to the gods. Hunters were obliged to follow unwritten rules and restrictions. For example, it was not allowed to kill more than three animals during one hunt. Shooting of sacred animals was only allowed only during fall and winter seasons. It was a disgraceful act to kill a female tur, wild goat or red deer with a young, or a sleeping animal. Shooting any bird was considered as a disgraceful act for a hunter and it is still very rare nowadays. Unfortunately, almost all above mentioned hunting traditions are forgotten and there are very few people in the communities who follow them. Most of the poaching is done by visiting sport hunters from other parts of Georgia or from abroad. It should be noted that local people are unhappy with visiting sport hunters who tend to neglect local traditions and kill excessive numbers of game. According to locals high officials as well as border control police have been noted to be engaged in illegal hunting.

Illegal hunting is particularly intensive in south-western parts of the Tusheti National Park and Batsara-Babaneuli protected areas accessible to people almost entire year. Most heavily hunted species include bears, tur and chamois. Poachers include local people from nearby villages and visitors. According to local sources poachers frequently hunt bears in April with the primary aim to capture live cubs.

Illegal fishing by using prohibited means to harvest fish (e.g. electric shocking, poisoning and using dynamites) is not rare fact, threatening the entire populations of various fish species. Usually, local population that use fish as a supplement food employ legal catch methods. Visiting people on the contrary mostly use illegal methods. High officials from outside Tusheti are sometimes among the illegally fishing visitors. Illegal fishing mainly takes place in the Alaznis-tavi area.

Unsustainable harvesting of timber resources is a serious problem for the entire river basin, including upstream areas.

Illegal logging for export and own consumption purposes was very large-scale problem in 90s. The government was deeply involved in such illegal schemes and moreover, was organizing and managing such schemes. One of such schemes was the sanitary cutting in state forests that in accordance with many experts and watch-dog NGOs served to harvest high quality trees for further selling. Although illegal logging has declined in recent years, is still a factor for biodiversity degradation. More specifically, while illegal logging for export purposes has been suspended completely as a result of government efforts, logging for fire wood, including illegal logging is still intensive, regardless of the fact that households are allowed to cut wood for fuel. However, due to the complicated procedures to harvest fire wood as well as technical difficulties and lack of financing to collect timber and transport from forests, local population still prefers to illegally cut the trees. On average, one household in Akhmeta municipality uses 6 m^3 wood for heating and cooking (from 5 to 10m^3) and about 1m^3 as building material. Currently, the government works on the amendments to forest use regulations, which will significantly ease the cutting forests for fire wood and other domestic needs and will allow for free of charge collection of wood chips in any forests.

It is noteworthy to mention the unique tradition of conservation of local forests in Tusheti. There are certain patches of forests considered as sacred ones that are preserved in their original form and represent virgin forests. Thus, they along with local cultural and religious value have high conservation value. There are 10 such forests in Tusheti, 3 in v. Shenako, 1 in v. Diklo, 2 in v. Chigo, 1 in v. Dartlo, 2 in v. Kumelaurta and 1 in Sanare location.

Not only the illegal logging puts high pressures on forest ecosystems of upstream areas, but also commercial logging undertaken by a number of concessioners, operating in Akhmeta municipality and the upper part of Telavi municipality (v. Pshaveli). More specifically, 1,211 ha of land with 1,485 m^3 of annual volume of allowed cuts for a 20-year period and 274 ha with the same duration are leased to the company Imedi, LLC in Akhmeta (Pankisi gorge) and Telavi municipalities (Pshaveli community) respectively; 4,411 ha with 4,831 m^3 of allowed annual volume of cuts and, 9,484 ha (9,370ha of forest cover) with 10,078m^3 of allowed annual volume of cuts are leased for a 20-year period to the company Georgian Wood and Industrial Development, Co. in Akhmeta municipality and, 4,807 ha[38] with 6,024m^3 volume of allowed annual cuts for a 20-year

[38] 4,834 ha is a total area total state forest fund of the licensed forest, with 4,780 ha of forest cover

period in Telavi municipality (Pshaveli community) – to the same company; 306 ha with 320 m^3 of annual volume of cuts of beech trees for a 10-year period is leased to the individual entrepreneur "Beka Oniashvili". The problem with these commercial loggings is that many of long-term licenses were issued before 2009, when new amendments were made to the forestry code. Before that (2004-2008) it was allowed to carry out commercial logging without any inventory and forest use and/or management planning. Thus, many licensees started their operations without having any forest plans. They have developed their forest use plans only after some years of their operations. In accordance with the current legislation, all the burden on forest inventory, allocation of the harvesting stands, selection of cutting methods, etc. is put on the investor that increases uncertainty of the investor and thus, transaction costs. For instance, there are no specific rules, describing in detail accepted methodologies and techniques for forest cuts, invasive species, pest control, erosion control activities, etc. Furthermore, there are no nationally-adopted standardized templates (formats) of forest use plans and therefore, they differ significantly among investors, some of the containing forest protection measures and some of them not. Furthermore, there are no requirements set out in Georgia on construction and maintaining of roads to forests as well as on extraction and transportation of logs. Therefore, this process is done chaotically without any prior planning and the simplest methods are used that might have negative impacts on ecosystems. For instance, it was observed in Akhmeta forests that logs are dragged by tractors and there are no special routes assigned for this. This, itself puts pressures on soils and ultimately on forest groves. In addition, there are no environmental impact assessments required for timber harvesting and no eco-audits are conducted before approving the forest use plans. The cutting is allowed at 35^0 and steeper slopes that accelerate land erosion, landslides and mudflow processes. Large sections of forests licensed out are located at 30^0 and higher degree slopes and are of high value with soil protection and water regulation functions. Furthermore, in accordance with the existing regulations, forest harvesting stands are allocated based on maturity age of the trees and not based on technical maturity of the forests. In Georgia, natural conditions of east and west are different and technical maturity of one specific species in west can be reached earlier than in east. For instance, beech in the West Georgia can reach 40-60 cm diameter at age 100, while in the East Georgia it can reach the same parameter only at age 120. Furthermore, government authorities do not have enough capacity to check whether or not the concessioners adhere with license conditions. Significant amounts of sawdust are accumulated within the territories of concessioners that are then dumped into the river beds posing threats to local fish.

Livestock farming and grazing in particular, on alpine and sub-alpine meadows including Tusheti PAs put high pressures on these ecosystems. Historically, Tushetians followed traditional grazing patterns and practices that implied the following: graze lands were located at high altitudes up to 3,000 m.a.s.l. All pasturelands were divided into several zones according to elevation and land use type. This was traditional system of organization of high mountain, sub-alpine and alpine pasturelands across the entire Caucacus and notably all over the world (e.g. in Alps). The pasturelands were divided into three main zones: pastures for lactating livestock, those for cattle and, those for sheep. This pattern naturally is based on local conditions. In Tusheti there were cattle graze and sheep graze lands. Cattle graze lands were divided into two zones: (i) for cows and (ii) for oxen. Sheep graze lands had three zones: (i) for lactating sheep, (ii) for non-lactating females and male sheep and (iii) for lambs (as they reach summer pasturelands lambs are separated form the females).

Usually, land use patterns followed vertical zoning. The land around the villages was cultivated and cereals were grown or used for hay-making. Barley was grown in lower parts of these lands and rye was grown in upper parts toward the alpine areas. Plots for cereals were usually terraced. Both barley and rye plots were cultivated every other year. During non-cultivation years barley plots were used for haymaking and rye plots

– for cattle grazing (land is normally not productive for haymaking after rye). The land above cultivated plots and with more rugged terrain, unsuitable for growing crops was used for lactating cattle. Higher pastures located further away from the villages were used for sheep grazing. This land use pattern and especially the plot rotation scheme was apparently the most suitable and efficient way of using land in Tusheti. Since 1940s the above traditional grazing system was entirely abandoned. Soviet economy demanded an increase in sheep numbers and neglected local traditions and ecological conditions. The original zoning of pasturelands and pasture rotation schemes were abandoned causing serious deterioration of the pasturelands and fostered massive migration of Tushetians down to the lowlands. The Tushetians were actively encouraged to specialize on sheep farming and other livestock and other forms of agriculture including land cultivation were abandoned. All of this caused major shifts in the traditional life-style. All Tushetians switched to a migratory life-style i.e. spending the winter season in the lowlands and only returning to Tusheti for the summer.

Solid waste dumping in river beds and on landscapes by local population as well as by owners of guest houses within and outside of protected areas puts high pressure on both, aquatic and terrestrial biodiversity. This is common practice all over the territory of the river basin, including upstream.

Protected areas tourism, although being very beneficial for enhancing financial sustainability of the PAs, is one of the fast growing pressures on the PAs ecosystems and biodiversity. For instance, during the summer of 2009, Tusheti was visited by more than 2,000 visitors and, in August 2010 the number of visitors increased by 160% reaching 5,200. A conservative estimate for the number of TPA visitors for 2011 is between 6,000-10,000 visitors with approximately 40% to be internationals. Of course, this will increase the disturbance of local wildlife and degradation of local ecosystems that is already observed in the TNP. For instance, trash and litter is frequently left scattered all over the camping sites, visitors shelters, picnic areas; trails for horse riding and biking are already eroded, unrestricted biking, hiking and horseback riding in fragile ecosystems and habitats, cause disturbance of wildlife, e.g. in Chigo gorge, Sanane ridge, in forests south to Omalo and near Diklo gorge etc. With a growing number of visitors these problems will become more serious. Furthermore, in order to accommodate the larger number of tourists there is a need for building relevant infrastructure that will have a negative impact on the environment, especially during the construction phase. During the operations of this infrastructure there will be larger amounts of wastes, including wastewaters released into the environment, unless compost closed system toilets or wastewater treatment systems are installed. Furthermore, it is not advisable to use fuel-engine generators for guesthouses, since they cause emissions of pollutants into the air. Renewable energies, mostly solar systems and hydropower should be considered as a main source of power supply.

Finally, there is a frequent disturbance of wildlife of the TPA from border police, conducting regular patroling of border areas by helicopters.

In the middle to low reaches of the basin, where lower part of Telavi municipality as well as Lagodekhi, Kvareli and, Gurjaani, Sagarejo, Signagi and Dedoplistskaro municipalities shared by both Alazani and Iori Basins are located, major pressures on natural landscapes and biodiversity are imposed from agriculture and industrial (primarily, from agro-industry) activities, densely populated areas and, unsustainable utulization of biological resources.

More specifically, urban surface and agriculture run-off as well as untreated wastewater from sewerage systems and industries concentrated in densely populated urban areas of Telavi, Gurjaani, Kvareli, Lagodekhi and Dedoplistskaro, discahrged into surface waters pose threats to aquatic ecosystems. Furthermore, waste dumping on river banks also imposeds threats to fish.

Land tenure and land use change, although being insignificant today, was very intensive before the break-up of the Soviet Union that has seriously damaged natural landscapes.

Various mining operations, including limestone, marble, clay, sand and gravel mining in many watersheds of the Alazani river basin, including watersheds of the rivers of Alazani, Kabali, Duruji, Kisiskhevi, Lopota, Ilto, etc. also pose pressures on local landscapes and biodiversity (for more details please refer to the table of licensed mineral resources in annex 3).

It is generally known that mining industries, even those that do not cause heavy metal and acid leaching into the ground, have negative impacts on the environment during and after operations. These impacts include but are not limited to alteration of the relief, pollution of air, water and soil during operations, degradation of ecosystems through fragmentation of habitats and ecosystems, lowering of water table, soil erosion, reduction of aqua fauna, etc. For instance, extraction of sand and gravel from river banks, floodplains and river beds (instream mining) in large quantities, or through digging below the stream bed, etc. may change the geomorphic structure of rivers, including channel degradation and erosion. Instream mining alters channel geometry, including local changes in stream gradient and width-to-depth ratios. Thalweg relocation can occur when flooding connects the stream to floodplain mines. Local channel scouring and erosion can occur as a result of increased water velocity and decreased sedimentation rate and thus, decreased sediment load associated with mines. Where mining activities are numerous and concentrated, an upstream channel degradation and erosion can occur, referred to as *headcutting.* Headcuts induced by sand and gravel mining can cause dramatic changes in a streambank and channel that may affect instream flow, water chemistry and temperature, bank stability, available cover, and siltation. Channel erosion from headcuts can cause loss of upstream property values; reduce recreational, fishing, and wildlife values; and contribute to the extirpation and extinction of stream fauna. The combined processes of channel incision and headcutting also can undermine bridge piers, aqueducts, gas pipelines, etc. Furthermore, river sedimentation and increased turbidity can occur from mining activities, wash-water discharge, and storm runoff from active or abandoned mining sites. Decreases in dissolved oxygen and increases in temperature have also been reported downstream from dredging activities. Mining-induced changes to the geomorphic structure of the stream can significantly affect fish habitat and abundance. Instream mining can reduce amount of coarse, woody debris in a channel, known as important fish and invertebrate habitats. Effects of mining on fish communities also may vary among and within streams as well as among different fish species. In accordance with scientific studies, although fish species differ in their ability to tolerate suspended sediments, most could survive short-term exposure to greater than 1,000 ppm. Exposing fishes to concentrations less than 25 ppm caused no harm to a fishery, and chronic exposure to concentrations of 25 ppm-100 ppm would generally be tolerated. High turbidity and sediment loads may favor nonsight feeders such as catfish, whereas sight feeders such as trout and bass may not resist such levels of sediments.

Without remediation, stream recovery from sand and gravel mining can take decades. Some stream reaches 10 years after mining were reported to be in worse condition, with significant signs of channel alteration and no available fish cover. Conversely, recovery in some streams can be rapid, depending upon river hydrology and sedimentation rate. There are bans or certain restrictions on river inert material extractions in many countries worldwide. These include but not limited to complete avoidance of sand and gravel mining in streambeds, (2) avoidance of direct connection of floodplain excavations with streams, and (3) filtering of wash water before returning it to streams. Bank stabilization, re-vegetation, buffer strips, control of headcutting, and washwater recycling might be required to recover the river environment. Although rock gabions can be used to halt headcutting, they are an extreme measure that may alter fish movements and behaviors. Another approach to mediate disturbance effects is to estimate the annual bedload sand and gravel supply from upstream, considered the replenishment rate, and limit annual mining to some fraction of the replenishment rate considered to be a "safe yield". For example, Washington biologists have sought to limit instream mining to 50% of the replenishment rate as an estimate of safe yield to minimize mining effects on salmonid spawning habitat. The approach is based on scaling mining operations relative to the river bedload. However, bedloads are extremely variable from year to year and it will be very difficult to define safe yields for more than 1 year.

In Georgia, unfortunately, environmental impact assessment and environmental impact permits are not required for mining operations, including oil and gas extraction. Nor do site management and remediation/conservation plans are required to be developed and implemented by the licensees. Methodologies for calculation of allowable volumes of extractions and/or extraction rates and sites of extraction, take into consideration only available reserves and resource demands. However, the safe yield concept is not used and the majority of environmental concerns are not taken into consideration before putting the site and the resource under the auction. Furthermore, environmental inspectors only can check compliance of the licensees with the extraction limits(quotas) or their compliance with technical regulations existing for effluent discharges. Such issues as soil erosion, fish abundance, soil quality, air pollution from fugitive emissions are completely left out of state regulation. In practice, law enforcement officers check only extraction amounts. Effluent discharges are not monitored and controlled at all due to low institutional and staff-level capacity of the environmental inspectorate.

Unsustainable pasturing, including overgrazing is a significant problem in almost all municipalities. Local population graze their livestock everywhere, including floodplain forests, state forests of national importance and even in Vashlovani protected areas. In the Vashlovani PAs Tush shepherds graze their sheep in designated pastures during fall and winter seasons. They frequently ignore the boundaries of pastures and graze their sheep illegally in areas not designated as pastures. This, itself puts high pressures on small to medium sized mammals and ground nesting birds as well as on forest ecosystems in particular, on pistachio trees that have very low natural regeneration rate. Night fires and shepherd dogs also impose negative pressures on the PAs’ ecosystems. Regardless of this, sheep grazing has also a possitive impact on the landscapes and the vegetation cover and contributes to the wider diversity of biological resources there.

With regards to unsustainable use of biological resources, Illegal logging for fire wood is intensive in former collective farm forests surrounding the inhabited areas as well as in the forest fund of national importance that put high pressures on forest ecosystems. In the past, floodplain forests were preserved well and there were no logging activities in these areas. After the independence, when Georgia faced serious power crisis, wood cutting even in floodplain forests and within the protected areas for fire wood extraction became a common practice. In fact, it is allowed to cut and remove dead and fallen trees in the Vashlovani protected areas except for the strict natural reserve. Regardless of this, people frequently cut standing/live trees. These pressures are especially high on forests adjacent to settlements. Such locations are, for instance, Shavi

Mta near village Sabatlo, Lekistskali near Ksristkskali, Jumaharbor floodplain near Kastristskali and Artsivis Kheoba near Dedoplistskaro.

In terms of commercial logging, there is a large concessioner "Georgian Wood Industry Company" in Kvareli municipality holding the 20-year concession on 150,000m^3 volume of annual timber harvesting within 10,052 ha of the state forest fund as well as smaller concessioner company "Khome" in Telavi municipality holding the 10-year license to harvest 2,500m3 beech annually. The license was issued to the first company in 2007 and to the second company in 2009 without any preliminary inventory and ecological study of the area. The licensee first years of its operation didn't have any forest use/management plan and the government from its side had very poor capacity to conduct effective compliance assurance monitoring and control.

Poaching is also very serious problem in middle to lower reaches of the Alazani river basin, including Vashlovani Protected Areas and the government capacity to prevent or reduce it is very weak. Most of local hunters as well as visitors mainly from the Capital ignore hunting seasons and often use illegal methods of hunting. There is a high demand in derivatives of wild species such as skin, fat (of bear, wolf), etc. For example, in late 1980s and early 1990s Libertine vipers were caught in large numbers (two thousand per year) for the purpose of obtaining the venom. Because the demand in primary (unpurified) product has declined the species is no longer exploited. Hunters still kill the snakes to prevent interaction with hunting dogs.

In the Vashlovani PAs, hunting imposes the greatest pressures on keystone species. Illegal sport hunting takes place all over the year excluding summer. Wild boar, bear, etc. are the most widely hunted species. Usually, hunters move to the PA when the number of game is declined outside it. Local population also hunts for subsistence or guides less experienced hunters. Overall, Georgian hunters have little options and opportunities to hunt legally. Although there are a number of hunting farms in Lagodekhi, Gurjaani, Kvareli, Dedoplistskaro municipalities, etc. evidently, they are not managed properly and are not adequately supplied with game stock. Hunting poses the pressures not only on the size of animal populations but on their distribution, since gun fires, barking and running dogs scare large mammals. Achievement of one of the major objectives of the VPAs – reintroduction of goiter gazelle (Gazela subgutturossa) and recovery of leopard (Panthera pardus) is hindered by illegal hunting. Furthermore, shepherds grazing their sheep in the VPAs frequently kill wolves in order to avoid or reduce the stock loss.

Illegal fishing also takes place in the Alazani River. Fish are caught for both private consumption and commercial purposes. People often use illegal methods such as electroshock, fixed nets, poison and dynamites that pose a major threat to all aquatic species. Protected areas staff is more successful in combating illegal fishing than poaching.

Fires impose high threats to ecosystems of the Vashlovani PAs. Grass fires are very frequent that are difficult to control due to the lack of water and fire fighting equipment. These fires are most widely caused by damaging practice of local farmers to burn their lands as well as by similar wrong practice of shepherds to burn their pastures to allow for fast grow of a new grass.

Currently, PA rangers are equipped and trained better than couple of years ago. However, they still have little resources and poor capacities for effective enforcement. Lack of poaching data hinders the full understanding of poaching patterns and trends. Although, camera traps and collared radars help the rangers to identify and find poachers. In general, Vashlovani PA is staffed with 26 law enforcement officers.

Additionally, there is a PA Director based in Dedoplistskaro. This number of law enforcement officers is not enough for effective work. Rangers usually patrol by horse for periods of less than six hours, approximately eight times per month. In one month, on average, two violations are detected.

Among the natural pressures, natural disasters and climate change are the major ones causing landscape and biodiversity degradation. Climate change impacts are very high in venerable arid and semi-arid areas, especially in Dedoplistskaro municipality the pressures and impacts of which are discussed in detail in previous chapters.

Likely pressures on natural ecosystems especially, on aquabiota could be imposed from copper mining and processing operations in the Alazani river gorge. There are significant deposits of copper in the basin and presumably a license(s) will be issued to extract this deposit.

Iori River Basin. Similar to the Alazani river basin, human interventions as well as natural factors impose high pressures on landscapes and biodiversity of the Iori River Basin. While in the upstream and extreme downstream areas natural factors such as natural disasters (in upper reaches: mudflows, landslides, floods and in lower reaches: droughts, etc.) and climate change pose the largest pressures on the ecosystems, in the middle to lower reaches were densely populated areas are located higher pressures come from land cultivation, urban infrastructure, industrial activities, etc. In the extreme lowcourse of the basin which is practically unpopulated, the largest pressures on ecosystems are imposed from upstream water users, overgrazing, illegal hunting, oil and gas operations.

More specifically, in upstream areas where Tianeti municipality is located the large pressures of natural ecosystems and species are from naturally occurring landslides, mudflows, floods. However, human pressures are not insignificant as well. Illegal logging, hunting, fishing as well as overgrazing and unsustainable commercial harvesting of timber resources pose high threats to the landscapes and species.

Illegal logging for fire wood is sizable in Tianeti municipality. The region is underdeveloped and poor and therefore, local population does not have enough resources to meet its cooking and heating demands especially, in remote mountainous areas. The average consumption of wood for heating and cooking is $6m^3$ annually and for construction – 2 m^3. Due to the complicated procedures for getting the fire wood cutting tickets as well as due to the lack of financing to ensure cutting and transporting logs from forests and to pay for fire wood, the large number of villagers is engaged in illegal logging. For instance, detected illegal cuts in the municipality made up $47{,}320m^3$ in 2008, $65{,}380m^3$ in 2009 and, in 2010 – 3,650 m^3, which might be much more higher if we add to this amount undetected cuts. On the other hand, law enforcement system is weak to control illegal cuts in state forest fund and forest concessioners do not have enough means to control illegal activities in their territories.

Usually, fire wood provision system is managed by the central government and harvesting happens in the state forest fund of national importance. Meanwhile, local authorities can be more effective in managing such systems. Forests of local importance have the high potential to satisfy the local needs for fire wood. Moreover, current law on Licenses and Permits does not cover tending, sanitary and forest regeneration cuts specified in the Forest Code. Such activities are necessary for sustaining the healthy ecological status of forests on the one hand, and may become an important source of firewood for the local population. Unfortunately, since 1999 when the Forest Department was deprived the right to conduct sanitary and forest restoration cut, due to the past corruption, tending and other types of forest cuts in order to maintain and improve the ecological status of these resources have not been carried out. In addition to using wood produced through such cuts as firewood, it should be allowed to use secondary timber products, e.g. wood chips as well as development of briquette, pellet, industries, etc. should be promoted.

Apart from illegal cutting, commercial logging operations also impose pressures to natural ecosystems. Namely, there are following concessioners in the Tianeti municipality: Georgia Wood and Industrial Development Co. ltd", holing a 20-year license for cutting 9,080m^3 wood within 7,687 ha of forests of Artani and Akhalsopheli quarters of Tianeti State Forestry unit and, a separate 20-year block license to cut 1,600m^3 timber annually in Bochorma forestry unit of Tianeti forestry Division with a total area of 1,534 ha; "m. hauz+", Limited, holing the 20-year license to harvest 1,021m^3 timber annually in the forest fund of the Tianeti municipality (860 ha) and; Company "Vakhtang Betlemidze" holding the 10-year license to harvest 5,719m^3 of beech and 117m^3 hornbeam annually in 790 ha of state forests within the Sioni unit of the Tianeti forestry.

Poaching similar to Alazani river basin, is also significant in the Tianeti municipality. Law enforcement officers control fishing more effectively than hunting.

In the middle reaches of the Basin pressures on natural landscapes and biodiversity from densely populated urban and rural areas increase and become the major factors determining degradation of biological resources. Urban run-off, wastewater discharges from both sanitation systems and industries, agriculture run-off and land cultivation activities impose significant threats to the biodiversity. Recent intensive road construction activities have also posed pressures to the ecosystems during the construction phase.

Unsustainable harvesting of biological resources, including illegal logging in the state forest fund of local and national importance as well as in floodplain forests together with poaching are also significant threats to the basin's ecosystems.

There are minor oil and gas extraction activities in Sagarejo and Signagi municipalities that have a locilized impact on surrounding landscapes and ecosystems.

Overgrazing is the greatest problem in dowstream areas of the Basin particularly, in Dedoplistskaro municipality. Traditionally, arid and semi-arid zone of the Caucasus has been used as winter pastures for livestock, mainly sheep. In winter times, large numbers of sheep are moved to the winter pastures from north-east and central parts of the country. Sheep migration to the zone begins in September and the sheep stay there until April of the next year.

Before the Soviet regime, communities had followed a sustainable system of pasture rotation. All shepherds involved in the animal migration cycle were united in cooperative sub-groups. Each sub-group received two plots of the arid land for 10-15 years to utilize as pastures. All pastures consisted of two different zones: hills and plains. At the beginning of the fall season, each sub-group first occupied the hilly areas of one of their two land plots. In winter they moved down to the plain areas. This could be called "Seasonal Utilization". Furthermore, the shepherds utilized only one plot for the entire year, not touching the second plot and, the next year they moved to the second plot allowing the first plot "to rest". In addition, there was a full rotation of plots among shepherds after 10-15 years. Mutual enforcement was possible due to the size of the groups, social links among their members, and the dimension of the plots.

The Soviet regime abolished the private sector and created collective farms (so called Kolkhozes and Sovkhozes). It has promoted intensive utilization of winter pastures. Over the time the use of winter pastures changed in terms of both grazing methods and intensity (densities of sheep per ha). Despite the fact that during the communist period sheep number did not increase significantly, the ecosystems suffered severe damage due to the unsustainable pasture management.

After Georgia's independence, adoption of a market economy and the subsequent recognition of private and communal property rights have not resulted in reintroduction of old pasture rotation system. In addition, the total number of sheep in the area has increased as certain number of livestock is brought from the neighboring territories of Azerbaijan and as well, as Georgian shepherds can no longer use Kizlar pastures in the North Caucasus. Sheep migration from Georgian summer pastures begins in September and the sheep remain there until late April of the next year. Sheep density significantly exceeds the carrying capacity of the pastures. In addition, shepherds do not use fodder as supplementary food for their sheep and the herds entirely depend on pasture grass that enhances the pressures on pasturelands. Overgrazing is particularly harmful during spring months when plants begin a new life cycle. During that period sheep choose to graze a new grass. Forbs are especially affected by grazing, while they play critical role in maintaining pasture productivity and forming the structure and the composition of pasture plant communities. After the sheep leave for summer pastures in May, stubbed and overgrazed grasses and herbs are unable to regenerate. As a result the plant communities are in general simple and the biomass is severely reduced. Due to the severe erosion of the pastures, shepherds move to new territories including protected areas or try to improve quality of pastures. Unfortunately, the methods used by shepherds lack scientific basis and might be malignant to pasture ecosystems. For instance, artificial fires used most widely by shepherds are in general known to improve certain types of habitats and increase their productivity but they should be managed carefully taking into consideration local oro-climate conditions and type of vegetation cover. At present fires start from late February and last to April affecting new vegetation. Shepherds burn not only pastures, but surrounding shyblyak steppes (so-called areulebi) and even floodplain forests.

Apart from unsustainable grazing and pasture management practices, during Soviet times, pressures on ecosystems of pasturelands were imposed by intensive irrigation without taking consideration local soil conditions, leading to soil salization and bogging. In the past, even hilly areas of the pastures were irrigated intensively that imposed threats to the top soil of hills and foothill as well as to the plain vegetation through washing down dissolved gypsum and making it accumulate in the lowland areas. This itself posed threats to the plain vegetation. In 1970-80s, the use of new plots of land for agriculture was very intensive. For this purpose, the Iori River was dammed and mechanical irrigation systems based on electrical pumps were constructed. Incorrect irrigation intensified the process of salinization. The construction of the Dali Reservoir on the river Iori, significantly affected the natural water regime of the river. This may be one of the reasons for the decline in floodplain forests downstream the reservoir. At present the irrigation infrastructure is paralyzed and considering current electricity shortage its reconstruction and operation are unlikely to be economical.

Illegal logging is also a serious problem in middle-to lower reaches of the Iori Basin. This happens in state and protected areas forests and, in flood plain areas.

Various mining industries, including gas and oil exploration and extraction activities concentrated in Sagarejo and Dedoplistskaro municipalities (Taribana, Mirzaani, Nazarlebi, Mtsare Khevi, Kikakupra, Ninotsminda, etc) impose threats to arid and semi-arid ecosystems, though at smaller-scale due to low levels of extraction. Moreover, it is planned to increase oil production rates in the future if prospective reserves prove to exist that will further enhance the pressures on the ecosystems. Furthermore, there are several quarries that extract cement, facing limestone, brick clays, etc. During operations phase, these quarries pose pressures on the ecosystems in terms of destruction of relief, original ecosystems, species habitats, air, soil and ground water pollution by dust, silt and oil and, soil erosion. In addition, ground water table can be reduced. After ceasing the operations, large holes usually filled in with lakes and with steep slopes are left in place of quarries. Although, during the course of work these holes might be covered by vegetation, the original landscapes will be never restored. Some reinstatement works might be necessary in order to bring these damaged landscapes close to surrounding relief and landscapes.

In addition to limestone and clay mining, there are numerous river bank, floodplain and instream sand and gravel mining operations in Sagarejo, Gardabani (Sartichala, Muganlo, Khashmi, Gombori, etc.) and Signagi municipalities that also represent threats to local biodiversity.

Likely high pressures on the natural ecosystems in the future could be imposed by increase oil production activities. As it was discussed in previous chapters, oil producing companies in Iori river basin are going to increase their productions that will significantly increase the pressures on surrounding ecosystems.

<u>Rioni River Basin.</u> Similar to upstream areas of the Alazani and the Iori river basins, in the upper course of the Rioni river basin major pressures on natural landscapes and biodiversity are put from natural disasters including landslides, mudflows, floods, forest fires, etc. The area is less populated, urbanized and industrialized and therefore, anthropogenic pressures on ecosystems and biological resources are imposed from such activities, poaching, extensive logging and fishing, illegal forest cutting and fishing.

There are a number of forest concessioners in the region holding long-term timber production licenses. Namely, these companies are as follows: “Ir Turi”, limited, holing a 10-year concession to cut 11,180m^3 fir and, 22,500m^3 spruce and beech annually on the 413ha of Gviara forestry unit of Ambrolauri Forestry Division; “Rioni Wood” limited, holding the 10-year license to cut 9,950 m^3 beech and 11,660m^3 fir annually on 630 ha of land of the Uravi forestry unit of the Ambrolauri Forestry Division; “Emzar Mukbaniani”, wide profile company, holding the 10-year license to cut 1,800m3 wood annually, of which 720m3 is beech, 900m3 – coniferous trees and 180m3 – common alder. Total area of the licensed forests is 1,342 ha that belongs to the Khophuri section of the Lentekhi forestry unit of the Racha-Lechkhumi forestry division; Value Trading Corporation, holding the 10-year license to cut 1090m3 wood annually, of which 673m3 is beech and the rest – fir and spruce. The total area of the concessioned forest is 858ha that belongs to the Lentekhi section of the Lentekhi forestry unit of the Racha-Lechkhumi and Kvemo Svaneti forestry division.

In the region illegal logging happens primarily to meet cooking and heating needs of rural population, especially in remote villages. Although, registered volumes of illegal cuts are quite low, with 3348.4m3 average annual value (2005-2009), this does not reflect the real picture. Annual household demand for firewood is 12m3, while the supply – 3m3 (2009), which is only 25% of total individual household demand. Thus, it should be assumed that the majority of firewood demand is met by wood produced illegally.

Currently, both illegal and legal logging put pressures not only on forest ecosystems and their inhabitants, but also on the species populating sub-alpine and alpine belts. For instance, in Svaneti the Western tur lives in unforrested areas. Degradation of the forest belt causes damages to the upper belts and as a result, vertical zonality of vegetation changes ultimately affecting the tur populations.

Illegal and unsustainable hunting on large mammals, including bear and the wild goat is very serious problem in the Racha-Lechkhumi and Lower Svaneti region. Even nowadays hunting is considered as a proud business among local population. In 19th century, there were sizable populations of West Caucasian tur *(Capra caucasica)* in the Racha-Lechkhumi and the Lower Svaneti inhabiting Shodi Mount areas. This species is endemic to the West Caucasus. In the 19th century, annually, up to 100 individuals were killed by the villagers of Gebi, Glola and Tchiora. As a result, tur populations have been reduced and now it is very difficult to somewhere see them. Scientific data are also absent on the population size and habitats of this species.

In Svaneti up to 220 tur individuals were killed annually in the 19th century. The highest pressures on Western tur are imposed in the Zeskho gorge, where hunters are coming even from Zemo Svaneti and Racha. Hunting season starts in late August and lasts until December. The hunting of this species is prohibited, but law enforcement mechanism is weak. First of all, the police cannot penalize sellers of the tur derivatives, since there is no such law regulating the issue. The second, law enforcement officers lack technical equipment, knowledge and even motivation due to the low salaries to conduct effective compliance assurance monitoring and control. The most targeted species currently are the brown bear, chamois *(Rupicapra rupicapra)* and roe deer. Due to the reduced population size of the tur, hunting on this species has also decreased.

As it was discussed in previous parts, mining industries, both operational and abandoned ones and their wastes pose high pressures on the ecosystems of the Racha-Lechkhumi and Lower Svaneti region. More specifically, toxic waste sarcophagus (cemeteries) in Lentekhi and Ambrolauri municipalities are damaged and toxic chemicals are exposed to the environment. Arsenic mining and processing wastes are accumulated on the banks of the River Tskenistskali in Lentekhi municipality. Currently, long-term licenses are issued to extract ferrous and non-ferrous metals in the region, including arsenic, antimony and gold of the Lukhuni deposit in Ambrolauri municipaliy, copper of Zeskho deposit in Lentekhi municipaliy; manganese of v. Shkmeri deposit in Oni municipality, etc. With regard to non-metal minerals, there are on-going operations of limestone, gypsum, diabase and sand and gravel extraction in all municipalities of the region. Since there is no EIA and environment permit required for mining operations, the pressures on ecosystems will stay to be high and will further increase with the growth on mining activities in the region. More speicifically, the region is rich in non-ferrous and precious metals of copper, zinc, cobalt, tungsten, molybdenum, gold, silver and their extraction will increase pressures on the natural resource base and the ecosystems of the Rioni basin.

Construction and operations of large HPP cascades in the Rioni during the last century has already impacted negatively spawning areas of trout in upstream areas and the Black Sea Salmon in downstream areas as well as many terrestrial fauna species through destruction and fragmentation of habitats, breeding and sheltering areas of mammals. Large areas of unique ecosystems and cultural landscapes have been flooded due to the damming and reservoir construction.

Next years high pressures on terrestrial and aquatic species and ecosystems will be imposed by new large-scale HPP schemes (e.g. Namakhvani cascade, Alpana HPP) that will cover all upper, middle and lower reaches of r. Rioni in Tsageri, Tskaltubo and Tkibuli municipalities. More specifically, during the consutruction phase the river turbidity and sedimentation will increase that will threaten aquatic biota. During the project operation phase, minimum ecological flow has to be guaranteed in downstream waters in order to maintain healthy environmental status of the river, including aquatic biota. It is calculated that for Tvishi reservoir these value should be 15 m3/s, 16 m3/s and 16.3m3/s for Tvishi, Namakhvani and Zhoneti reservoirs, respectively.

Furthermore, many natural and cultural landscapes and ecosystems will be altered during the construction phase, including deciduous forest ecosystems that cover about 90% of the Namakhvani HPP project site. The highest pressure will be put on the Rioni River that will be transformed from riverine landscape to lentic environment at reservoir places and downstream areas. Thus, the natural environment in and around standing waters will change.

Pressures on local terrestrial fauna and flora will be high during construction phase, including pressures on habitats, breeding and sheltering areas of mammals and nesting areas of many birds. In addition, spawning, sheltering and living habitats of aquatic biota will be threatened.

The Namakhvani project ESIA has identified 9 highly sensitive biodiversity areas. These are: confluence of the river Utskherisgele with the Rioni, floodplain forests on the left band of Rioni, located southwest of the village Zogeti, left banks of the River Lekhidari and, located on the construction site of the Namakhvani HPP dam, are lying on the left-hand bank of the Rioni River, to the east from the Namakhvani village on the opposite side of Rioni, floodplain covered with meadows and wetlands lying on the left bank of River Rioni to the south from the Namakhvani Village on the opposite side of Rioni, the right bank of the Rioni at Zhoneti reservoir construction site, small stream, south from the village of Sakire and, channel of the small river of Okinkila to the north of Zhoneti Village. These areas are represented by various ecosystems varying from mixed forests of pine and hornbeam, colchic forests of oak, chesnut and beec,h rhododendron and other evergreen species of Colchis origin, including box tree and lianas as forest undestory, floodplaing forests of alder trees, chestnut trees and box-trees, wetlands, etc. These areas are sheltering, breeding and/or feeding areas for such animals as brown bear (*Ursus arctos*), wolf (*Canis lupus*), fox (*Vulpes vulpes*), badger (*Meles meles*), pine marten (*Martes martes*), wild cat (*Felis silvestris*), Roe deer (*Capreolus capreolus*), Wood vole (*Terricola majori*), Mole (*Talpa sp*.). Among birds, common buzzard, Eurasian griffon (Gyps fulvus), various forest birds are found. Among ampnibian, two species of amphibians (Marsh frog and Caucasian toad) are found. Among reptilians, grass snake, dice snake, meado lizard (*Darevskia praticola*) etc. are found. Among fish banded demoiselle *Calopteryx splendens)*, brook trout (*Salmo fario*) are observed. Among invertebrates beautiful demoiselle (*Calopteryx virgo)* and freshwater crab are recorded (*Potamon sp.*). Some of above sensitive areas are breeding, feeding and sheltering areas of arboreal species of bats.

In addition to all above activities, tourism poses the pressures on the ecosystems of the upper reaches of the River Basin. Moreover, it is planned to build large tourism and recreational infrastructure around the Shaori resrvoir that will enhance the anthropogenic pressures on the ecosystems of the region. There is also a plan to build a new road from Khasuri to Racha that will also impose pressures on biodiversity and landscapes during the construction phase.

Among natural pressures, active geodynamic processes, including landslides, mudflows, avalanches and floods represent the threat to the local biodiversity (pressures of natural factors are discussed in detail in previous chapters).

In the middle to low reaches of the basin (Imereti, Samegrelo) the major pressures on ecosystems and biodiversity are imposed by urban and rural settlements, infrastructure development, various industries especially, mining industries and, from damming and storing of stream water. Threats of the poaching and intensive logging are also significant.

Historically, land use and land use changes posed significant pressures on natural ecosystems of middle to lower courses of the Rioni Basin. There pressures were the highest during the Soviet regime, when the rapid urbanization and industrialization of the country happened. During the 70 years of communist party ruling, many natural landscapes and agriculture lands were transformed into urban settlements and industrial sites. However, after the break-up of the Soviet country, land use and land use change pressures have declined, due to the drastic fall of Georgian economy. Although since 2004 there are some signs of recovery, in accordance with official statistics, there is no trend of expansion of agricultural and urban areas. Population size of Imereti region has reduced by over 2% since 2000. During last ten years the population size of Kutaisi, the largest city in the west Georgia has increased only by about 1%, which is very insignificant growth. This is due to the low natural growth rate of local population as well as due to the migration of labor force from the region to the capital. However, with the full-scale operation of free industrial zone in Kutaisi, migration of people from rural areas and other cities might increase and the urban sprawl can be intensified. This will itself incur the increase in pressures on natural and cultural landscapes and biodiversity from urban development, including land use change, construction, urban infrastructure development, etc. Amount of waste and wastewater generation will also increase that will result in high volumes of wastewater and solid wastes released into the environment that will threaten aquatic biota.

Current on-going large infrastructure projects, including Black Sea high voltage transmission line, Kutaisi-Senaki-Poti section of East-West main pipeline main gas pipeline also impose pressures on natural landscapes and ecosystems (please see figure 8 in annex 7).

The Black Sea transmission line crosses landscapes of Zemo Imereti Plateau (Upland) and Kolkheti foothills and plains (Zestaphoni section). Zemo Imereti plateau consists of two orographic features: Dzirula crystal massif with the Surami ridge and Chiatura plateau. Natural landscapes here are represented by broad leafed forests, which to the west transform into cultural landscapes of agricultural lands, settlements, secondary scrub and meadows. Forests of the area are rich in relict and rare species. Kolkheti foothills are plains are represented by south Imereti foothills joinining with the northern slopes of the Achara-Imereti ridge and the Guria and Imereti hills. Along the railway corridor passing through the area fragments of natural landscapes, including secondary *Carpinus* spp. woodland, mixed broad-leaf woodland, *Q. imeretina* (Red List of Georgia, **RDB**) and *Zelkova carpinifolia* (Red List of Georgia, **RDB** Georgia) forests are met. There are large areas of forest preserved on the left bank of the river Rioni. The transmission line corridor affects highly sensitive areas of Khanistskali section, Zekari section represented by oriental beech forests, Zemo Imereti Plateau represented by natural landscapes of C. caucasica mixed with Cytisus hirsutissimus and, with Hypericum orientale understories as well as by Q. iberica mixed with Q. imeretina (Red List of Georgia, RDB) and, with Rhododendron luteum understory and, Ajameti managed reserve. In addition, moderately sensitive floodplain forests of *Sakraula and Kvirila rivers will be affected by river crossings.*

Another project that crosses lower reaches of the Rioni Basin is Kutaisi-Senaki-Poti section of the East-West main gas pipeline, although the pipeline does not go through the natural habitats and landscape of high ecological value and does not threat rare, endemic or relic species. The largest pressures will be put on fish populations, which are abundant in the extreme low-reach of the Rioni at the confluence of the river with the Black Sea.

Part of the Senaki-Poti gas pipeline passes through two sections of the Kolkheti National Park, where the transport corridor is located. Over 80% of Senaki-Poti section are covered with cultural landscapes represented mostly by pastures and ploughed areas. There are also secondary forest patches represented by *latanus orientalis, Alnus barbata*, *Fraxinus oxycarpa* and *Amorpha fruticosa*. Forest understory is represented by *Rasberry* and *smilax scrub*. Large areas are also occupied by mezophylic boggy meadows. From place to place wetland vegetation is met along the main drainage canals. In Chaladidi and Nabada area species of aviafauna, adapted to urban environments are met including Andrea cinera, Circus aeruginosus, Falco tinnunculus, *Tringa ochropus, Perops apiaster, Hirundo rustic and Delichon urbic, Motacilla flava, Passer domnesticus, Corvus corone*, etc. In the forest fragment near settlement Nabada following birds are met: *Botaurus stellaris, Ixobrychus minutes, Laurus cachinnans, Buteo buteo, Motacilla alba, Turdus merula*. About 20 species are nesting birds represented mostly by birds adapted to urban environments.

As for the ichtiofauna, the pipeline crosses several drainage canals, poor in fish and, one artificial canal, through which Rioni flows into the Black Sea. This is very sensitive area, since it is abundant with fish. Out of total 49 fish species found in Rioni, 45 are found in this section including sturgeon. Fish includes local and migrating species. Therefore, the construction should be done after the spawning period and through air corridor. Pressures on the riverine environment may be put through change in morphology and topography of the river canal, change in sedimentation movement, hindrance of fish migration, pollution of surface and ground waters by oil production and construction wastes, noise, vibration, etc.

In terms of pressures from industrial activities, middle to low reaches of the Rioni basin are traditionally highly industrialized regions, with intensive mining operations and ferrous and non-ferrous industries, including manganese processing, ferro-alloy, chemical, textile, food, electro-mechanical, etc. facilities.

Among on-going mining activities, extraction of ferrous metals (manages and iron in Imereti), coal (Tkibuli, Imereti), non-ferrous metals (copper and gold in Martvili Municipality, Samegrelo-Zemo Svaneti region), various types of limestone, sand and gravel, marble, basalt, teshenite, diorites, tuffogenic breccias, clays, agate, etc. occurs in the region. In addition, there is pit extraction in Samegrelo region. Most of existing mines are open pit quarries posing high threats to natural resource base, including land, water and biota, both aquatic and terrestrial. Pressures from ore extraction activities on landscapes and biodiveristy are imposed: by acid mine water drainage and run-off as well as by drainage from mine waste piles, tailings, dumped waste rock, casing leaching out of toxic metals or their release from soil; land erosion and during severe storms and floods washing down of pollutants (primarily, heavy metals and sediment) into surface waters, threatening aquatic biota, including fish, benthic macroinvertebrates, phytoplankton and algae; direct disruption of ephemeral, intermittent, or perennial streams and wetlands; land clearing, alternating topography of dominant landscapes and affecting the distribution of vegetation and the wildlife; noise during operations resulting in displacement of wildlife populations, etc; exposure to toxic/hazardous chemicals through solution ponds, tailings' impoundments or spills threatening individuals.

Abandoned mines also pose high threats to the terrestrial and aquatic species and entire ecosystems through toxic substance leaching, surface run-off, etc.

As for the industrial facilities, various ferrous metal and coal processing plants and smelters having out of date pollution control technologies pose high pressures on the quality of soil and water resources and, on biodiversity exposing them to toxic substances through pollutants releases into air, water and soils. It is noteworthy to mention that currently construction of 13 MW installed capacity coal-fired thermal-power plant is on-going and the next step is the construction and commission 300 MW installed capacity thermal plant in Tkibuli area. This plant might impose significant pressures on the ecosystems of the area through depositing acid loads, in the form of dust and acid rains. Moreover, sulfur dioxide can be transported to long distances by the prevailing air masses and deposited in a high distance from Tkibuli as acid rain.

Similar to other regions of Georgia, these pressures are also significant in the middle to low reaches of the basin, although less relative to 80s in terms of agrochemicals loads and the level of land cultivation. Overgrazing is in mountainous areas and forests is also a problem,

As for unsustainable harvesting of forest resources, illegal fishing and hunting all these are the problems in middle to low reaches of the basin.

There are several forest long-term concessioners in Imereti and Samegrelo regions. More specifically, in Martvili municipality, Samegrelo Zemo Svaneti region 135 quarters with average size of 136 ha in Kurze and Taleri districts of Martvili Forestry Unit are licensed out for 10-year period (2006-2016) to the Company "Georgian Forestry". The land area of the concessioned forests make up 18,320 ha, of which 17,302.5 ha (94.48%) is covered with forests. All these forests belong to the first category with water regulation and soil protection functions. The majority of forest stands is represented by mature and over mature trees making up 63.6% of total forest, followed by adult (middle-age) trees – 20.9%, near mature trees – 12.8% and, young stands – 2.7%. More specifically, young forest stands make up 388.7 ha with 28,730m3 volume of wood reserve, middle-age trees – 3,135 ha with 481,360m3 volume of wood reserves, near mature stands – 2,534 ha with 475,050m3 wood resources and, mature and over-mature stands - 10,402 ha with 2,842,780m3 wood resources. The licensee according to forest use plan, will cut 95,132m3 wood over 10-year period on 1,437ha of forests, with the largest amount to be cut during the year 1 (11,780 m3 on 226.4 ha), the second largest amount -during the year 2 and 3 (10631m3 on 199.3 ha annually) and, smaller equally annual amounts – during the remaining years (8,870m3 on 116 ha annually). Furthermore, there are three licensees in Imereti region. "Georgian Wood and Industry" holds 20-year license (2008-2028) on 18,482 ha to cut 24,621 m3, International Timber Producing Company, limited holds 10-year license (2009-2019) on 963 ha to cut 14,586 m3 broad-leafed (beech, etc) trees annually in Tskami district of Sachkhere Forestry Unit; Bemoni, limited holds a 10-year license (2010-2020) on 1,763 ha of Khumuti district of Vani forestry unit to cut 2350m3 beech and 150 m3 alder.

As for illegal cutting, in 2005-2009 total registered volumes of illegal cuts amounted to 19480m3 with 3896 m3 average annual volumes of illegal cuts in Imereti region and to – 28921m3 with 5,784.2 annual average volumes of illegal cuts. However, similar to all other regions of Georgia this does not reflect a real picture of illegal cuts. More specifically, in Imereti region fire wood demand per household is 7 m3, while in 2009 this demand was met only by about 23% (1.6m3). In Samegrelo-Zemo Svaneti annual household demand is estimated at 8.4m3 and supply was only 0.8m3 in 2009, which is 9.5% of existing demand. Most probably, fire wood demand is at large met in Imereti and Samegrelo-Zemo Svaneti by illegal cutting.

In the Rioni estuary and the coastal zone, where Kolkheti National Park is located there are unique wetland ecosystems with peat bog, mire and marsh. They are habitats for numerous species and in particular, for migratory birds. Other important habitats are coastal dunes, rocky shorelines and pine groves. Over centuries these areas have undergone significant anthropogenic pressures of land use and land use change especially, during the last century when the large-scale wetland drainage and peatbog reclamation for agriculture use has occurred together with massive deforestation in place of which tea, citrus and tung tree (Vernicial fordii) have been planted. Peat has been extracted and used as fertilizer.

Post-Soviet decline in all economic activities although has resulted in reduced pressures from economic sectors, including agriculture, this sector though, together with fishery still plays a leading part in the region's economy. The largest problem here is illegal fishing, in particular, on sturgeon.

From local population, pressures on unique ecosystems within and outside the Kolkheti National Park are imposed by illegal wood cutting and fishing and, overgrazing. Within the Kolkheti National Park (KNP), people graze cattle and water buffalo during the entire year in wet forests, secondary shrub forests and meadows on peat, and on the edges of bogs. However, it is difficult to judge the impact of grazing because there are no accurate stocking data. In addition, in mires local people harvest reeds for roofing, cut alder trees for construction timber and firewood and collect medicinal plants.

There is also a pit extraction on-going in the region since 1930s. The total pit reserve is estimated at more than 100 Mt and the total area at 1,000m2. The peat is mostly used as a fertilizer.

Settlements, including the city of Poti pose pressures on the estuary and the coastal zone, through domestic waste disposal, agriculture and urban surface run-off, effluent discharges from industrial facilities and sewerage systems. For instance, Poti municipal landfill is located on the bank of the r. Rioni and poses threats to the riverine environment.

Regarding the natural pressures on the estuary and coastal zone ecosystems, floods, sea level rise, climate change, decrease in river sedimentation, etc. occurring as a result of both natural phenomena and man-induced ecosystem changes impose high pressures on these fragile areas.

4.3.2 Environmental Impacts on Ecosystems and Biodiversity

Alazani-Iori River Basins. In upstream areas of the Alazani and Iori River Basins, alpine and sub-alpine meadows and mountainous forests are highly impacted by unsustainable logging and grazing. Fish populations are also significantly affected by illegal fishing, although there are no data and studies on the ecological status of fish all over Georgia. Fish are impacted not only by illegal fishing, but also by instream, river banks and floodplain sand and gravel extraction by numerous companies.

In Tusheti and Batsara-Babaneli protected areas, especially in easily accessible parts large mammals are illegally hunted, included rare and endangered species, e.g. bezoar goat, tur, raw deer, etc.

In middle reaches with densely populated urban and rural areas, natural landscapes are drastically reduced and transformed into cultural lands, including settlements and agricultural lands.

Floodplain forests that are spread on Alazani and Iori river banks and are met in both middle and lower reaches are significantly declined, especially, on Iori River Banks, due to the artificial change of the river regime (Dalis Mtis reservoir, etc.), tree felling, grazing and artificial fires. Therefore, habitats of a numerous species are degraded.

Semi-deserts and steppes used as winter pastures in lower reaches of Iori and Alazani river basin are severely eroded due to overgrazing and unsustainable pasture management. There are also large areas salinated and bogged due to high ground water table and improper irrigation.

Areas around oil fields and various quarries are severely degraded, although these activities are not voluminous and do not affect large areas.

Regarding the individual species, wolves are heavily targeted by shepherds and locals in and around Vashlovani PAs, to avoid or reduce killing of sheep. Furthermore, such large mammals as red deer, raw deer, chamois are the most targeted species. In addition, there is a high disturbance by hunters of leopard and goitered gazelle. The major purpose of the Vashlovani National Park was to reintroduce goitered gazelle and recover leopard that is currently hindered by illegal hunting.

The one of the largest environmental problems in Alazani-Iori river basins, as it was discussed above is climate change and human induced desertification affecting large landscapes in downstream areas particularly, semi-deserts and steppes. Such trends are observed in Chachuna steppe, southern foothills of Kotsakhura Ridge, Iori Steppe, Eldari plateau, Taribana valley, Natbeuri, Chatma depression, Terraces of the River Iori downstream of Dali Reservoir, etc. To a lesser extent from place to place desert communities are also found in pistachio light woodlands. All arid and semi-arid ecosystems of the Iori River Basin, including species inhabiting them are highly vulnerable, first of all due to the fact that these ecosystems represent the edge of the global ranges of Legertine viper, striped hyena, goitered gazelle, etc. complicating the geographical and demographic expansion of these species. The second, these areas are the habitats to species that are not specific to arid ecosystems, including lynx and bear typically populating broadleaved, coniferous or mixed forests. Third, due to the presence of a large artificial lake and floodplain forests the area is rich in waterfowl and white eagle, highly vulnerable to natural disasters including droughts, fires, etc. Many endemic and/rare species met here, including but not limited to Thuja orientalis, Pistacia mutica, Bongardia chrysogonum, Pirus sachokiana, Ulmus georgica have very limited distribution and low abundance and therefore, are highly vulnerable.

Rioni River Basin. In the upper courses of the Rioni River Basin, similar to the upper courses of Alazani and Iori River Basins, the most affected ecosystems are forests and sub-alpine and alpine meadows due to illegal and commercial logging and grazing. This affects not only local flora, but also animal species, e.g. western turn that populates sub-alpine and alpine belts in Svaneti and cleaning the forested zone causes disturbance of the Tur habitats.

In terms of the animal species, bear and wild goat are the most targeted by illegal hunters. Traditionally, the most hunted animal was the western tur, but due to the over centuries pressures, its population has dramatically reduced.

Fish are affected by illegal fishing and various mining operations, in particular by extraction of sand and gravel from Rioni and its tributaries. These operations are done without any environmental impact assessments and permits and, therefore, no impacts on fish are taken into consideration.

The most affected from pollution of land and water resources by abandoned arsenic mines in Racha-Lechkhumi are the agro-biological resources of the region, including livestock and agriculture lands. Renewal of extraction operations will farther exasperate the existing environmental problems related to arsenic mining. Moreover, if the gold mining is started in Oni region this might incur serious health and environmental impacts, especially impacts on aquabiota.

Due to the planned and on-going or planned large-scale HPP development projects, significant areas of natural ecosystems as well as cultural landscapes will be lost and fish populations as well as floodplain ecosystems affected.

In the middle to lower reaches of the Rioni River Basin, natural ecosystems though less rarely met than in upstream areas due to the population and economic pressures, are affected by industrial activities, mining operations, particularly manganese mining operations, urban infrastructure development, etc. The impact of such activities is habitat loss, fragmentation, pollution, disturbance of breeding, bird nesting and fish spawning, etc. In addition, cultural landscapes and their aerobiological resources, including crops, pasture meadow, etc. are significantly impacted by urban, population and industrial pressures that is manifested in land erosion, loss of soil fertility and productivity, pollution, etc. Aquatic biota is disturbed by various mining operations since their sheltering, breeding and feeding areas are disturbed.

Low-mountains, foothill and plain forests met in the middle to low reaches are significantly affected by illegal and commercial logging and cattle grazing as well as fish – by illegal fishing.

Each of the large infrastructure projects has its impacts on the natural ecosystems of the region. For instance, the Black Sea transmission line is supposed to have an impact on nine sensitive areas of natural landscapes, including Colchic and floodplain forests. Therefore, ESIA is a tool to identify, avoid and/mitigate potential impacts.

The most vulnerable ecosystems given their complexity, richness, rareness, relicenses, endemism as well as current and likely anthropogenic and natural pressures coming from all upstream, middle reach and downstream areas are the Rioni mouth, estuary and the coastal zone with their peat bogs, glacial relic sphagnum mires (e.g. Nabada 2,900 ha open and 6,700 ha forested Sphagnetum and, Maltakva 300 ha open and 800 ha forested bog), marshes, duns, and pine groves. All the upstream pressures individually or in a synergy influence the area. The largest impacts are the ecosystem fragmentation and species loss due to coastal erosion, eustasy, sea surges, floods, river alteration due to the urban, industrial and agriculture development, pollution due to the discharge of pollutants loads from upstream areas, particularly nutrients and oil products.

Peatbogs and mires that once occupied very large areas during the Soviet regime have been drained, deforested and turned into agriculture lands in the last century. Degraded peatbogs then have been invaded by alien species. Such Colchic relics as *Osmundra regalis, Molinia litoralis* and *Solidago turfosa,* have declined dramatically and now are on the verge of extinction due to impacts from human activities. *Drosera rotundifolia* is also declining due to the very same reasons. All of these species are included in the Red Data

Book of Georgia. Furthermore, *Hibiscus pontica, Kosteletzkya pentacarpos* and *Salvinia natans* are on the verge of extinction.

The Rioni River together with other rivers of Kolkheti lowlands provide spawning areas for migratory fish and are particularly crucial for populations of sturgeon (Acipenseridae), including extremely rare species of Acipenser sturio, categorized as being "on the critical verge of extinction" (CR) in the IUCN list for rare and endangered species. In recent decades the Rioni River has been the only location reported for this species throughout its entire range. Given the high commercial value of sturgeon, this fish is one of the most affected by illegal fishing. Moreover, on-going and planned HPP projects will significantly alter the river regime and sedimentation that will hinder the spawning areas of this fish.

Overall, the wild fauna of the protected areas has been degrading at high rate, with many species being on the verge of extinction. For instance, Atlantic sturgeon *(Acipenser sturio Linne),* banded newt *(Triturus vittatus)* and Aesculapian snake *(Elaphe longissima* Laurenti), which are food species for birds such as the black stork *(Ciconia nigra* Linnaeus), great egret *(Egretta alba* Linnaeus) and whooper swan *(Cygnus cygnus* Linnaeus), are included in both the Red Data Book of Georgia and the List of Endangered Species for Europe.

Despite the high self-generation capacity of swamp and wet forests, virgin areas do not re-establish their original structure after logging and this may lead to biodiversity losses. For instance, the post-logging secondary forest lacks beech (Fagus), ash (Fraxinus) and maple (Acer campestre), whose capacity for self-regeneration is lower than that of alder (Alnus).

4.4 Utilization of Local Energy Resources

Alazani-Iori River Basin. As it was mentioned in part 2.1.7 above, energy potential of waters of Alazani river basin, similar to all river basins of Georgia is underutilized. Among existing resources, only hydro resources and wood fuel are used.

Hydro potential of the Alazani river basin is used only at ~ 8% of estimated 414.2 MW installed capacity. There are up to 10 medium to small hydropower plants with total of 34.1 MW installed capacity and with Khadori HPP being the largest plant (24 MW installed capacity).

Currently, in Kakheti electric power supplied is almost fully utilized by local population and municipalities, since there are no direct consumers (medium to large businesses) in the region. The power to local population is supplied by Kakheti power Distribution Company. In fact, the power generated locally is underutilized since there is no/very low demand from industries and businesses. Electricity access is provided to all settlements except for Tusheti remote area, where donors are trying to provide solar energy for electricity and hot water supply.

Regarding the heat supply, as it was mentioned in previous chapters, cities and lowland villages are supplied with natural gas. However, populations of remote area where there is no gas supply, use solely fuel wood for heating and cooking. In villages, where there is a gas supply, most of people prefer to use fuel wood for heating and gas for cooking, due to the high gas price. Official supply of fire wood to local population does not meet the local demand and the gap is filled in by wood harvested illegally. For instance, in 2009, in Kakheti the demand was met only by 26%.

Most widely, local population use inefficient wood stoves and energy efficiency of residential and municipal building is very low. Due to this, usually, locals heat only one room. Meanwhile, through implementation of low-cost energy efficiency measures people can use less wood and heat larger spaces.

Iori River Basin. In Iori River Basin, only hydro resources are used, while there are significant solar resources in the region. Oil in smaller quantities is also produced, but mostly not for local consumption.

Out of total of 41.5 MW technical potential of the rivers of Iori basin, only 9.14 MW power capacity is used by Sioni HPP. Meanwhile, upstream of the basin have over 30 MW capacity. In fact, due to the existence of a complex irrigation scheme in the basin there are three HPPs using Iori water and supplying Tbilisi nearby settlements with electricity. The total installed capacity of these HPPs is 30.26 MW and together with Sioni HPP make up 39.4 MW installed capacity, which is not a bad value.

Electricity in the Iori river basin is at most used by local population due to low/no demand from other sectors.

In terms of heat supply, the cities and lowland villages are supplied with natural gas. However, remote village population use solely fire wood for heating and cooking since there is no other heating means for them. Similar to Alazani river basin, even those locals who are provided with natural gas prefer to use wood for heating due to the high gas price. In 2009, official supply of fire wood in Mtskheta-Mtianeti was 2.4m3 per household that amounted only to about 26% of a demand – 9.4m3. In Kakheti the demand was met only by 26%.

Rioni River Basin. In the upper courses of the Rioni River Basin hydropotential is utilized at 37%, which is not a low value compared with those of other targeted basins. There are several medium to large HPPs and two small HPPs with total of 157.26 MW installed capacity. However, even this capacity is not optimally utilized and total average annual power generation is about 80% of designed values due to improper maintenance of dams and reservoirs.

Currently, several large-scale projects have started in Racha-Lechkhumi and Lower Svaneti and Imereti regions (e.g. Alpana HPP, Lukhuni HPP cascade and Namakhvani HPP cascade) to add about 550 MW new capacity to the electricity grid.

Regarding other renewable energy resources, none of them are used for electricity generation.

As for the heat supply, cities, towns and nearby villages of Racha-Lechgkhumi and Lower Svaneti region are supply with natural gas, while remote areas do not have an access to it. Therefore, they use solely fire wood for heating and cooking. Many of those people, who have natural gas, still prefer to use it for cooking and fire wood – for heating. Usually, fire wood is burnt in inefficient wood stove and only limited space is heated. Officially wood supply does not meet fire wood demand and satisfies the local demand within the range of 28-30%.

During last several years USAID and UNDP implemented pilot projects in Racha-Lehkhumi region to demonstrate the benefits of using alternative sources of energy and to raise public awareness among the local government and population. For instance, UNDP has provided high-efficiency wood stoves and solar water heaters to vulnerable and poor families and installed up to 20 individual biogas digesters. In addition, two solar water heaters have been installed in Oni and Ambrolari sports schools. Out of these clean energy technologies, the most popular among local population has become solar water heater due to easiness to operate and maintain it. For instance, during the second phase of the project local guest houses contributed 40% share and installed solar water heaters in their houses. USAID has made its focus on biogas installation and micro HPP that has been installed in village Gadamshi.

In the middle to lower reaches of the basin, total installed capacity of existing HPPs is 301.6 MW, of which only one 2 MW SHPP is operated in Samegrelo region and the rest – in Imereti region. Total theoretical technical potential of the local rivers of Rioni basin in Imereti region is estimated at 669.3 MW. Existing HPPs work at their 75-85% capacity on average. For instance, Gumati HPP cascade generated 321.983 mln kwh in 2010, while its designed power generation is 376.000 mln kwh, Vartsikhe HPP generated 814.466 mln kwh compared to 1,050 mln kwh designed capacity.

Two new HPPs will be soon built in Tskaltubo municipality as part of the Namakhvani HPP cascade. In addition, there is on-going project for construction of 13 MW coal-fired power plant in Tkibuli that is a first step towards building a large thermopower plant with 300 MW installed capacity.

Electricity supply to Imereti and Samegrelo regions is round-off-the-clock. A distribution company – Energopro Georgia distributes electricity to the majority of west Georgian regions, including Racha-Lechkhumi, Imereti and part of the Samegrelo region. The majority of the latter is supplied with electricity by Apkhazeti company from Enguri HPP. There are also direct consumers in Imereti region. In 2010, total supply of power to population through distribution company was 2,799.7 mln kwh. Meanwhile, “Georgian Manganese” was supplied with electric power in the amount of 988.1 mln kwh and the company “Saqnakhshiri” (Georgian coal) – in the amount of 6.3 mln kwh.

As for the heat supply, cities, towns and foothill, hill and lowland settlements are supplied with natural gas. In remote areas, for instance, mountainous settlements of Martvili municipality, etc. there is no gas supply. In Samegrelo hazelnut producing companies use nutshell as a fuel to meet their own heating demands as well as provide it to local population to satisfy the part of their heating needs. However, fire wood is a major source for heat for rural population and official supply does not meet a demand. For instance, in 2009 local wood supply per household was 0.8 m3 that is only about 10% of a demand (8.4m3).This figure in Imereti region was 1.6m3 per household that made up only about 23% total fire wood demand.

Regarding other renewable energy sources, geothermal resources existing in Martvili, Senaki, Tskaltubo and Abasha municipalities are of very limited use. Mostly, they are either unitized or used for greenhouses.

Regarding other renewable energy resources, there is very limited application of biogas, peat and solar energy by individual households or guesthouses along the shore.

4.5 Linkages between Resources Uses and Ecosystem Functions

Alazani-Iori River Basins

In the Alazani and Iori river basin, the waters of the basin and associated resources, including land and biological resources have the following functions: 1. Health - to provide drinking water, nutritional base, energy and clean environment to population; 2. Economic (commercial) – to provide water and other resources for agriculture, industries, fisheries and power generation; 4. Livelihood support – to provide resource base for local subsistence economies (wood for fire, timber and woodchips as construction materials, mushrooms, berries, medicinal plants, pastures, etc); 3. Ecological – to maintain the ecosystem integrity, richness and healthiness; 4. Disaster Risk Reduction – to prevent floods, landslides, mudflows and avalanches or reduce their impacts; and 5. Aesthetic – to provide recreational resources to the populations. The importance of these functions varies among upstream and downstream areas as well as between Alazani and Iori river basins.

Ecosystems of the upstream areas of both Alazani and Iori river basin have more value for supporting biodiversity, maintaining ecosystem integrity, providing high quality recreational resources and supporting the subsistence economies of local communities in comparison with commercial value. More specifically, mountainous forests there mostly have water regulation, soil and avalanche protection functions and are the habitats for many terrestrial fauna and flora, although due to high density and coverage area they are considered by the state of high commercial value. Therefore, degradation of these natural ecosystems will ultimately result in increased natural disasters, reduced water resources, loss of biodiversity and, reduced aesthetic value leading to decreased tourists flow. In addition, this will also affect the livelihood of local populations strongly depending on natural resources of the watershed (fire wood, drinking water, non-timber resources, pastures, etc.). Therefore, it is necessary to take into consideration precautions against degradation of these forests which may end-up in increased natural disasters and reduced water resources. In addition, reduced aesthetic value due to degradation of natural ecosystems will result in decline of tourist flows. Furthermore, it should be thought to utilize secondary forest products, e.g. wood chips and wood wastes (e.g. saw dust) to be used for heating and cooking. Alpine and sub-alpine meadows of the targeted basins are habitats for many endemic, rare and endangered species, e.g. east Caucasus tur, bezoar goat, etc. and unsustainable utilization of pastures and forest degradation may impact the populations of these species. Waters of the upstream areas also have high ecological and aesthetic-recreational value. They provide spawning areas for many river fish, including trout and, drinking water source for many terrestrial species. Furthermore, many of sources for drinking water are located in upstream areas. Water hydrology, including water flow and sediment regime starts forming in the upstream areas. Therefore, while utilizing or directly or indirectly affecting the river quantity and quality, the river morphology, hydrology and ecosystem integrity should be taken into consideration. For instance, there are copper deposits in upstream areas that are currently unutilized. There are plans to start extraction of these resources, which might have high impacts on water and soil quantity and might impose serious health and environments threats. In terms of economic (commercial) value, given low population density of upstream areas and thus, low economic activities, there is no much use of the rivers for various economic activities, except for hydropower generation and extraction of sand and gravel from river banks and floodplain terraces. However, currently, existing hydropotential is underutilized particularly, in the upper courses of the Alazani river basin. But, while considering the further development of the hydropotential the river regime as well as future climate change impacts should be taken into consideration, as well as the demand by various sectors. Furthermore, sand and gravel extraction that is done in numerous places in carried out without any prior environmental impact assessment and periodic checks. They might have significant impacts on river hydrology, although in mud-flow basins of the river Duruji and Kabali in Kvareli and Lagodekhi municipalities inert material extraction and river bed cleaning is might be needed. Currently, these operations are of limited scale.

Going down to the middle reaches of the basins, population density increases so do the various essential uses of water (potable water, irrigation, etc.) and related resources. Commercial value of the watershed resources also increase due to higher degree of urbanization and industrialization and land cultivation. Waters of the Alazani and Iori river basins are mostly used for drinking water supply and irrigation; at a lesser extent, by industrial facilities and, in Alazani river basin – by small hydropower plants. Current irrigation systems are inefficient with high water losses and some of them requiring electric pumping. It has an impact on water and land resources of the basin, causing decrease in land fertility and productivity and increase in water pollution and turbidity. Although, current use of agrochemicals is reduced due to overall drop in agriculture activities, but farmers don't follow good agriculture practices and in case of growth of this sector these pressures will be increased, given the low awareness of local population. From densely populated urban and rural settlements pressures are high on water and land resources, given the absence of water treatment facilities and absence of proper landfills. These pressures reduce the health, livelihood, economic, authentic-recreational and ecosystem support values of the basins. Furthermore, unsustainable logging, hunting and poaching is a problem is common to middle to low reaches of both Alazani and Iori river basins similar to upper reaches, that impact forest ecosystems, accelerate geodynamic processes and reduce the biological diversity. The most vulnerable to forest cutting and poaching are the unique floodplain forests in both Alazani and Iori River Basins that are habitats for many rare and relic species, resting areas of migratory birds and migratory corridors for a number of species. In addition, they regulate water regime of the Alazani and Iori rivers and prevent surrounding areas from floods. In addition, local population together with seasonal pastoralists graze their livestock in these forests, even in those located within the boundaries of protected areas.

Low reaches of the Alazani and Iori Basin are less densely populated than middle to upper reaches due to harsh local oro-climatic conditions. The degree of urbanization is also less relative to middle to upper reaches. Here natural landscapes occupy wider areas than in middle reaches, though they are mostly represented by semi-arid and arid ecosystems and at a lesser extent by floodplain forests. Ecosystems of downstream areas have higher health protection, ecological and livelihood support values than commercial and aesthetic-recreational values. More specifically, waters of lower reaches of the Alazani and Iori river basins are predominately utilized for drinking water supply and irrigating of agriculture lands. Land resources are mostly utilized as agriculture lands. Cereal production and livestock rising are the major agriculture branches here. The large areas of agriculture lands are used as winter pastures where nomadic pastorals come from various regions. These lands suffer highly from overgrazing, unsustainable pasture management and irrigation (e.g. no application of pasture rotation, burning of pastures, no irrigation or improper irrigation of the lands). In addition, almost complete cleaning of wind breaks in Sagarejo, Signagi and Dedoplistskaro municipalities have resulted in severe wind erosion of agriculture lands. Therefore large areas here are eroded, salinized and bogged with some of them completely transformed in badlands. Water shortage together with desertification is a huge problem in downstream areas of Sagarejo, SignagI and Dedoplistskaro municipalities that is accelerated by the climate change. Droughts here have become more frequent, longer and intensive. Estimates of climate change impacts show that river flow of Iori will be significantly reduced within next 50-year horizon and that of Alazani – not much, but there will be crop water shortage. In general, arid and semi-arid areas shared by Alazani and Iori river basins are very fragile and at the same time, very significant ecosystems due to the oro-climatic and biological peculiarities. They represent the verge of the ranges for many endangered and rare species and are impacted by harsh climate conditions. Therefore, their resistance to additional stress is very low. Meanwhile, anthropogenic pressures on these resources are high, including poaching, grazing, illegal tree felling, and killing of predators, mining operations, including oil and gas extraction that overweigh the carrying capacity of the ecosystems. Building of Dali reservoir in downstream areas that was aimed at irrigating large areas in Georgia and Azerbaijan have significantly changed the river regime and prevented downstream floodplain forests from recovering waters that enhanced degradation of these forests and further aridization of the downstream areas.

Stemming from above, it can be concluded that the resources in Alazani and Iori river basin are not used in an integrated way and environmental considerations are paid no/little attention while utilizing these resources for both meeting essential needs and generating profits. However, there is an example of integrated water resources management in Iori river basin. This is complex scheme of hydropower and irrigation in Tianeti and Gardabani municipalities. Sioni reservoir built for irrigation purposes is utilized for hydropower generation and recreation and downstream areas use irrigation water for additional hydropower generation. So far, there was no conflict among different water users. The scheme itself takes into consideration various water uses. However, in case of increase in irrigated areas and high droughts conflicts among various water uses might be generated.

Another good example of sustainable natural resource management is maintaining of sacred, holly forests in Tusheti which are preserved as virgin forests. There were also traditions of sustainable natural resource management in the past, including hunting among Tushetians and pasture management. Unfortunately, this knowledge is almost entirely lost.

Rioni River Basin

Similar to the Alazani and Iori River Basins, ecosystems of the Rioni River Basin have following functions: 1. Health protection - to provide drinking water, nutritional base, energy and clean environment to population; 2. Economic (commercial) – to provide water and other resources for agriculture, industries, fisheries and power generation; 4. Livelihood support – to provide resource base for local subsistence economies (wood for fire, timber and woodchips as construction materials, mushrooms, berries, medicinal plants, pastures, etc); 3. Ecological – to maintain the ecosystem integrity, richness and healthiness; 4. Disaster Risk Reduction – to prevent floods, landslides, mudflows and avalanches or reduce their impacts; and 5. Aesthetic – to provide recreational resources to the populations. The degree of significance of these functions varies among upstream and downstream areas.

In general, it should be mentioned that the Rioni River Basin is more densely populated than the Alazani and Iori River Basins, especially in middle to lower reaches and has a higher degree of urbanization and industrialization in comparison with Alazani-Iori River Basin. Therefore, health protection and economic uses of these ecosystems overweigh utilization of their ecological, aesthetic, recreation services. Upstream areas of the Rioni river basin are not densely populated and thus, urban and technogenic pressures on natural ecosystems are lower here than in downstream areas. Local resources, including water, land and forest resources are mostly utilized by local populations to meet their essential needs (drinking water, heating and cooking, etc.) and support subsistence economies (small farm systems, livestock rising, beekeeping, etc.). The region is rich in natural forests of high ecological and aesthetic value that provide habitats and shelters for many terrestrial flora and fauna. However, there forests undergo pressures from illegal and commercial logging and poaching. As a result of intensive hunting, for instance, Western tur, once abundant, became endangered now. Unsustainable logging, for instance enhances landslides, mudflows and avalanches being naturally very active in the region. The region has a high potential for tourism, given its ecosystems and mineral waters. In addition, there is a planned protected area of the Central Caucasus, the establishment of which is suspended due to other conflicting economic interests from government side. If established, the PAs will create additional niche for PA-based tourism. Furthermore, the area is very rich in mineral resources, especially in heavy metals, which were intensively extracted during the Soviet times, but now are mostly abandoned. The government intends to renew and as well expand mineral resources extraction activities that might have significant negative impacts on water, lands and biological resources of the region and diminish high aesthetic and ecological value of the region. Currently, limestone, clay, sand and gravel and the mostly extracted mineral resources, in particular, sand and gravel. These resources are extracted from river banks and floodplain terraces without any consideration of river topography, hydrology and aquatic biota. As for the use of waters of the Rioni River Basin in upper courses, they are primarily used for drinking water, including production of bottled water and for hydropower generation. Still, hydropower potential is underutilized and the government intends to maximize the use of hydro-resources. Already existing regulating HPPs in addition to bringing economic benefits to the country and the region have created significant problems to the surrounding areas. For instance, Lajanuri reservoir is almost entirely silted and has dramatically changed the river regime. Its power generation due to the decline in the useful volume is significantly reduced. While there are a numerous mining operations on the rivers of Rioni extracting inert material from the rivers, huge reserves of such materials accumulated at the bottom of Lajanuri are not used at all. Shaori and Lajanuri damming have also affected spawning areas of trout. New HPP schemes that are to be built in Racha-Lechkhumi area will also affect the river regime, especially sediment flow that will ultimately lead to the accelerated coastal erosion and loss, if not properly managed. In the middle reaches, with densely populated Kutaisi-Zestaponi agglomeration, the health protection and economic (commercial) functions of natural ecosystems become more important. Therefore, technogenic and agriculture pressures on ecosystems and natural resources increase relative to upstream areas. Waters of the middle course are consumed by household, agriculture, industrial and power sectors. There are numerous small to medium-size industries in the region releasing pollutants into all environmental media. Particular threats are imposed by manganese extraction and processing activities in Tchiatura and Terjola municipalities, which pollute surrounding environment with highly toxic metals. There is also coal extraction in Tkibuli area that also poses pressures on natural environment. It is planned to build a 300 MW coal-fired power plant that will utilize high sulfur-content coal that might lead in high acid loads on land and water resources. Although the large areas in the middle reaches are transformed into cultural landscapes and settlements, there are significant areas of Colhic middle-low mountain, hill and foothill and plain forests in the region, which are affected by illegal tree felling and commercial logging (Vani, Sachkhere, Martvili municipalitiess etc.). Poaching is a problem within and outside protected areas. Given the rapid infrastructure development, natural ecosystems including relic forests of Ajameti protected areas, Borjomi-Kharagauli PAs and Imereti Cave are under constant risk to be affected one or other infrastructure projects. For instance, initial route of the Black Sea high voltage transmission line was supposed to pass through the significant portion of the Borjomi-Kharagauli national park. However, due to the high pressures from NGO and donor community as well as concerns expressed by the Agency for Protected Areas the route has been corrected during the ESIA procedure. Still, some important areas of Ajameti forests, floodplain forests of r. Kvirila, etc. will be affected by the project. Hydropower potential of the Rivers of the Basin in middle to lower reaches is significantly used with several large regulating and diversion type of HPPs operating there. These schemes significantly altered the sedimentation regime and hindered the delta formation, especially, Gumati dam and reservoir, which is highly silted. There are significant reserves in the lake for construction materials, but they are not extracted. Moreover, new regulating scheme of Namakhvani cascade will have significant impact on the delta and the coastal zone and will accelerate their loss. Due to such manipulative interventions the areas downstream Kutaisi, Tskaltubo and, Rioni Delta are highly vulnerable to the floods. The extreme lower reaches of the basin, including Rioni delta and coastal zone are significantly altered as a result of wetland drainage, land reclamation, urban development. Only small area of unique wetlands relative to the original area is retained, which is now protected by the government. However, pressures although at lower rates continue to be imposed from local population in terms of illegal timber harvesting, fishing, hunting, grazing and artificial fires, peat extraction within and outside Kolkheti National park. Pollution loads from upstream urban and agriculture areas rich in nutrients are discharged to the delta area and ultimately to the Sea. Infrastructure projects have also impacts on the ecosystems of the Kolkheti National Park in terms of their fragmentation, disturbance of habitats and pollution of natural environment. For instance, Kulevi oil terminal had significant impact on the Supsa section of the Kolkheti National Park. In addition, the new road from Poti to Anaklia is supposed to cross the part of the Park that will have serious impact on it. Senaki-Poti gas pipeline will cross one of the artificial canals of r. Rioni very rich in local and transitory fish, including sturgeon. Among natural factors, climate change and eustasy dramatically affect the Rioni Delta and the coastal zone through sea level rise, flooding, sea surges and leading to the loss of the delta and coastal area and sinking of the land.

Thus, similar to Alazani and Iori River Basins, natural resources of the Rioni Basin are used unsustainably without taking in to consideration various functions of ecosystems and their integrity that in many cases lead to the degradation and loss of these ecosystems and their natural resource base.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The upstream areas of all targeted basins due to the low population density do not undergo significant pressures from technogenic activities and urban development. Therefore, large areas are occupied by natural landscapes and ecosystems of high ecological and aesthetic value that make these areas attractive for tourism development and recreation as well as for natural scientists; Tusheti and Batsara-Babaneuli PAs and Lagodekhi PAs consist of unique ecosystems and components of the Greater Caucasus. In addition, there is a planned PAs of the Central Caucasus in Racha-Lechkhumi region. Illegal hunting and fishing are the major threats to the species within the PAs and the most targeted mammals are bear, red and row deer, tur, chamois, wild goat, etc. Low enforcement is rather weak to effectively cope with illegal activities. Upstreams, especially, the Rioni and Alazani river basins are rich in timber resources, which mostly have ecological functions of soil protection and water regulation. But, due to the limited access to fire wood local population intensively harvests fire wood illegally. In addition, there are a number of concessioners in Tianeti, Akhmeta, Ambrolauri and Lentekhi municipalities who produce commercial timber of this high ecological value forests. Upstream areas are highly vulnerable to mudflows, landslides and avalanches. These geodynamic processes are extremely intensive in Racha-Lechkhumi and Lower Svaneti as well as at southern slopes of the Greater Caucasus. Rivers Duruji and Kabali in Kvareli and Lagodekhi municipalities flow in mudflow basins and pose high threats to local population. Geodynamic processes are intensified by unsustainable wood harvesting and overgrazing. Impacts of these natural disasters are high due to the non-existent of early warning systems and low capacities of local authorities and populations to cope with these phenomena. Upstream areas, especially, Rioni river basin, followed by Alazani river Basin are rich in water resources, both surface and ground waters that are used for drinking water and hydropower generation. But, these resources are underutilized. The existing HPPs are managed unsustainably and silting of reservoirs is not controlled that reduces the efficiency of the plants on the one hand and, causes river flow change resulting in flooding of surrounding areas (e.g. Lajanuri reservoir). Although urban areas have centralized water supply systems, such systems do not exist in absolute majority of rural areas. Moreover, sewerage coverage of the region is relatively low, mostly represented by urban systems, which do not have wastewater treatment facilities. Waste disposal sites also do not meet any minimum health and environmental standards. In rural areas they are dumped on river banks and beds. Solar and wind energy is not used at all and only fire wood is used from alternative sources for heating. Upstream areas, especially, those of the Rioni river basin are rich in mineral resources, the majority of which are not currently utilized that on the one hand prevents the environmental degradation, but on the other hand, does not support the economic development of the already poor regions with high level of unemployment. The government has the plans to restart many abandoned mining activities or extract new deposits, e.g. arsenic and associated metals deposits in Racha-Lechkhumi and Lower Svaneti, new copper deposit in Kakheti region, etc. At the same time, the state thinks to develop tourism potential of upper reaches of the basins that might become in a conflict with mining and other economic development objectives of the region as well as with conservation objectives of these areas. The largest mining operations are related to the extraction of limestone, clays, sand and gravel. Most of mines are open quarries that have significant impacts on surrounding environments. Inert material is extracted instream, from river banks and floodplain terraces without any environmental considerations in particular, impacts on river morphology, hydrology and aquatic biota.

In the middle reaches of the targeted basins agriculture and technogenic pressures increase in comparison with upstream areas, although current levels are much lower than during Soviet times. Therefore, many of existing reversible or irreversible damages to the natural ecosystems are inherited from the past. For instance, during the 70-year of communist ruling due to high urbanization and industrialization large areas of virgin forests and other natural landscapes have been transformed into cultural landscapes, settlements and industrial zones, especially in Imereti region. After the break-up of the Soviet Union, due to the economic collapse the majority of industrial facilities shut down their operations and many have been completely abandoned, which now are turned into brownfields with polluted soils and industrial wastes accumulated there. Now a number of industries have re-started their activities and due to the out of date technologies release high amounts of pollutants into the environment. This is mostly the case for the Rioni river basin. In Alazani-Iori river basins, there was no such industrial development and industries were represented by food processing facilities and vineries having less impact on the environment than metal extraction and processing, heavy machinery, chemical and other industries located in Imereti. Particular danger from industrial activities come from manganese extraction and smelting in Imereti region (Tchiatura, Terjola, Zestaphoni) seriously polluting waters and soils and posing high health threats to local populations. With the development and full operations of the Kutaisi free industrial zone the technogenic pressures on the natural resource base will increase. Kutaisi is the second largest city in Georgia and is surrounded by many densely populated cities and towns upstream and downstream that pose high pressures on water, land and biological resources and atmospheric air through urban run-off, vehicle emissions, untreated wastewater discharges and drainage water and leachates from waste disposal sites. Regarding the use of water resources the largest volumes are consumed by domestic and power generation sectors. Industrial consumption is also high compared with that of Alazani and Iori River Basins, where after power generation and drinking water the water is used for irrigation purposes. Central water supply systems are at large concentrated in urban areas. The majority of rural areas do not have central water supply systems. Sewerage systems exist only in urban areas without any wastewater treatment facilities. Wastes are disposed on so-called sanitary landfill the majority of which are outdated and does not meet minimum health and environmental standards. Moreover, in rural areas wastes are dumped directly into river gorges. As for the irrigation systems, although there have been some rehabilitation works on some of the major canals, the majority of systems need rehabilitation and proper maintenance. In addition, the lower level canals are in very poor condition. There are high losses in irrigation systems that cause irrigation erosion, salinization and bogging of large areas. Existing systems cannot recover the operational costs, since local communities do not have means to pay on the one hand, and state-owned irrigation companies – capacities to collect fees. Currently, it is planned to privatize the existing systems and introduce modern efficient technologies. However, the exact details and schedules of these plans are unknown. Regarding the utilization of energy resources, in the midstream of the target basins the hydropower for electricity generation, and gas and wood for heating are utilized. There is no utilization of solar and wind resources. Geothermal resources at very limited level are used for greenhouses in Imereti and Samegrelo regions. The government is planning to build new HPPs on the Rioni to use middle to low reaches potential. The first one is Namakhvani regulating HPP cascade that will definitely have an impact on downstream areas in terms of decline in sediment flow. The reservoirs will need to me operated and maintained properly and minimum ecological flow should be guaranteed. Similar to upstream areas illegal, logging, commercial timber production (Vani, Tskaltubo, Martvili, etc) pose threats to forest ecosystems as well as illegal hunting and fishing on terrestrial and aquatic fauna. In addition, mega-infrastructure projects, e.g. Black Sea transmission line have significant to moderate impacts on the natural environment in Imereti region.

Downstream Kutaisi and Tskaltubo, in Rioni Delta and the Coastal zone the population density is also high with the highest number of people living in the city of Poti, Black Sea port. These areas are highly impacted by floods, coastal zone and delta erosion due to change in Rioni flow, climate change, land use and land use change, eustasy and sea surges. The coastal zone needs constant artificial enrichment with sediments. It is expected that such pressures will grow due to new HPP schemes to be built on r. Rioni. The delta area known for its wetlands that represent the Ramsar site. Now they are protected under the Georgian Law and are the part of the Kolkheti National Park. Even such status doesn't fully guarantee the full protection of these areas. Local population harvests timber, graze cattle and catch fish illegally, regardless of the fact that the law allows for such activities in the support zone. There is also peat extraction, but in smaller quantities and not for fuel use. Illegal fishing is the largest threat to the fish population especially; to the sturgeon that is the transitory fish for Rioni. Any medium- to large-size infrastructure project has an impact on Rioni low reaches and the estuary abundant in fish and therefore, careful consideration should be given to environmental impacts of such projects during the ESIA processes. Downstream areas of Alazani and Iori basins are also extremely fragile since they represent the verge of the ranges for some of the endangered species; keep unique riparian forest ecosystems, having the elements untypical to arid and semi-arid areas and, very limited distribution of many rare and endemic plant species. Natural hydro meteorological conditions are also very harsh there and any additional pressures cause serious damages to such ecosystems. Meanwhile, regardless of low pressures from settlements due to the lower population density, there are pressures from sheep grazing, hunting by sports hunters and local populations, cutting riparian forests and from, artificial fires made by hunters and shepherds. Furthermore, climate change impacts are high in downstream of the Kakheti region with more frequent, lengthy and intensive droughts. It is expected that this trend will be maintained within the next 50-year horizon. Moreover, climate change studies show that there will be significant reduction in Iori river flow and thus, adaptation measures have to be taken.

Regarding the natural resource policies and management practices they do not support integrated natural resources and watershed management principles. The only tool to take into consideration inter linkages among various resources in the ESIA and environmental permit that is granted to a limited number of economic activities. During the implementation phases of these projects there is practically no compliance/very weak environmental compliance monitoring and control. Water allocations are done without taking into consideration demands by various sectors and minimum ecological flow is not guaranteed. Furthermore, currently, water flow is practically not measured and investment decisions are made based on old or estimated data. Climate change future impacts on the infrastructure projects are not taken into consideration as well. The most regretful situation existing in environmental monitoring. While in the Rioni river basin, water quality checking is more or less comprehensive it is practically absent in Alazani and Iori River Basins. Ground water and soil quality data are absent and there is no effluent monitoring and control. Early warning systems for disasters exist at very premature stage and need further development at both national and local levels.

5.2 Recommendations

Based on the baseline study of the Alazani, Iori and Rioni river basins and, for the purpose of the project it is suggested to narrow down the scope of project activities to upstream and downstream watersheds/areas of the major rivers of the basin (Alazani, Iori and Rioni and Tskenistskali) since they have the largest and diverse functions and undergo the highest pressures from natural and anthropogenic factors. It is also suggested to consider municipalities, which mostly are delineated from each other by natural watershed boundaries (water divides), as units for INRMW planning, in order to guarantee manageable scale for assessment and planning of watershed resources, water safety, energy resources, disaster and climate vulnerability, mitigation and adaptation and, at the same time to ensure coherence of watershed resources planning with existing geo-political structures and processes. The criteria for selection of the pilot watersheds might be, but not limited to: 1. Ecosystem richness and ecological value; 2. Economic importance of the natural resources and potential for economic development; 3. Poverty level; 4. Existence of local governance structure; 4. Willingness of local authorities to participate in the program; 5. Presence of sufficient number of local communities; 6. Presence of USAID and other donor projects; 7. Degree of infrastructure complexity; 8. Population density; 9. Financial resource availability; 10. Ecological vulnerability; 8. Vulnerability to Climate Change; 9. Vulnerability to natural disasters; 10. Anthropogenic pressures and impacts; 11. High replication potential; 12. High likelihood for success, 13. Richness in energy resources; 14. Interlinkeages among resource use and ecosystem functions etc. This is only indicative list of criteria, the final set of which will be elaborated through close consultations with all the partners.

Based on above criteria, the high potential for the selection have the following smaller areas: upstreams of the Alazani and the Iori, where Akhmeta, Tianeti and Telavi municipalities are located; downstream area of the Iori and the Alazani, where southern part of Signagi municipality and the entire Dedoplistskaro municipality are located; upstream areas of the Rioni River where Ambrolauri and Oni municipalities are located and; the extreme low reach of the Rioni encompassing the Poti surroundings and adjusent to Poti municipalities of Khobi, Senaki, Abasha and Samtredia, etc.

Upper reaches of the Alazani river, consist of wide areas of intact ecosystems, including protected areas (Tusheti, Batsara-Babaneuli, Ilto, etc) representing well the components of Caucasus mountainous ecosystems; are abundant in water and timber resources that are currently underutilized for power and fuel generation but having a high potential for further development; currently they undergo pressures from unsustainable utilization fo natural resources (Akhmeta, Tianeti and upstreams of Telavi), agriculture (Telavi) and urban areas (Telavi, Akhmeta, Tianeti); Have a myriad of environmental problems of drinking water quality, drinking water supply for rural areas, wastewater treatment, waste disposal, illegal logging, fishing and poaching (all municipalities), overgrazing, land erosion, unsustainable irrigation, etc.; have high tourism potential for PA-based (Akhmeta municipalities) cultural, agricultural and recreational (Telavi, Tianeti) tourism development; have high poverty level and are most widely dependent on natural resources to support their livelihoods. In addition, Akhmeta and Telavi have high success and replication potential, since there is a regional center in Telavi that could well-coordinate and support the project activities. Donors are active in both, Telavi and Akhmeta municipalities, including existing PAs. As for Tianeti municipality, it is far from regional center and there are no donor-supported programs on-going. However, without considering upstream areas many problems in downstream areas cannot be solved. Besides there is large hydrotechical scheme starting in Tianeti that utilizes significant amount of water in Gardabani municipality (same as municipality) that if not correctly managed and if the water is correctly allocated among the sectors might increase the water shortage in downstream areas of Signagi and Dedoplistsaro municipalities Downstreams of Alazani and Iori rivers are represented by very fragile arid and semi-arid ecosystems of semi-deserts, steppes and floodplain forests. These areas are the end line of the ranges of many endangered species and as well are inhabited by species (e.g. brown bear and lynx) that are not typical to arid and semi-arid areas; have various categories of PAs, including Vashlovani National Park. There is a conflict among various functions of ecosystems, including conservation function of the PAs and natural resources use. Therefore, they undergo pressures from sheep grazing, forest cutting by local population, hunting by sports hunters and locals, killing of predators to avoid sheep loss, etc. In addition, these areas are short in water resources and it is likely that this problem will further exasperate due to the climate change impacts and potential increased use by upstream users. Desertification, soil erosion, salinization and bogging due to overgrazing, unsustainable agriculture management practices (plowing of pastures, burning of arable and pasture lands, inefficient irrigation, or absence of irrigation, cutting of wind breaks, etc.). In addition, there are a number of mining activities for limestone and oil extraction that have significant impacts on local ecosystems. The area is rich in solar energy that can be utilized to produce electricity and heat. Finally, a number of donor-supported programs are on-going there, including EU-NACRES-FFI and GTZ supported biodiversity and climate adaptation programs.

Regarding the upstream of the R. Rioni, Ambrolauri, Oni and to a lesser extent Tsageri are represented by high ecological value forests, sub-alpine and alpine meadows of the Western Caucasus that are habitats for Western tur and a number of other large mammals. There are high pressures from illegal and commercial logging, illegal hunting and fishing. The area is rich in water resources that have high power potential but are currently underutilized. The government plans to further develop this potential that if not properly managed might have high impacts on the river regime in downstream areas. The area is also rich in biomass and the biomass fuel can be produced from wood chips, saw dust, manure, etc. The area is rich in mineral resources, particularly in non-ferrous metals of arsenic and associated metals, including gold that are not extracted at present. arsenic mines pose high pressures to local livestock and population and renewal and expansion of such activities will further enhance such pressures. This will be in a conflict with the government goals to develop the tourism, both recreational and health in Racha-lechkhumi region. Furthermore, the area is highly vulnerable to natural disasters, including earthquakes, landslides, mudflows and floods, which are accelerated by forest cutting and grazing on the slopes. Ambrolauri municipality where the regional governor is sitting is between Oni and Tsageri municipalities can easily coordinate the municipal level activities and mobilize their resources. There are a number of donors or donor-support programs active in the region, e.g, Care has its program there, USAID through its large-scale NEO program is going to enter the scene. UNDP is planning to implement flood management program in upper and low reaches of Rioni Basin. Therefore, catalytic effect of INRMW program might be high. As for the extreme downstream of the Rioni basin, it is one of the vulnerable and fragile ecosystems undergoing severe pressures from all upstream and downstream activities. It shelters tertiary relicts of Colchic refugium and is a habitat of many endangered, rare, endemic and relic fauna species. In addition, it a temporary shelter for a wide range of migratory birds and the waters there including brackish and fresh water are rich in both local and transitory fish, including sturgeon. There is a Kolkheti National Park in the region that is also undergoing of constant pressures from local population in terms of illegal logging, poaching, peat extraction, etc. Furthermore, many infrastructure projects end-up in the city of Poti, which is the major port for Georgia and therefore, have direct or indirect impacts on wetlands ecosystems and the delta. The area is highly vulnerable to climate change that exasperates the already on-going delta and coastal erosion due to the reduction of river sediment flow as a result of upstream man-induced river diversion and its regime change, eustasy, and sea surges, etc. The on-going Namakhvani HPP project together with other planned HPP projects will definitely have a negative impact on coastal zone. As for the natural disasters, floods threaten populations of lower parts of Khobi, Senaki and Abasha municipalities as well as the city of Poti.

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ANNEXES

ANNEX 1. PHYSICAL-GEOGRAPHICAL FEATURES OF ALAZANI, IORI AND RIONI RIVER BASINS

Figure 1. Satellite Imagery of Georgia

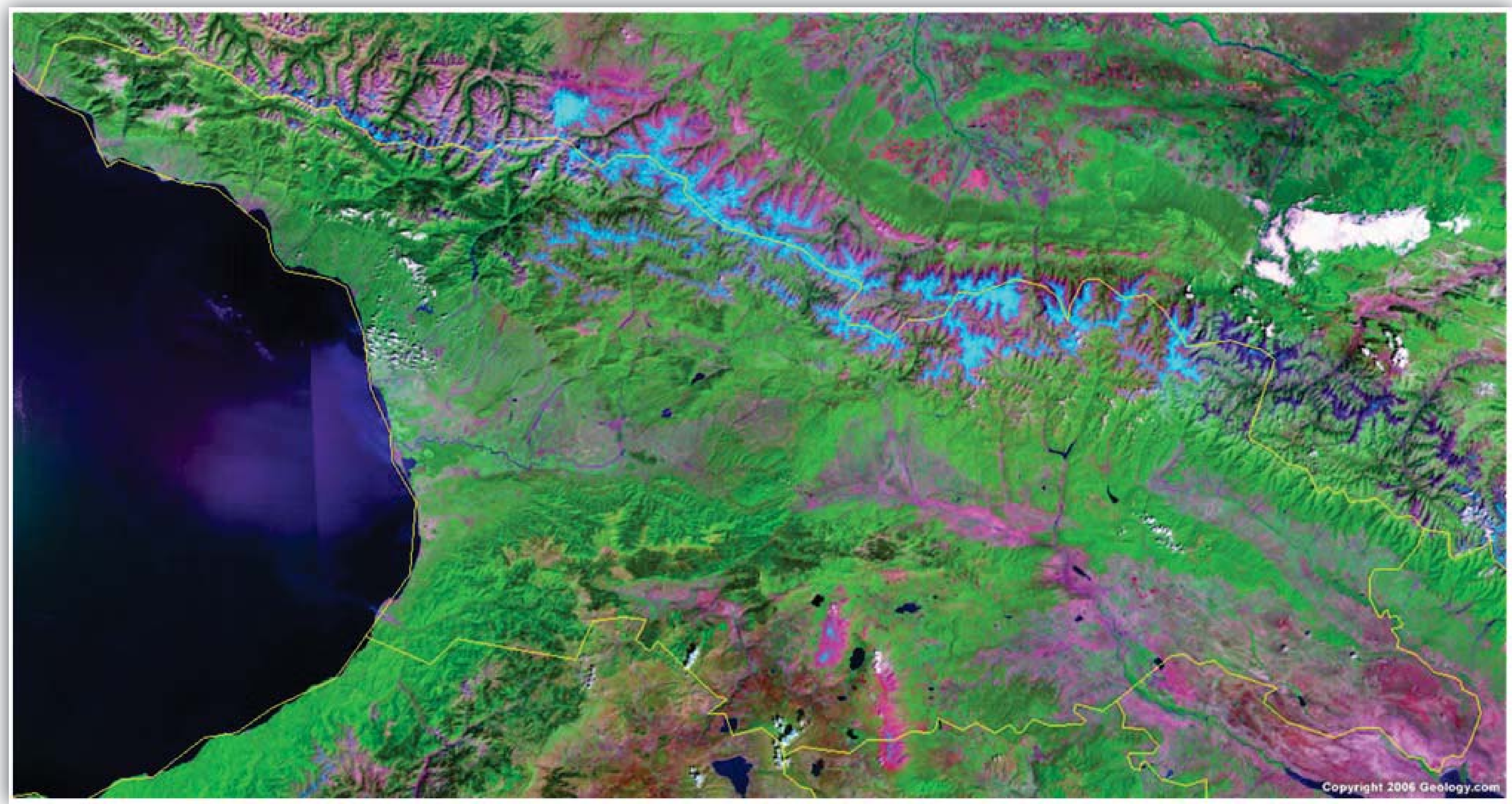


Figure 2. Topography of Georgia

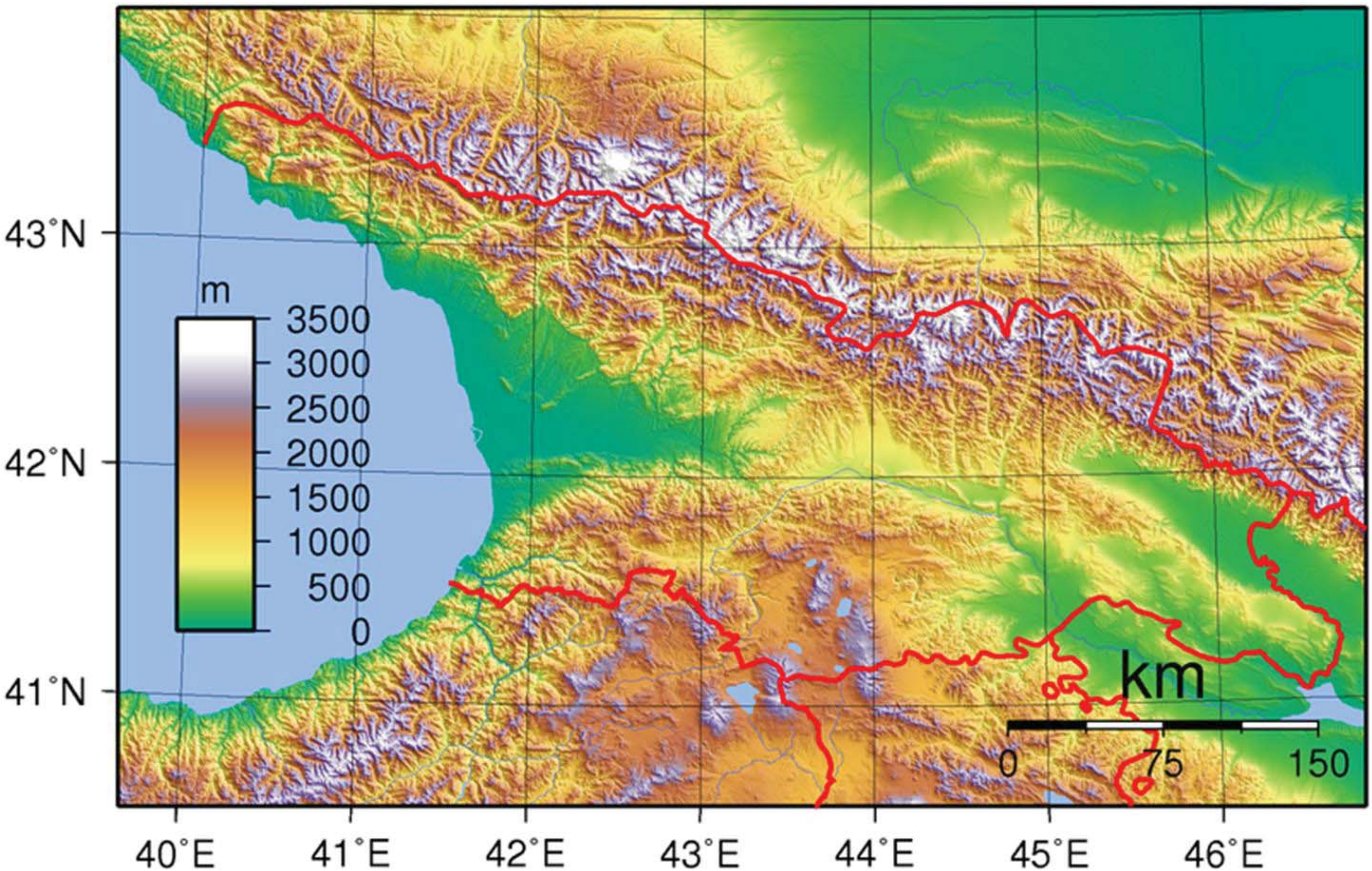


Figure 3. Physical-Geographic Map of Alazani River Basin

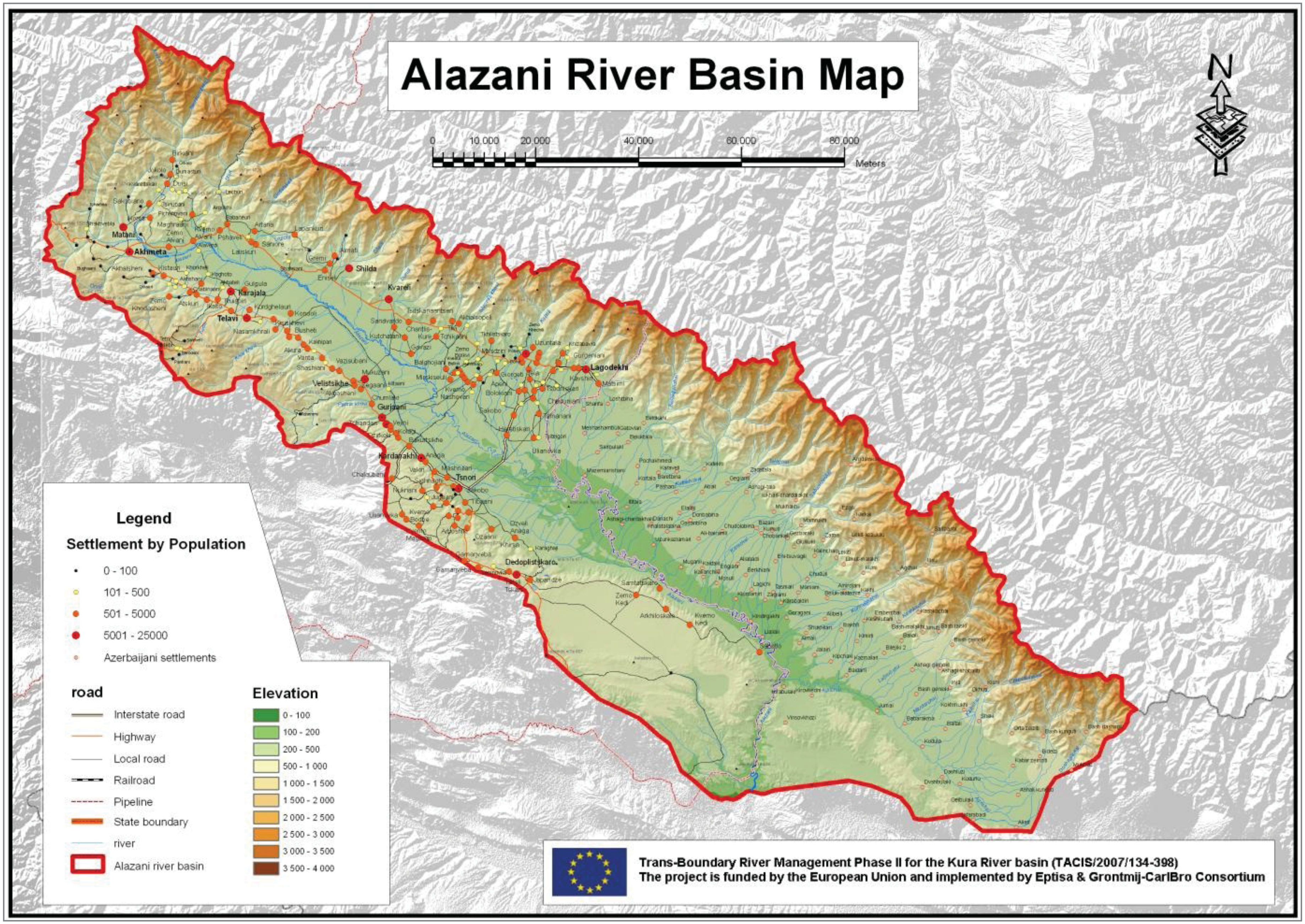


Figure 4. Map of the Physical-Geographic Regions of Georgia

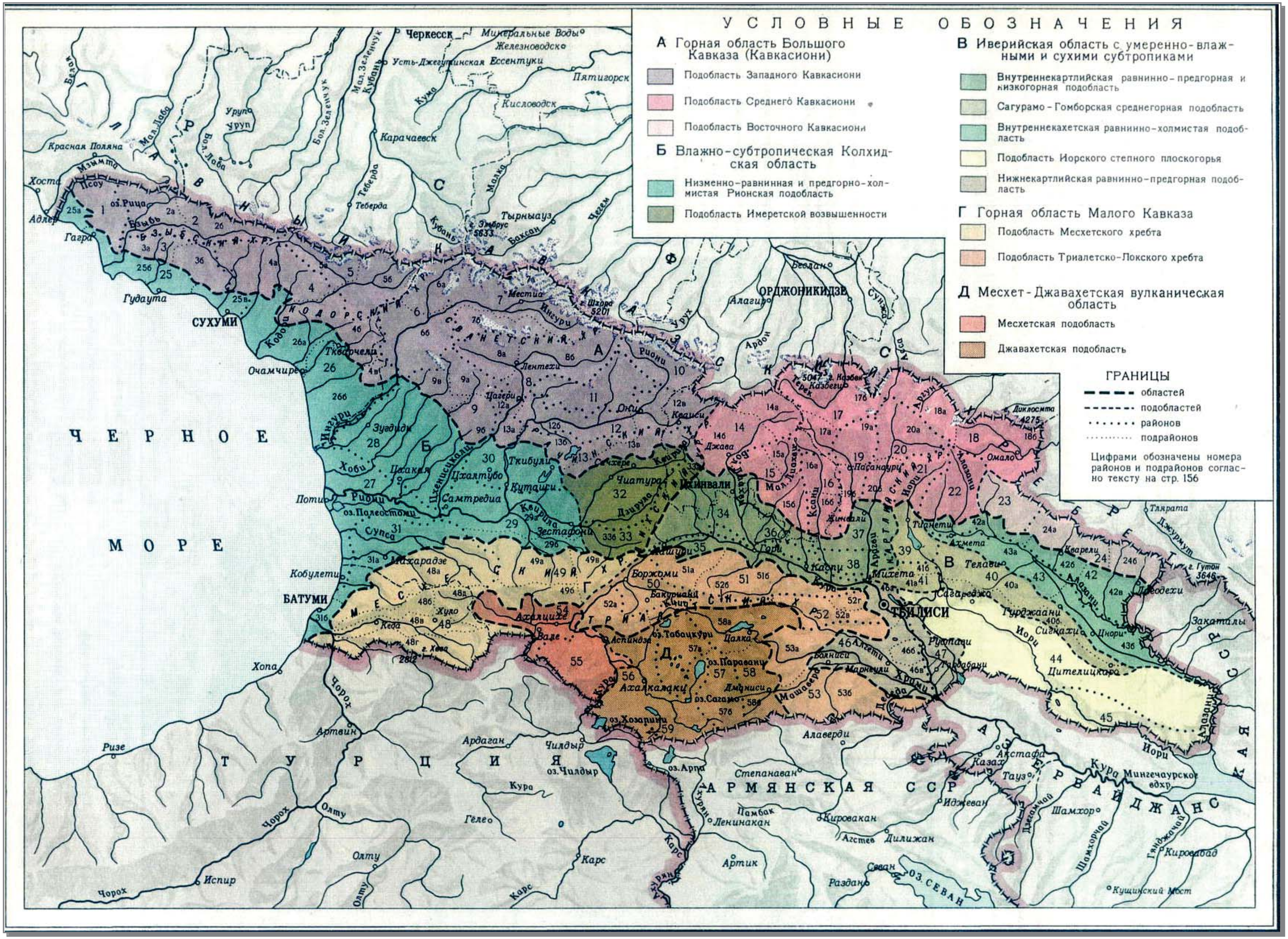


Figure 5. Map of Tusheti (Marked in Red is Alazani source)

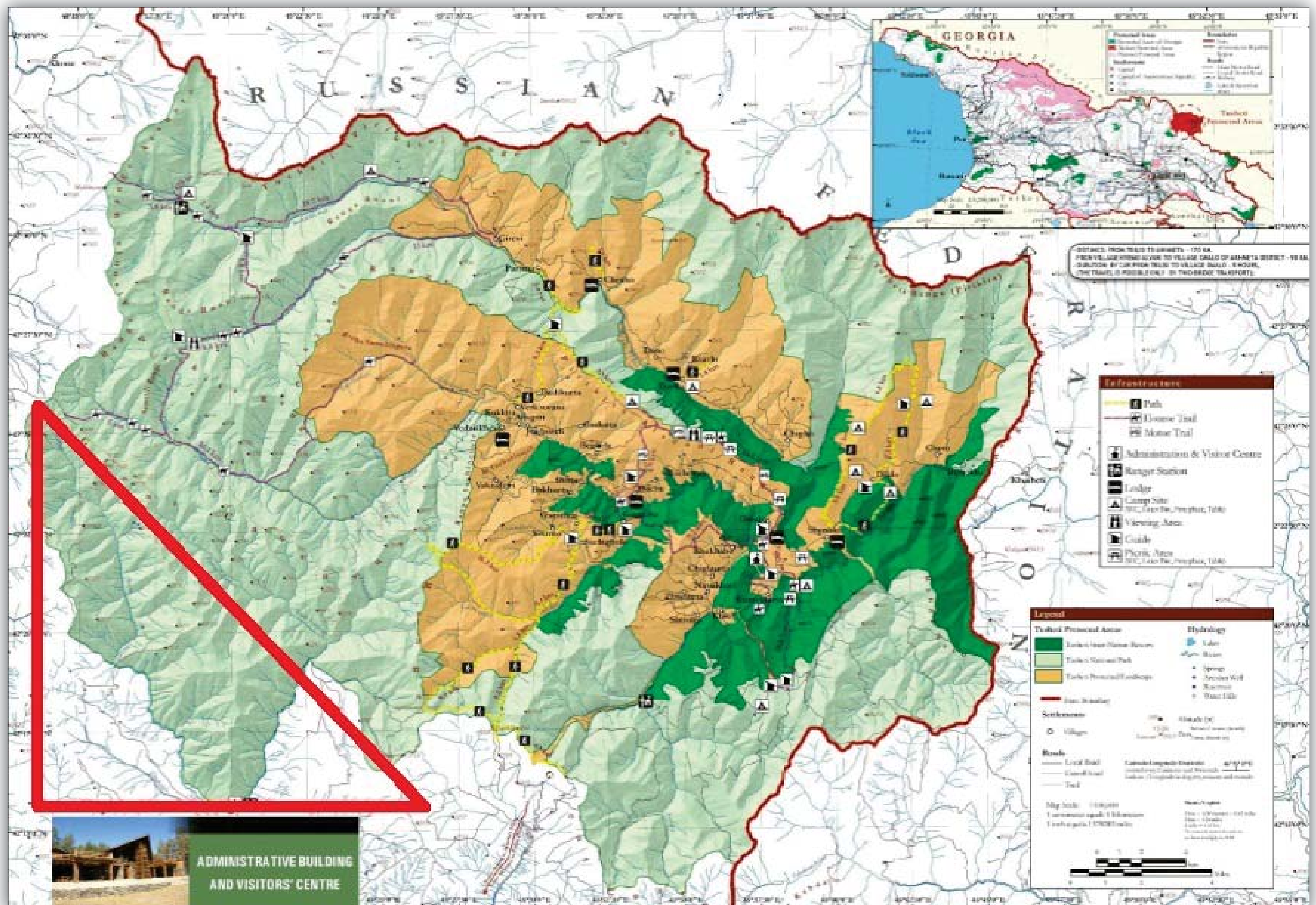


Figure 6. Climate Map of Georgia

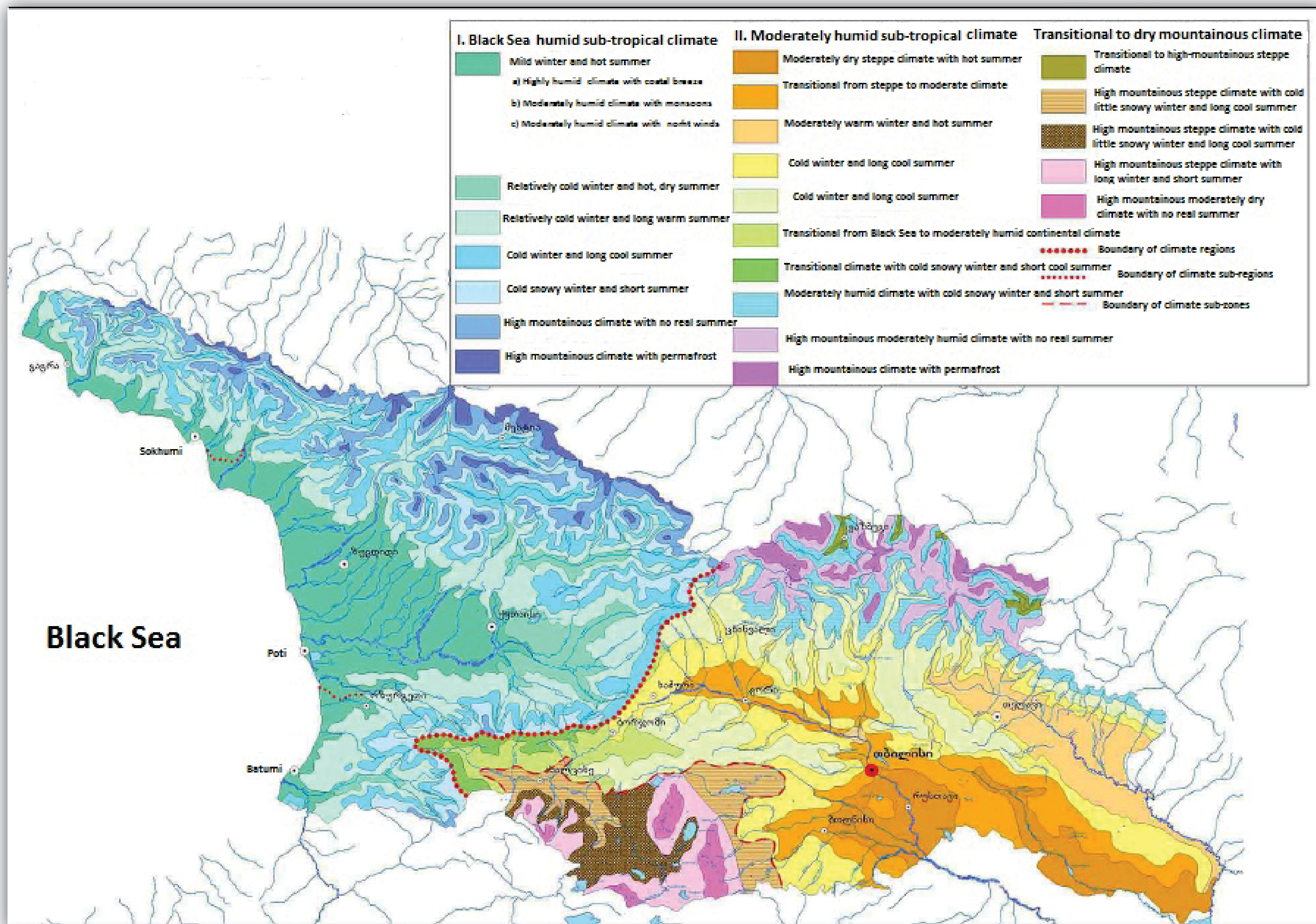


Figure 7. Average Annual Temperature of Georgia

Figure 8. June Temperature of Georgia

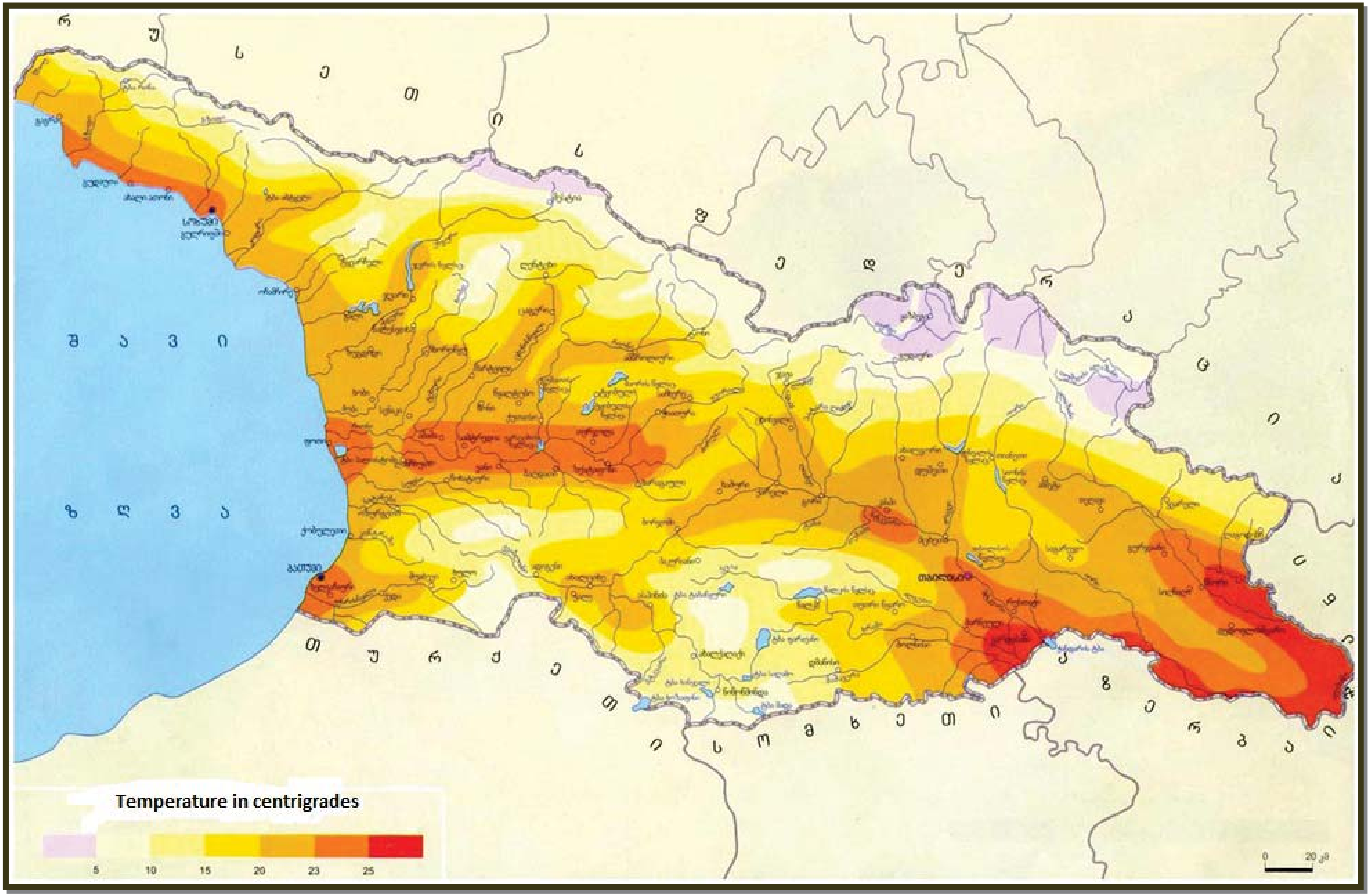


Figure 9. January Temperature of Georgia

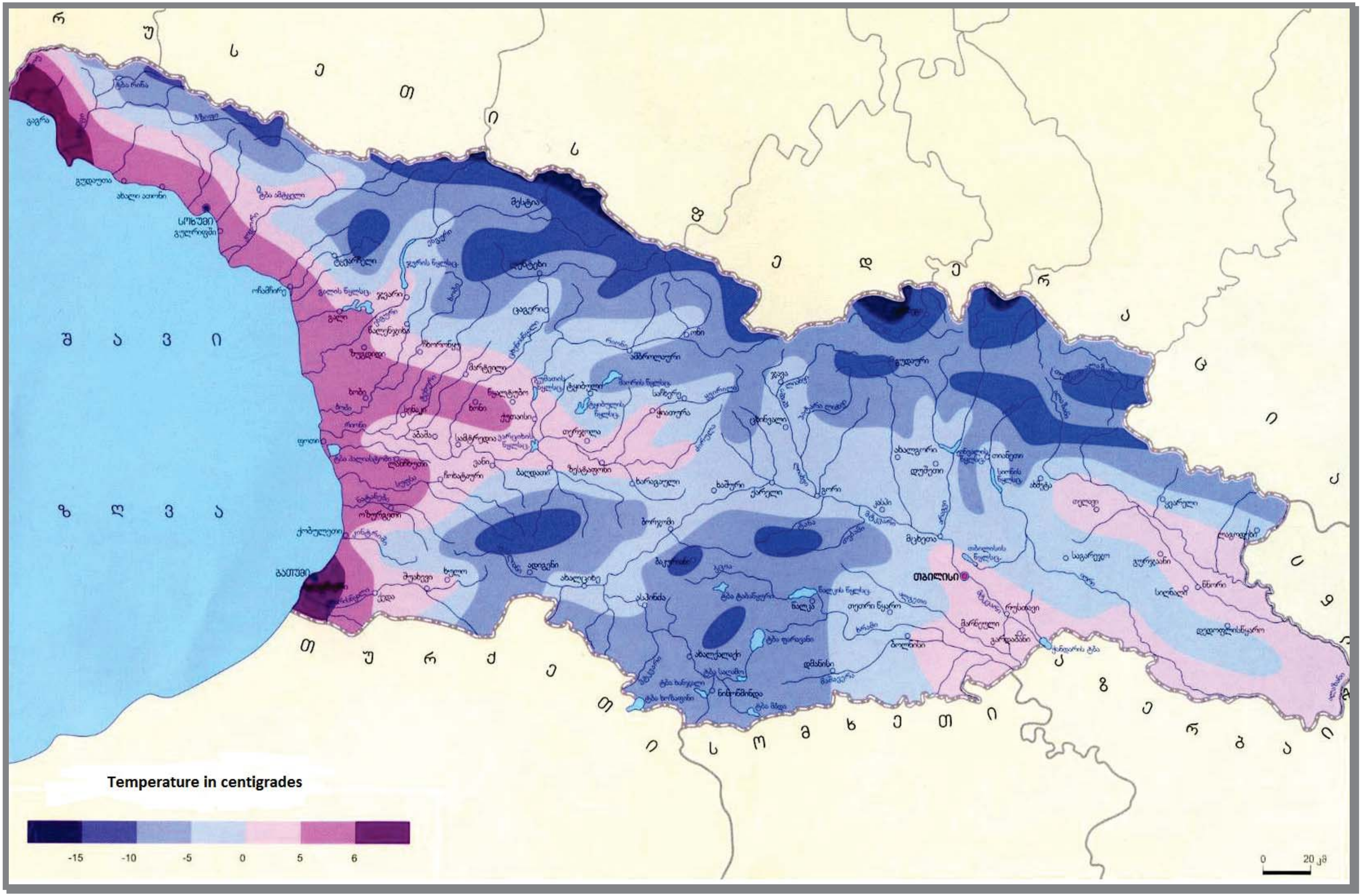


Figure 10. Annual Sums of Precipitation of Georgia

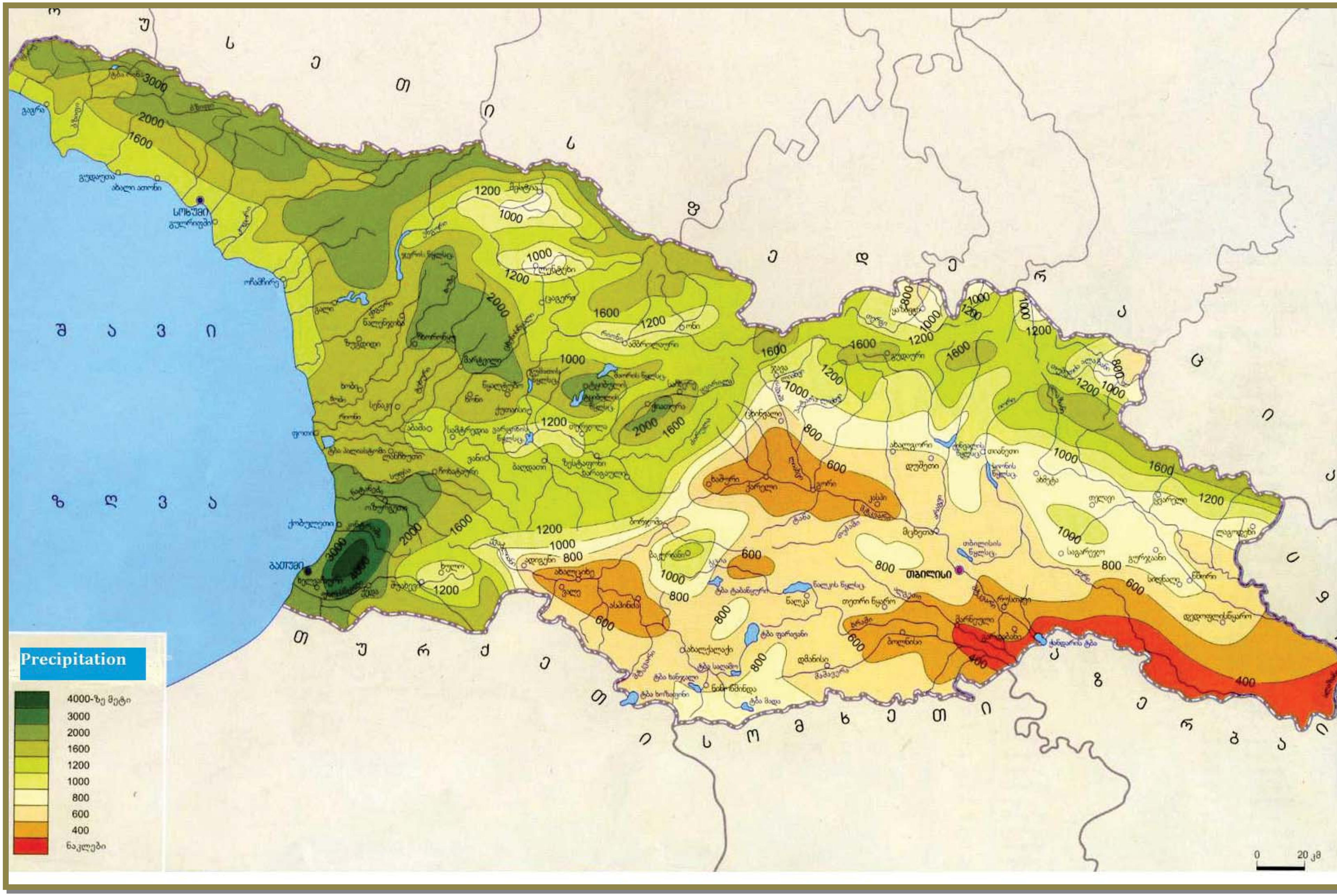
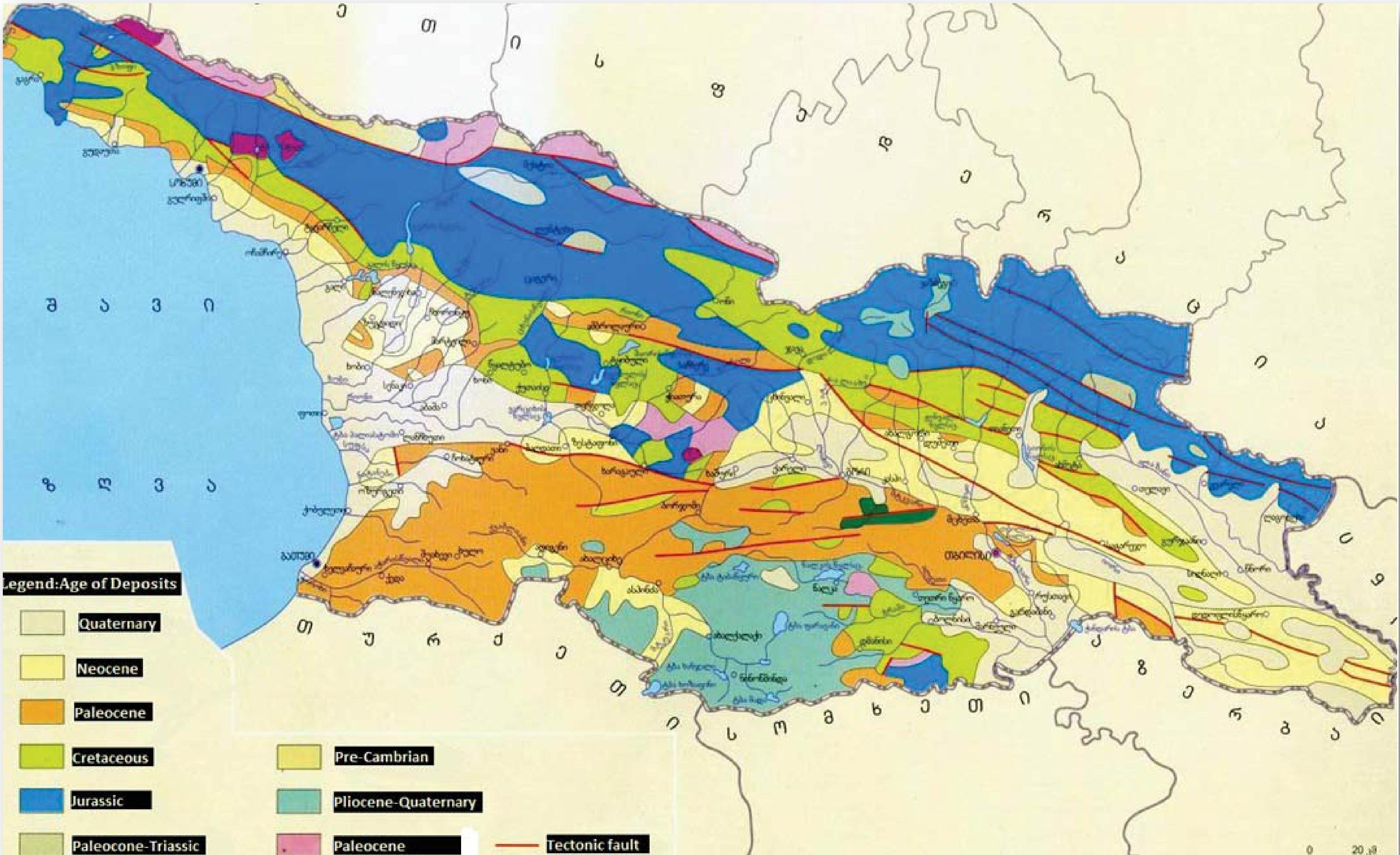


Figure 11. Geological Map of Georgia



ANNEX 2. LANDSCAPES, BIODIVERSITY

Figure 1. Map of Land Cover of Georgia

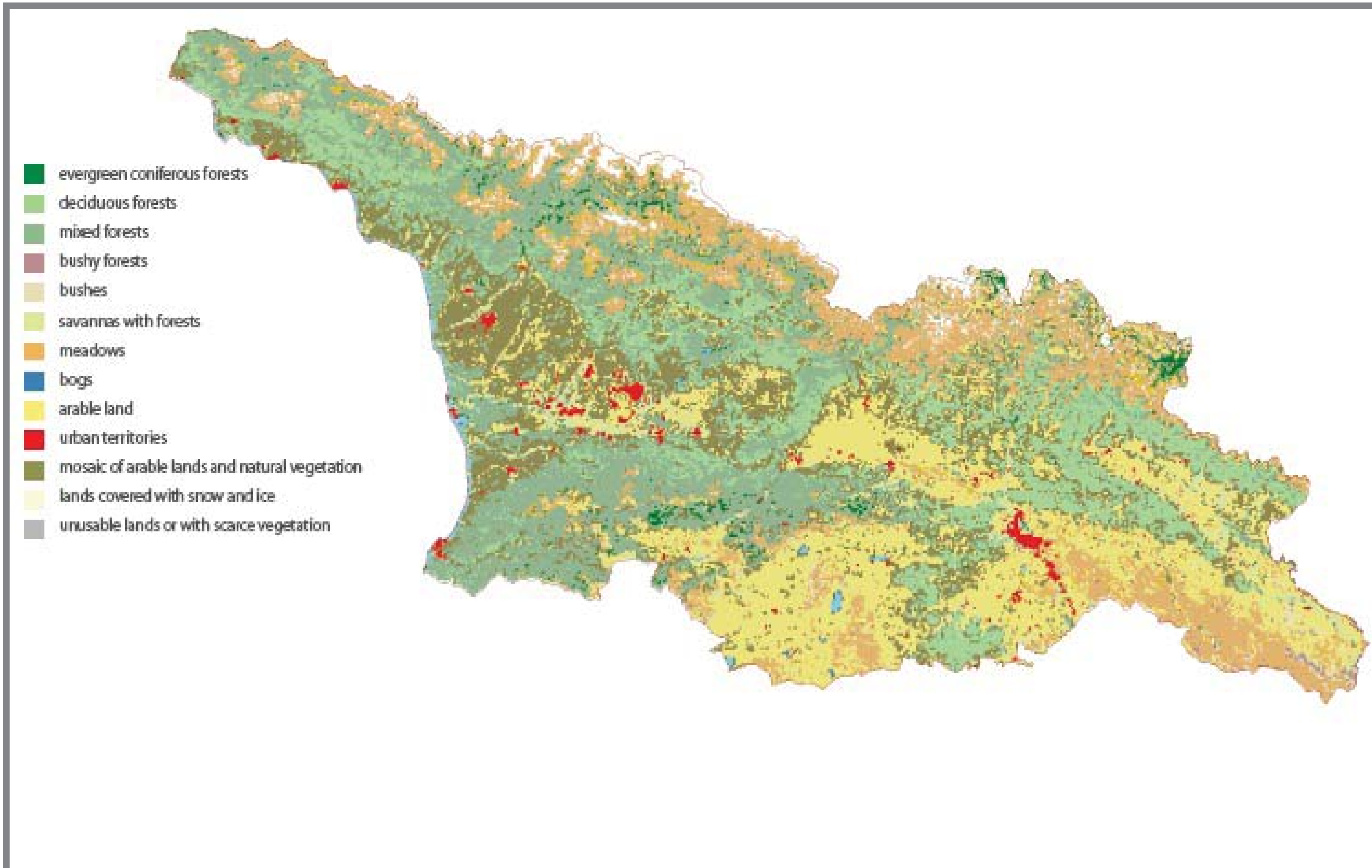


Figure 2. Map of Protected Areas System of Georgia

Figure 3. Map of Protected Areas of the Alazani River Basin

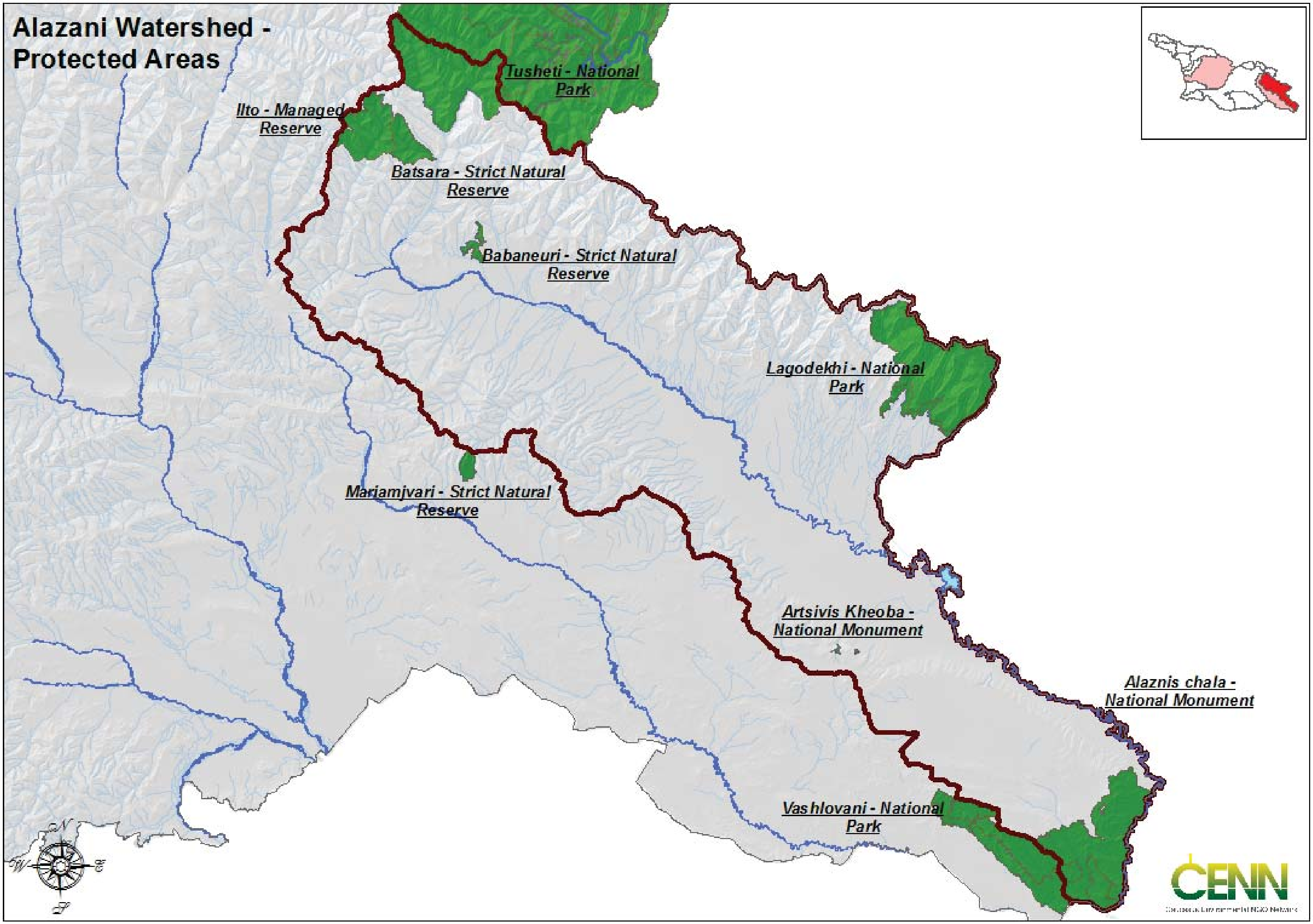


Figure 4. Map of the Bezoar Goat Habitat in Tusheti Protected Areas

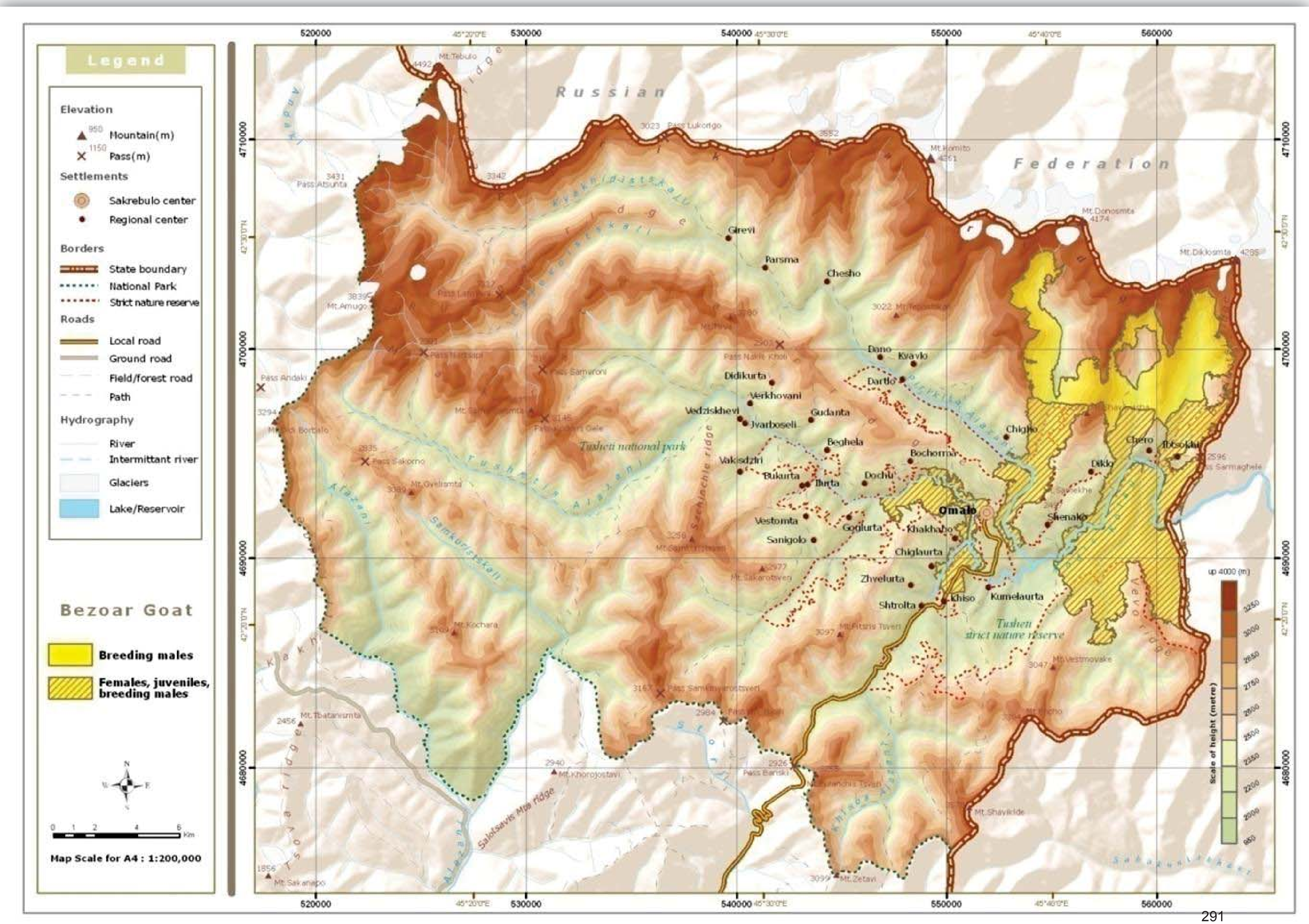


Figure 5. Caucasus Tur (*Capra cylindricornis)* Habitat in Tusheti Protected Areas

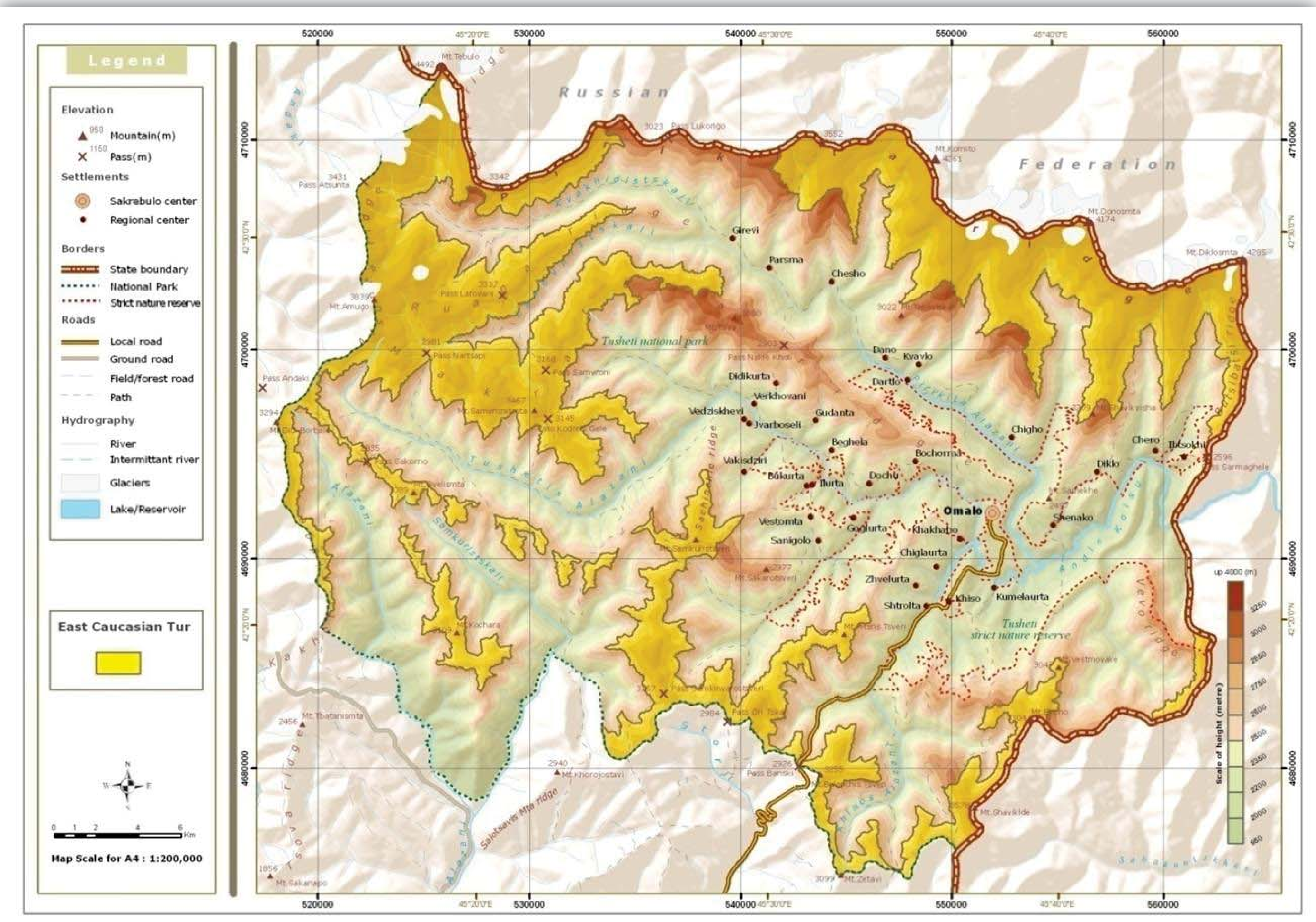


Figure 6. Important Areas for Bird Watching

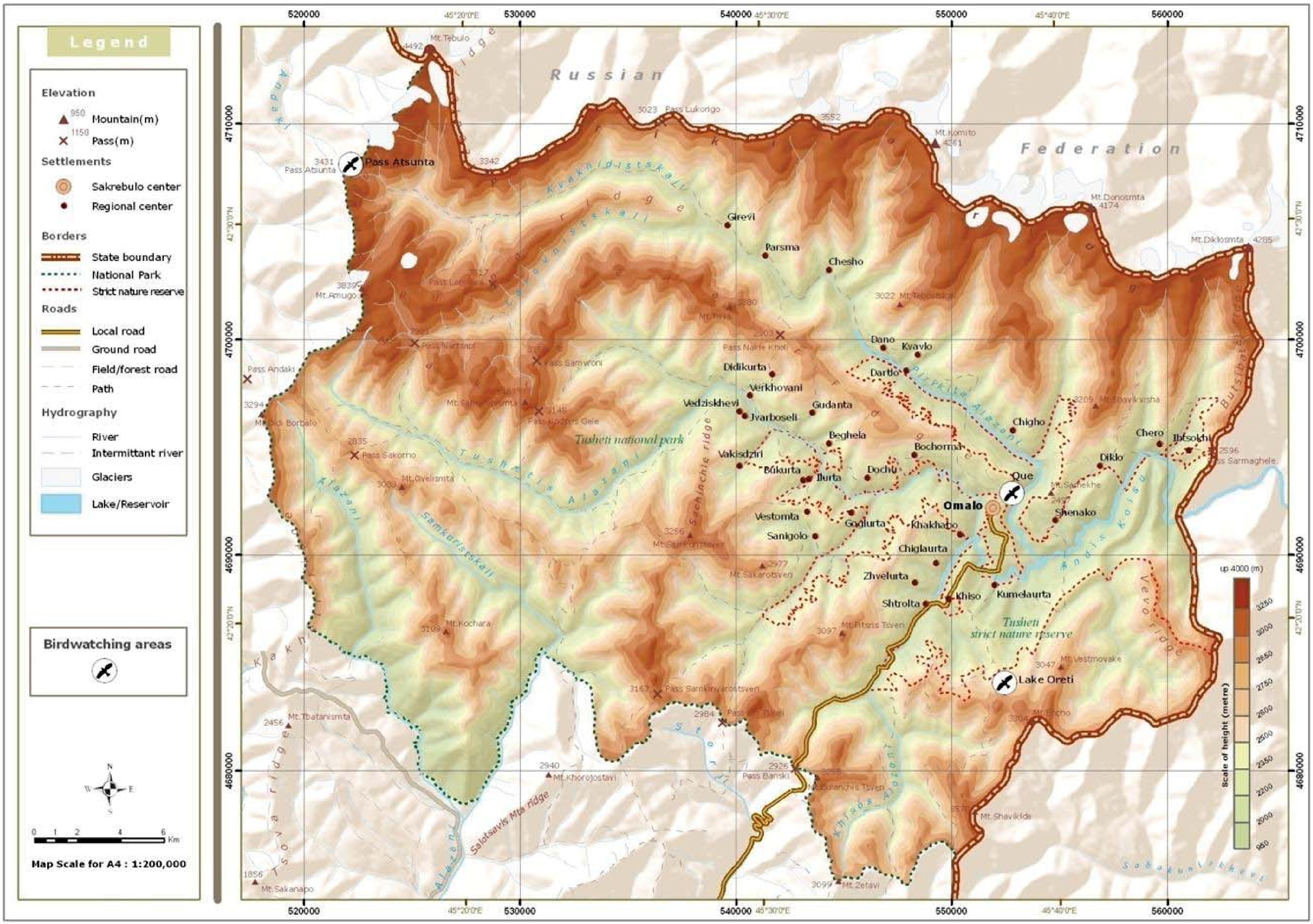


Figure 7. Map of Protected Areas of the Iori River Basin

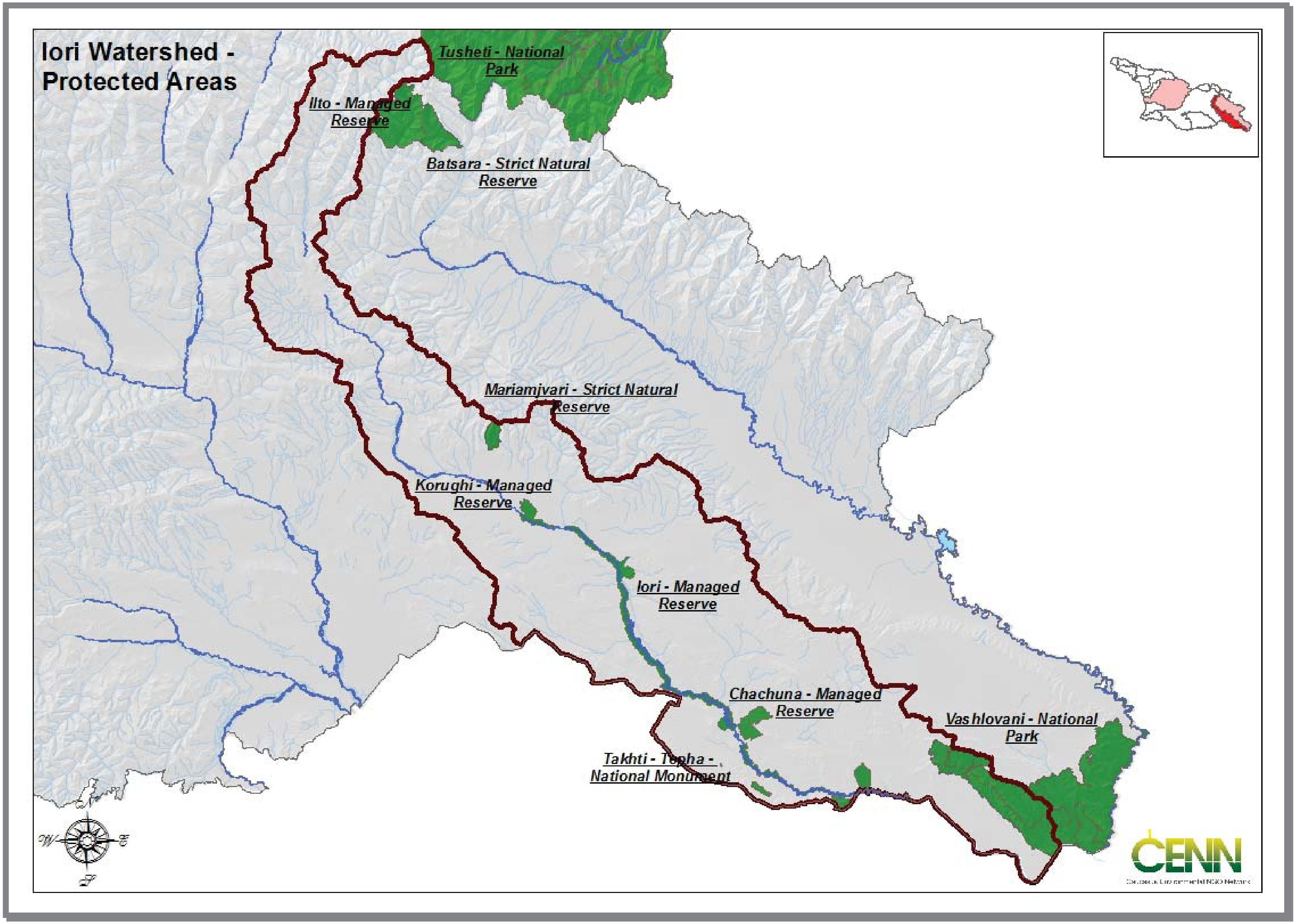


Figure 8. Map of Protected Areas of the Rioni River Basin

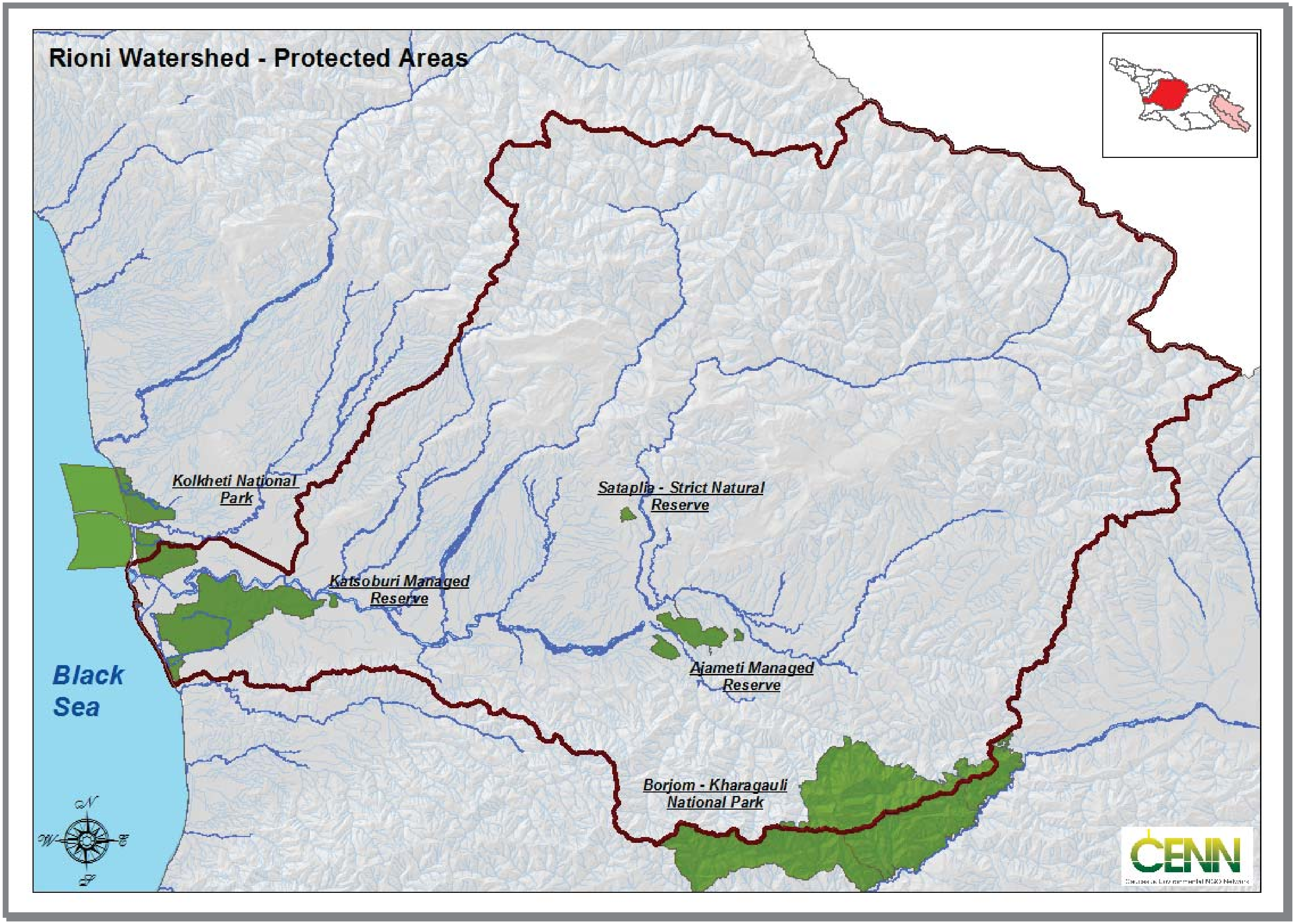


Figure 9. Map of the Borjomi-Kharagauli Protected Areas

Figure 10. Map of the Kolkheti National Park

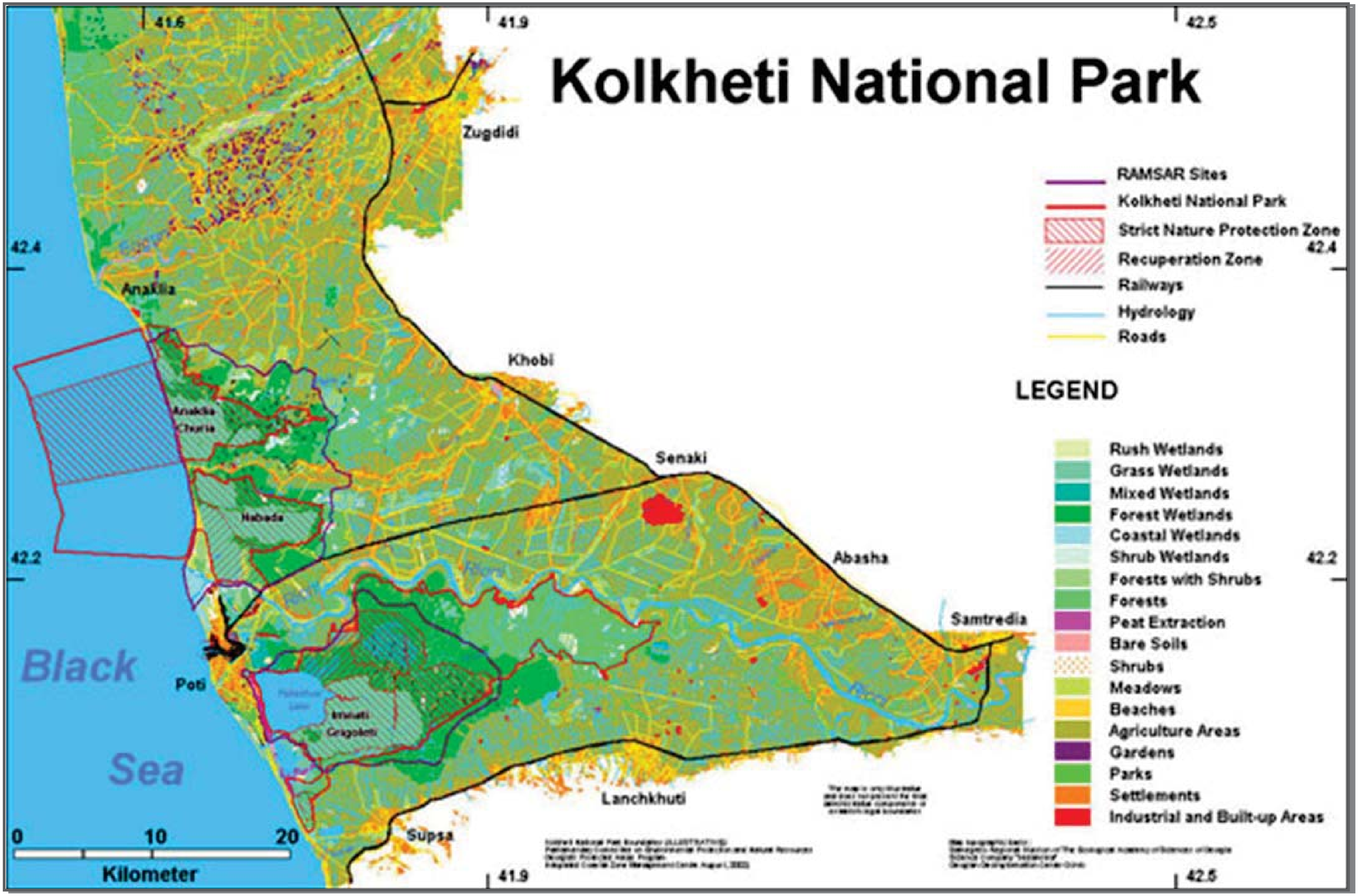


Figure 11. Planned Protected Areas of the Central Caucasus

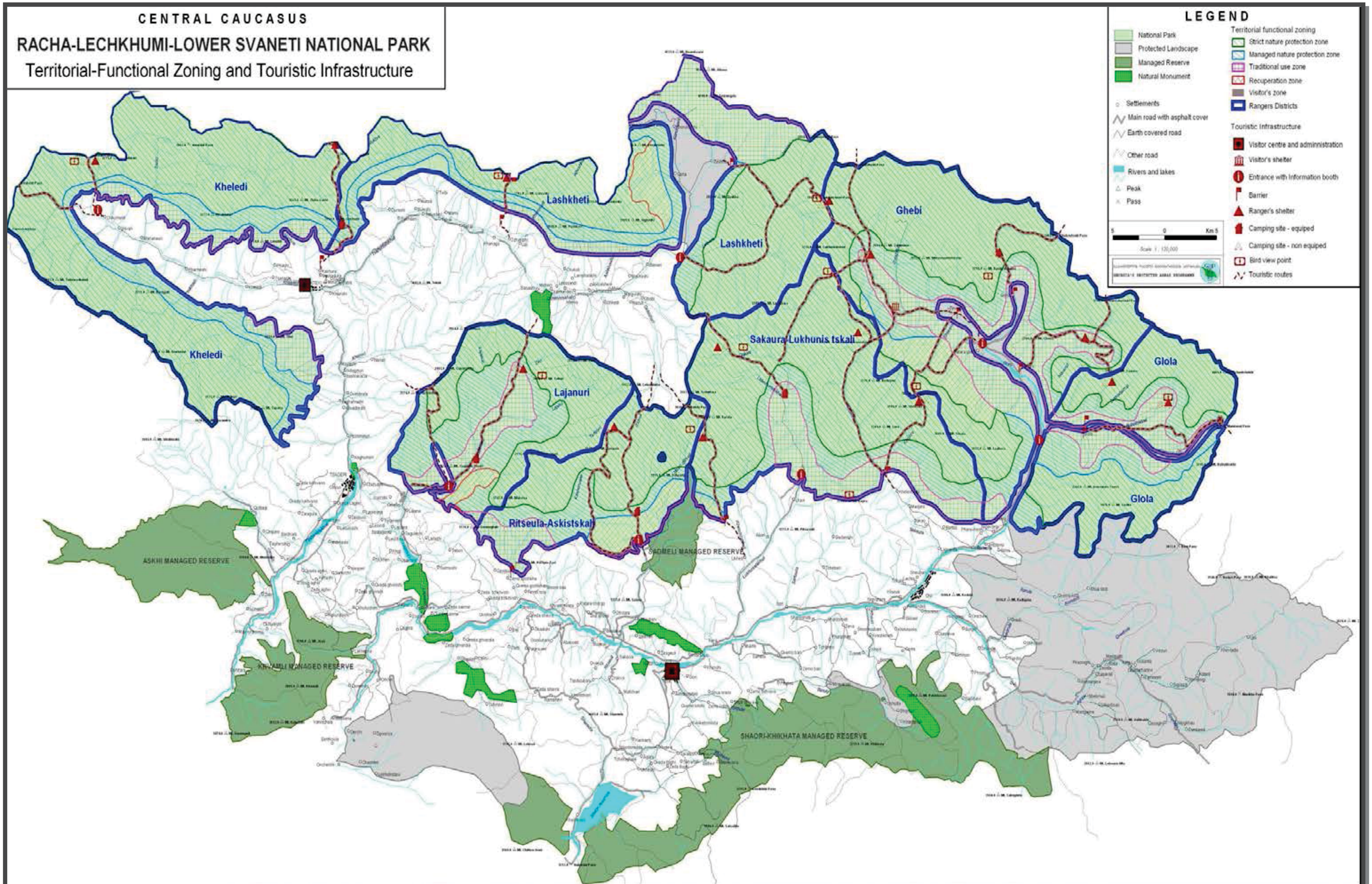


Figure 12. Map of the Forest Cover of Georgia

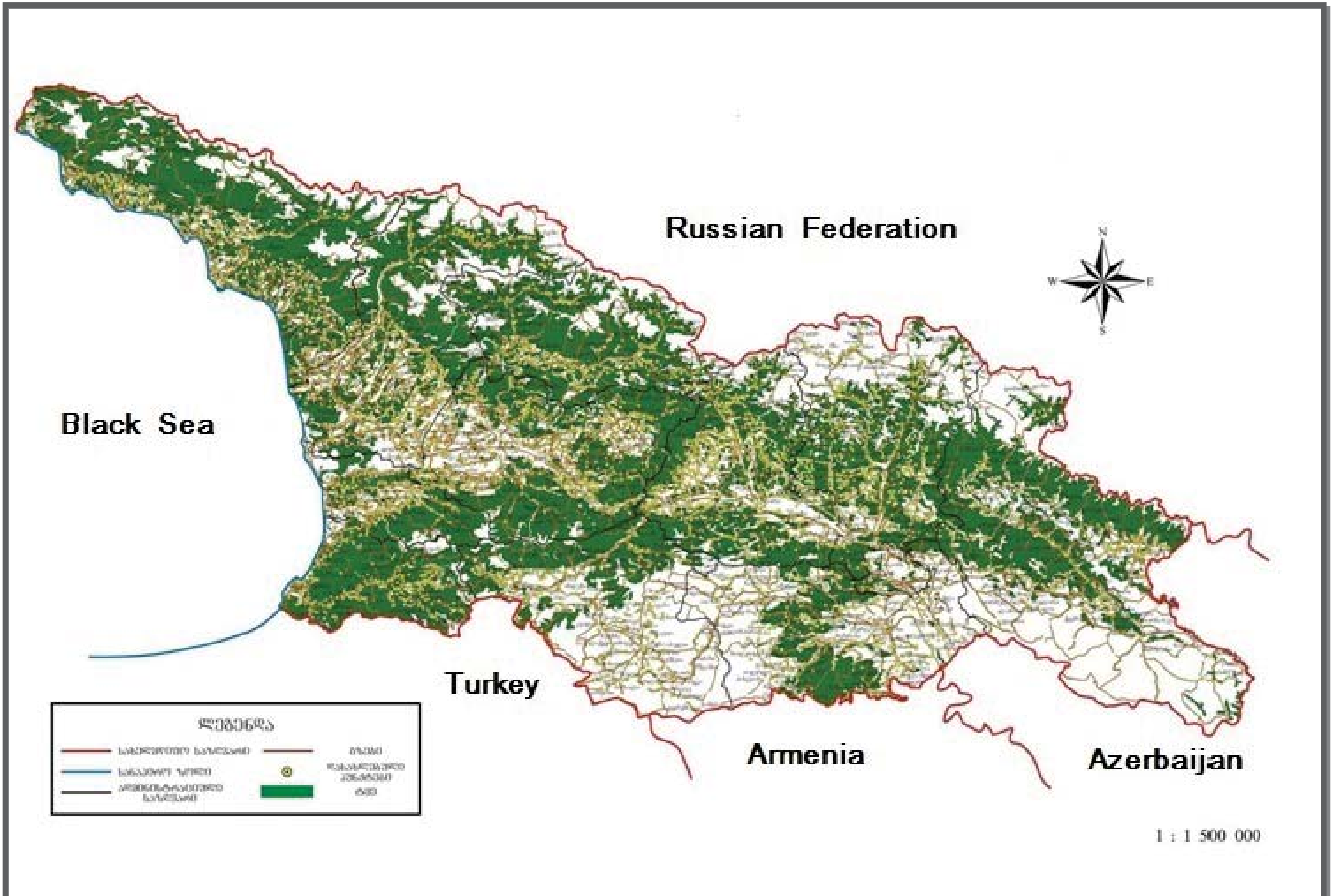


Figure 13. Map of the Forest Cover of the Alazani River Basin

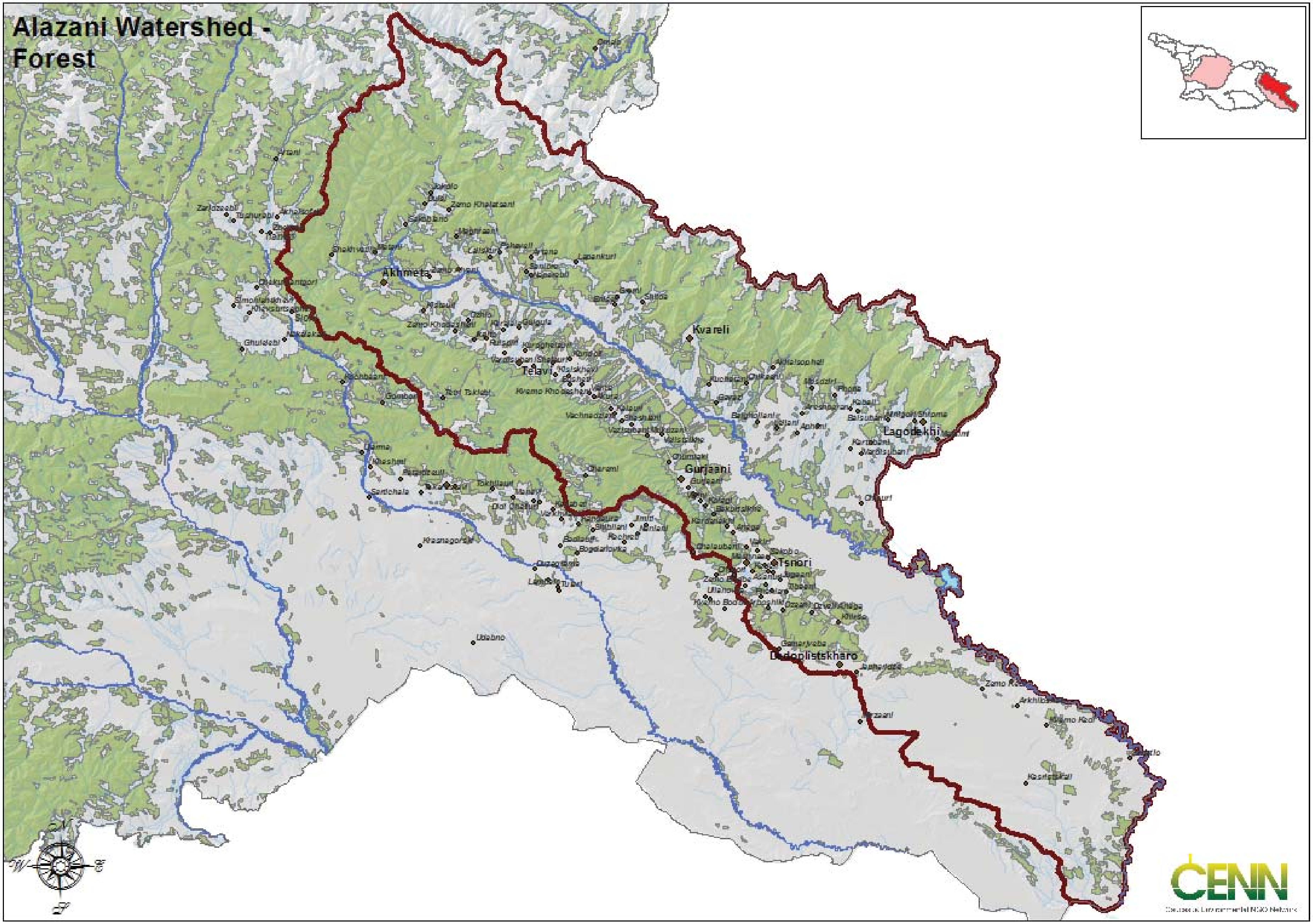


Figure 14. Map of the Distribution of Sacred (Holly Forests) in Tusheti

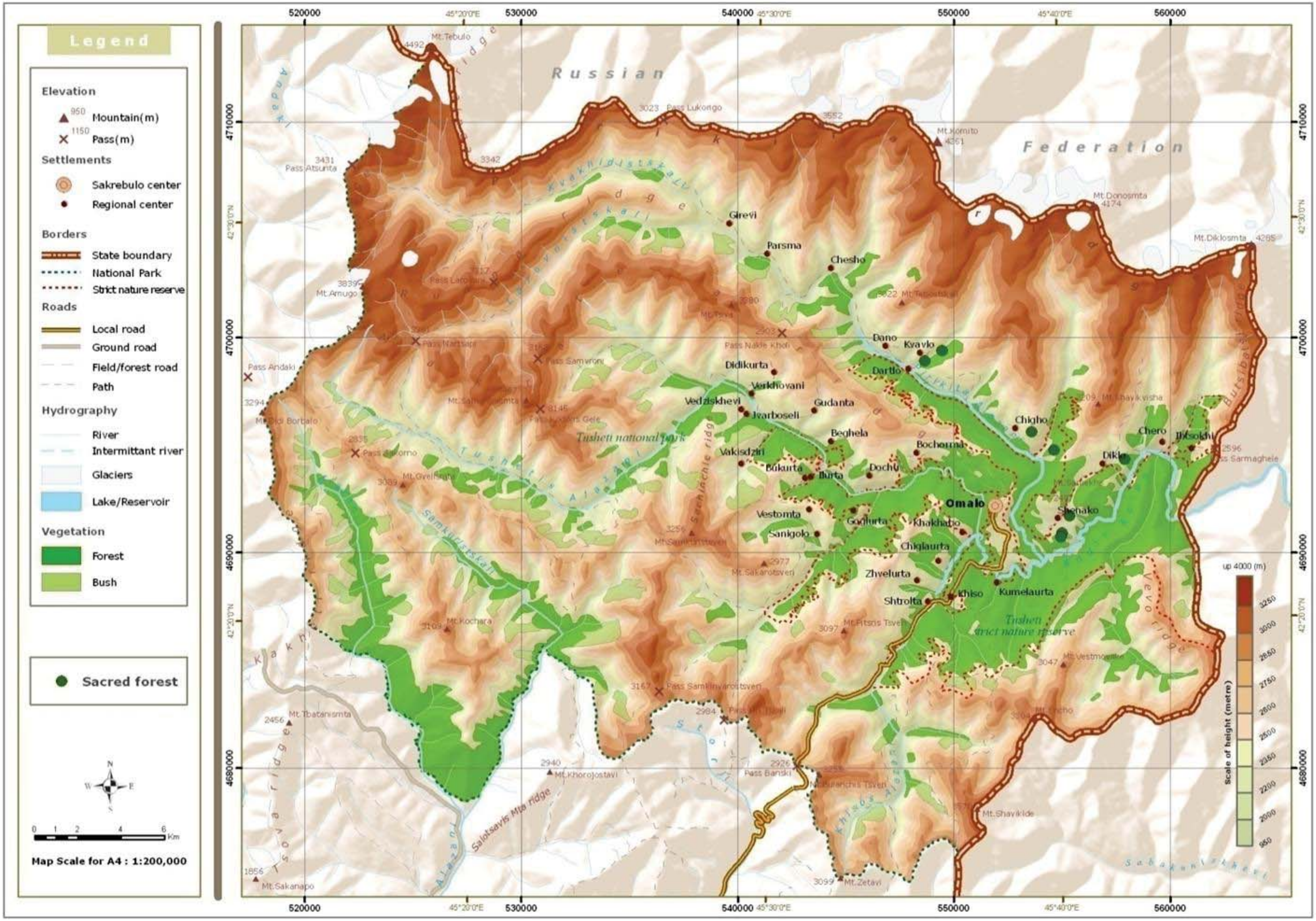


Figure 15. Map of the Forest Cover of the Iori River Basin

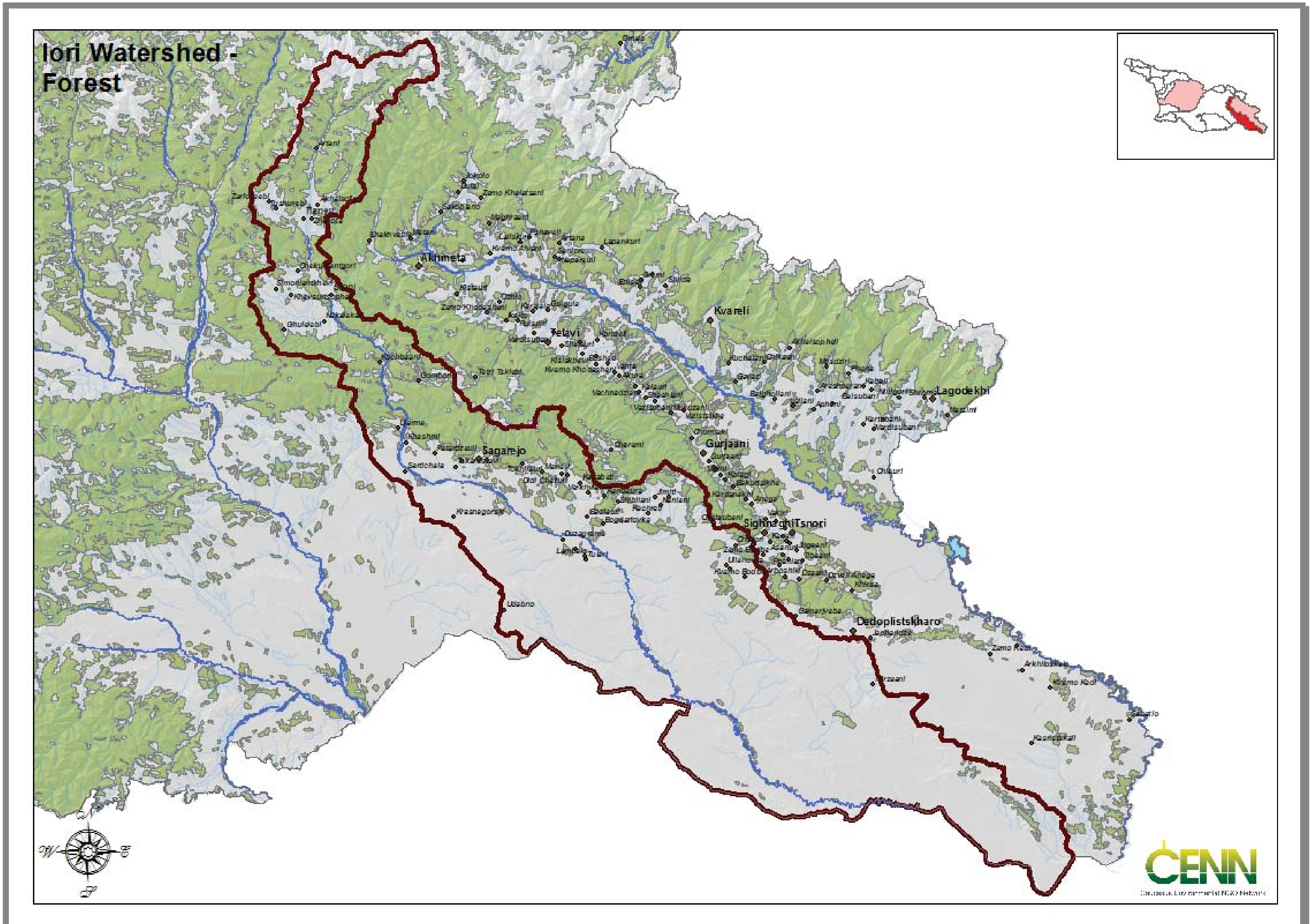
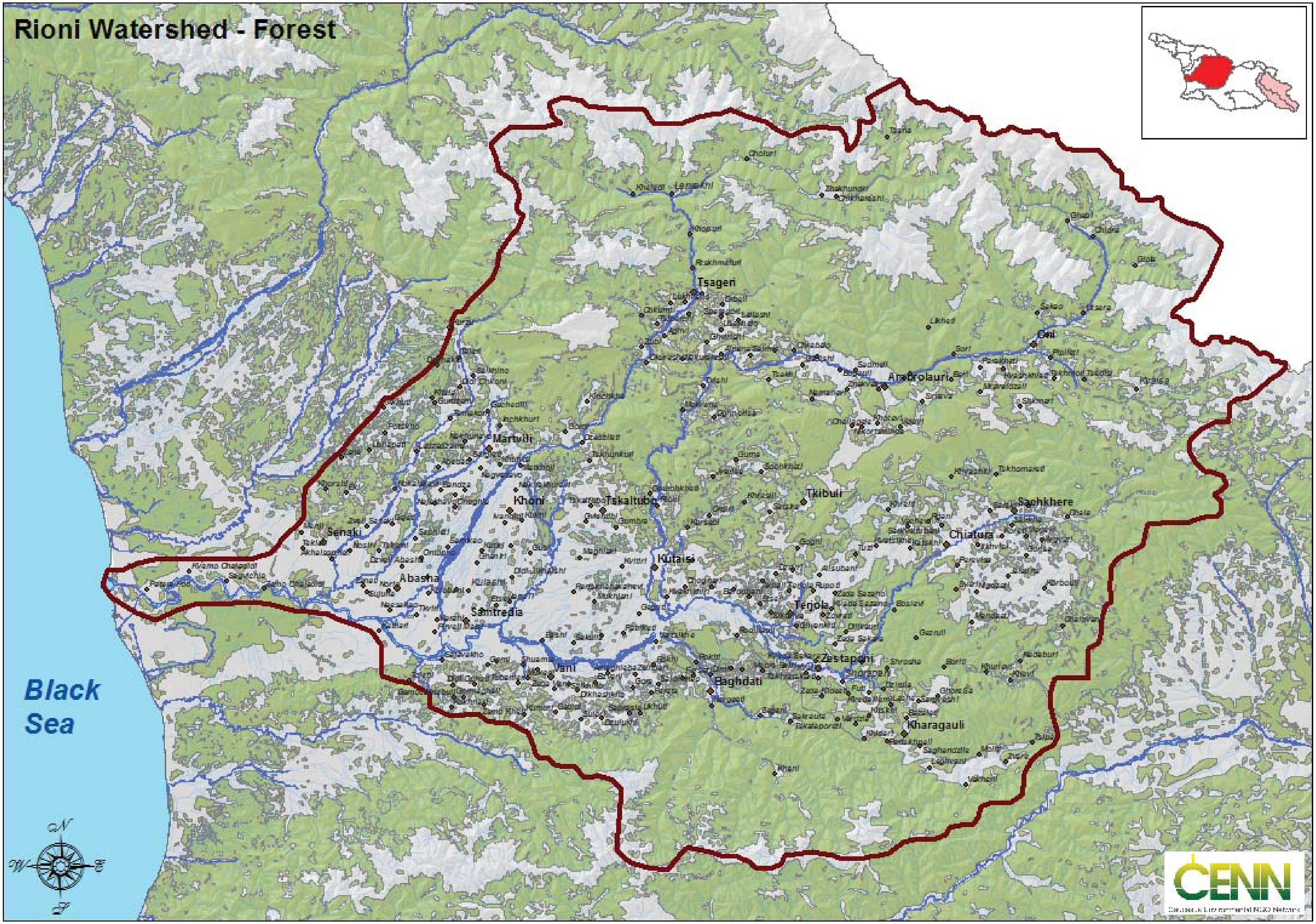


Figure 16. Map of the Forest Cover of the Rioni River Basin



ANNEX 3. LAND and MINERAL RESOURCES

Figure 1. Map of Soil Types of Georgia

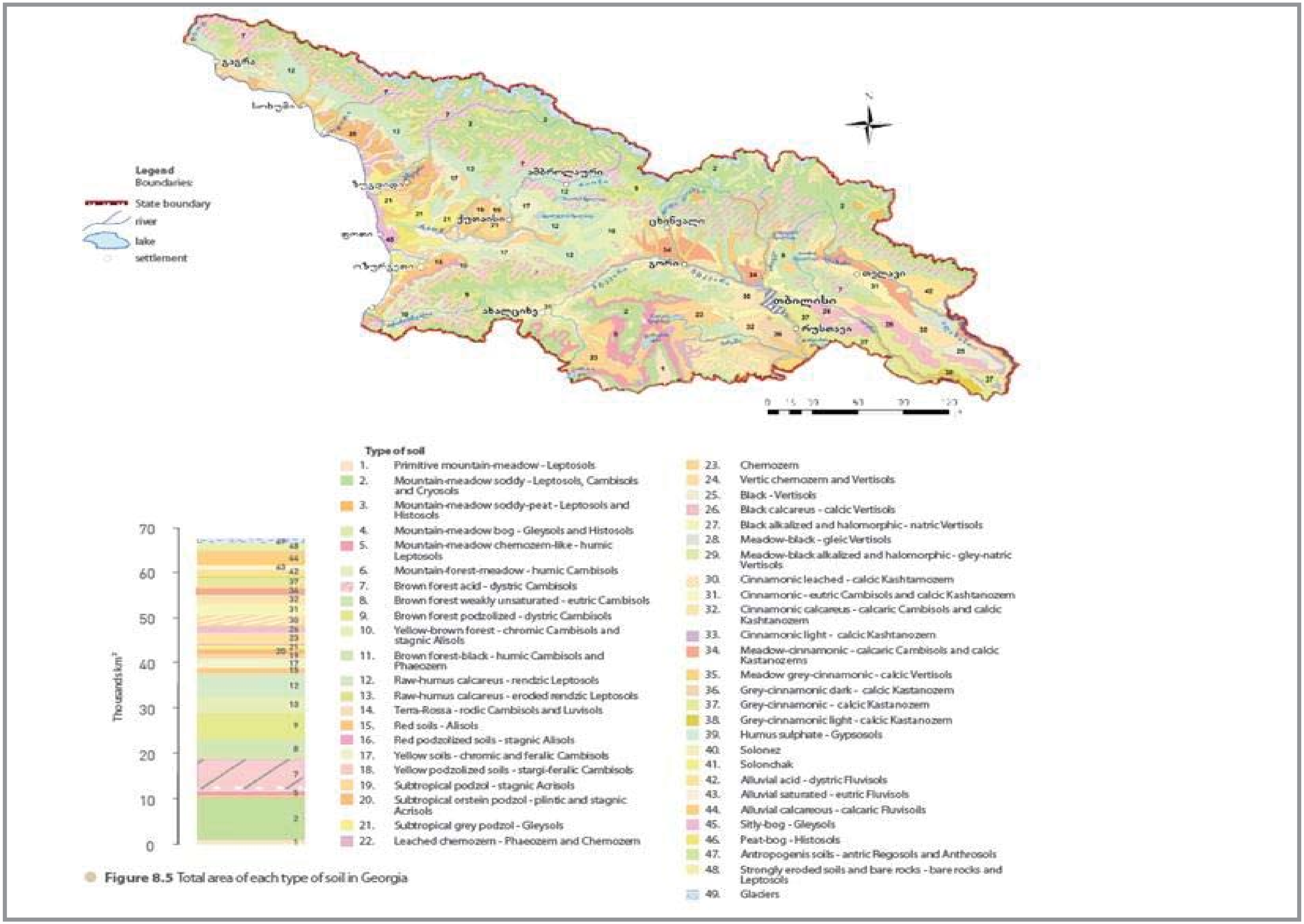


Figure 2. Map of Metal Deposits of Georgia

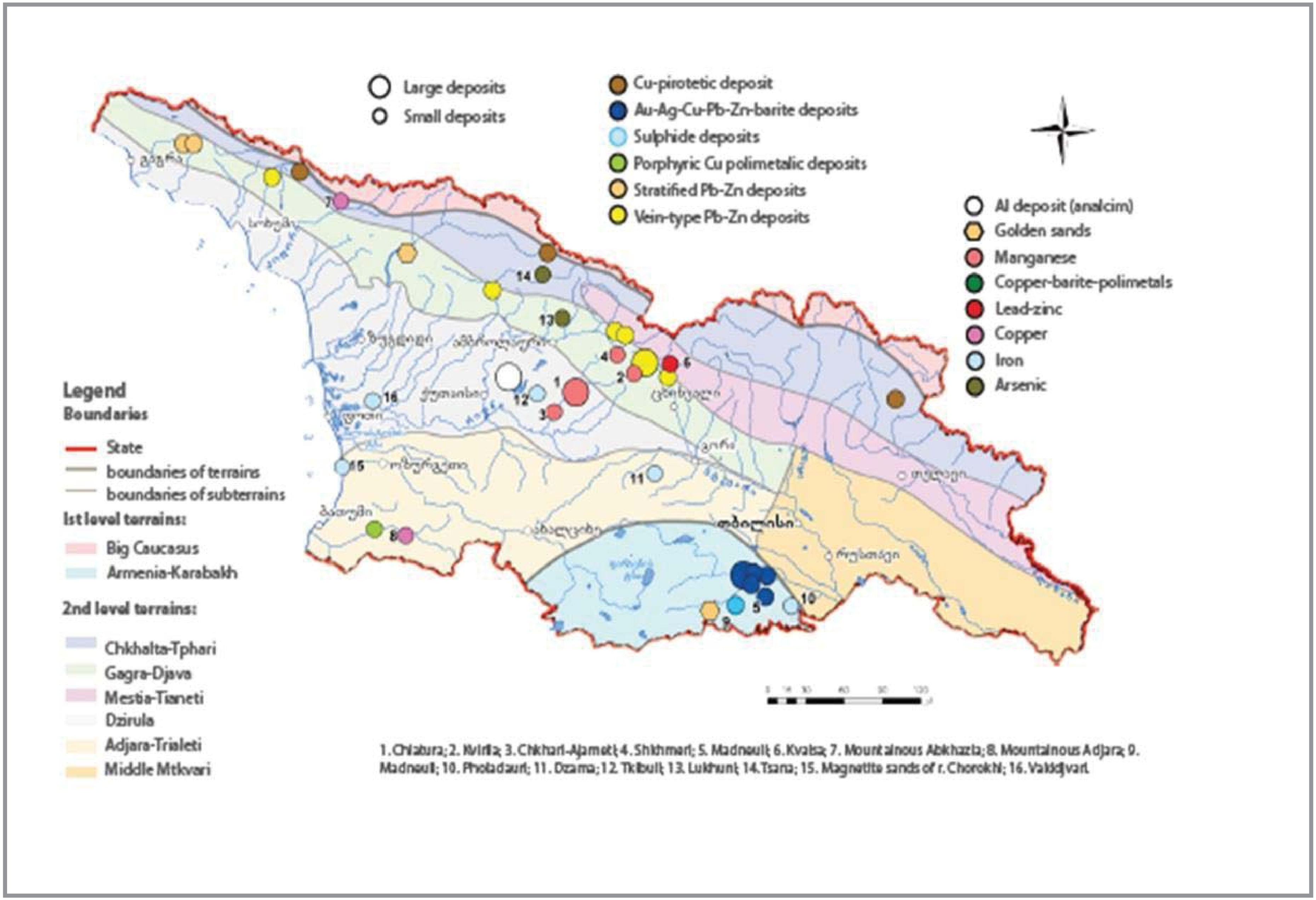


Figure 3. Map of Non-Metal Deposits of Georgia

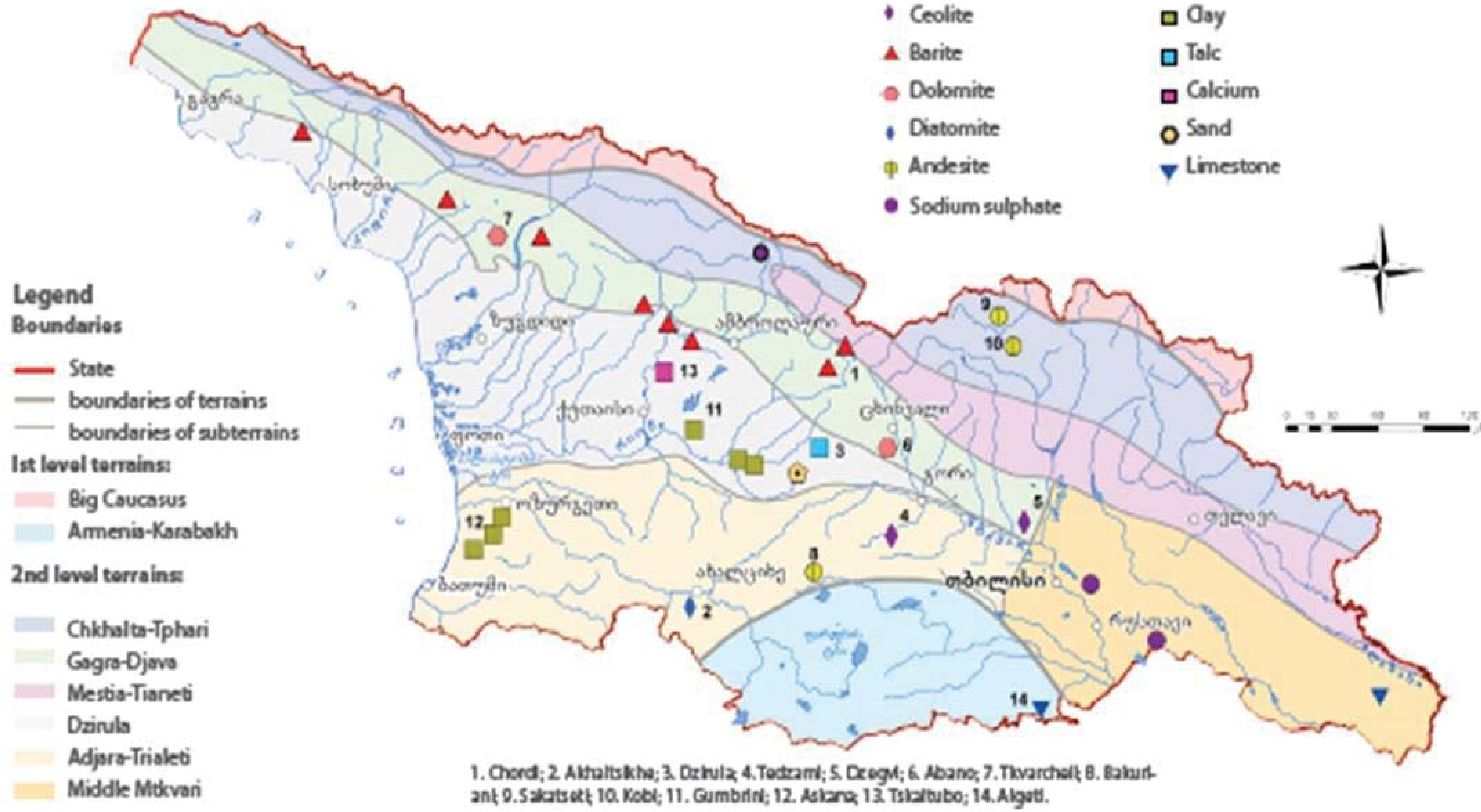


Figure 4. Oil Drinilling Operations in Georgia

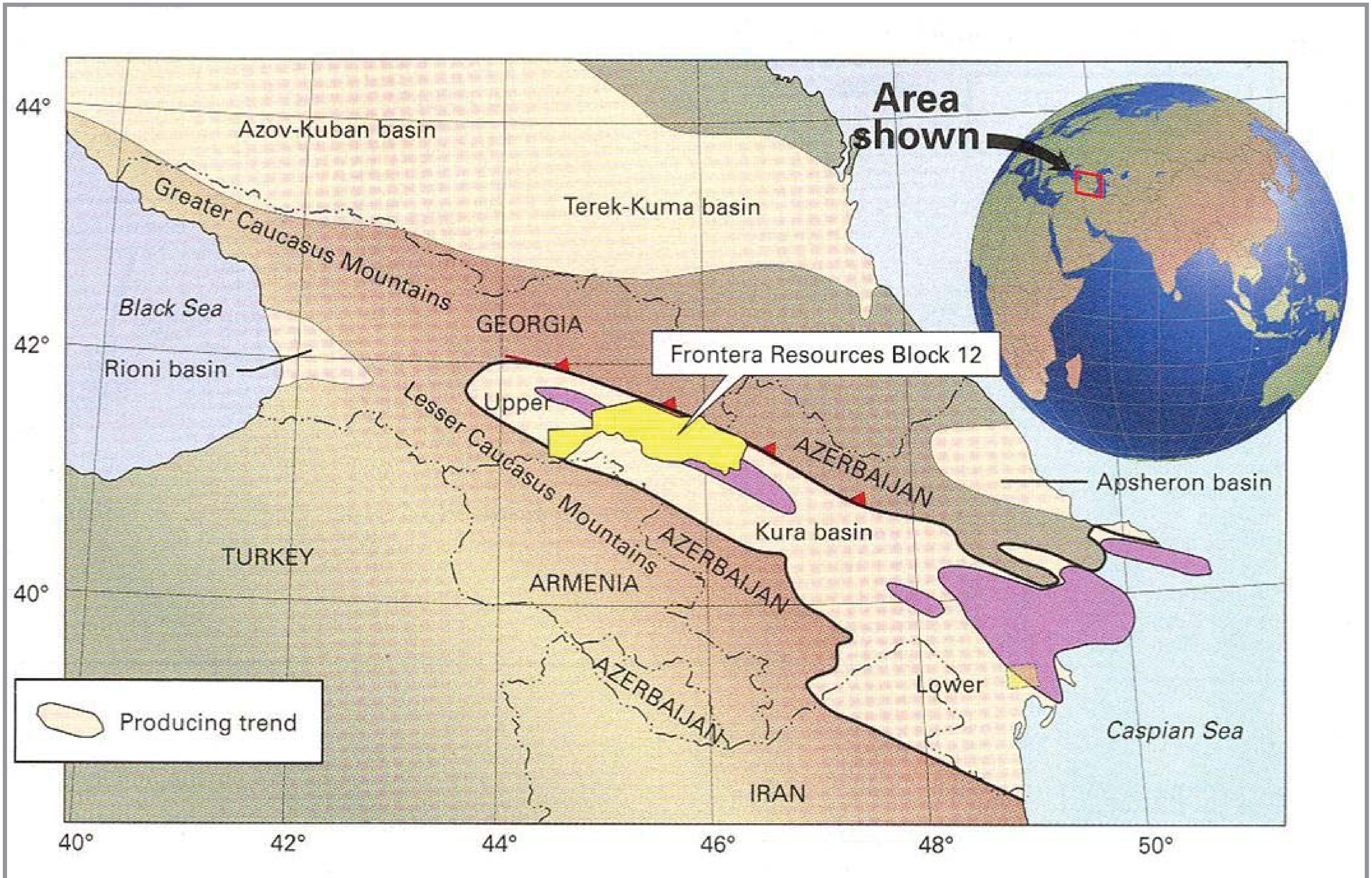


Table 1. Lisences Issued for the Use of Mineral Resources

Type of Mineral Resource and Its Source	License Owner	License registration time and validity	Allowable Amount of Extraction	Land Area
Sapharis Gele deposit quarts sand (Sachkhere district)	Sakalibe Qvishebi	12.07.94 03.06.98 20 years	18,600 m3/year - 29,800 m3/year	14 ha
Itavaza I deposit quartz sand (Sachkhere district)	Darkveta Construction Material Factory, joint stock	08.03.96 05.10.01 20 years	100,000 .m^3/year	14 ha
Khandebi deposit limestone (Kharagauli district)	"Iveria 92", limited	28.06.96 17.09.97 15 years	5,000 m3/year-15,000 m3/year	3.5 ha
Jvarisa deposit caoline cley (Tkibuli district)	"SamTo-Sainvestitsio Korporatsia", limited	04.08.00 08.02.01 10 years		20.9 ha
Tkibuli coal enrichment plant tailing	"Chiragdani", limited	29.12.00 04.09.01 20 years		9 ha
Eklari deposit grey and white limestone section I and II south-west boundary area (Terjola district)	Eklaras Kva, limited (Eklaris stone)	25.05.01 31.05.01 10 years	Unlimited amount	42.5 ha
Azkhamburi group deposits " Sakharetba and Grdzelitba" mirabilite exploration and extraction (Sagarejo)	Merabiliti, limited	15.03.02 27.03.02 10 years	90 t/year-100 t/year	114 ha
Nunisi mineral water (Kharagauli district)	Nunisi, limited	14.06.02 20.06.02 01.01.23	Max. 100 m^3/24 hours	5.2 ha
Kursebi teshenite (Tkibuli district)	"Saqtesheniti", joint-stock	08.11.02 25.03.03 10 years	unlimited amount	13 ha
Silicamanganese tailings (Zestaphoni district)	"Ekometali", limited	30.05.03 11.09.03 10 years	unlimited amount	2 ha
Godogani limestones (Terjola district)	"Viktoria", limited	05.12.03 18.12.03 10 years	unlimited amount	5 ha
Qlibela mineral water (Bagdati district)	"Igrika 97", limited	03.10.03 10.02.04 10 years	max. 1 m^3/24 hours	0.07 ha
Eklara depost rosy limestone (Terjola district)	"Eklara", limited	14.06.02 26.02.04 10 year	In accordance with demand	4.5 ha
Fero-alloy tailings (Zestaphoni district)	"Ekometali", limited	23.01.04 27.02.04 10 years	In accordance with demand: 105,200 m^3	10.7 ha
Copper ore exploration and extraction (Zeskho and Laphuri, Lentekhi district)	"Kordilieri 2", limited	26.12.03 16.03.04 20 years		5 000 ha
Dredging of r. Duruji bed, inert materials (Kvareli district)	"Duruji mineral", limited	30.04.04 05.05.04 10 years	Min. 30,000m3/years	394.7 ha
Eklara depost rosy limestone (Terjola district)	"Pheradi Qva", limited (colored stones)	14.06.02 28.05.04 10 years	In accordance with demand	5 ha
Gurni deposit cley exploration and extraction (Tkibuli district)	Boran maining, limited	28.05.04 07.06.05 20 years	unlimited amount	9.5 ha
Dorokhi ridge limestone massif exploration and extraction (Tkibuli district)	"Koka 97", limited	10.06.05 29.09.05 10 years	500-1000 m^3/year	1.2 ha
Kulbaki mineral water exploration-abstraction (Tsageri district)	"Bardnala", limited	06.05.05 17.10.05 10 years	30 m^3/24 hours	
Goradziri bazalt exploration and extraction (Sachkhere district)	"Gora", limited	19.08.05 15.11.05 10 years	3,000 m^3/year	5.7 ha
Sand and gravel of old bed of the r. Rioni (Vani district)	"Rike", limited	19.08.05 27.12.05 10 years	max. 40-50,000 m3/year	20 ha
Kursebo deposit Lolasheni section teshenite exploration and extraction (Tkibuli district)	"Koka-97", limited	10.06.05 12.01.06 10 years	min. 500 m3/year	1 ha
Non-ferrous metal exploration and extraction (Telavi and Akhmeta districts)	"Multimetali", limited	19.08.05 10.02.06 10 years		186 km2
Non-ferous metal exploration and extraction on Gombori ridge slopes (Akhmeta district, v. Ikalto)	"Edelvaisi-12", limited	21.07.05 13.02.06 5 years		293 km2
Tsitsabo Mta (Mount) limestone deposit II limestone extraction (Dedophlistskaro district)	"Caltsiiti", limited	19.08.05 28.02.06 10 years	max. 50,000 m3/year	24 ha

Heretiskari cley deposit processing and extraction (Lagodekhi district)	"Leba", limited	19.08.05 28.02.06 15 years	1500 m^3/year -3000 m3/year	2.65 ha
R. Kabali sand and gravel extraction (Lagodekhi district)	"Leba", limited	19.08.05 28.02.06 10 years	max. 8000 m^3/year	1.83 ha
R. Rganisgele gorge limestone deposit exploration and mineral extraction (Chiatura district)	"Chiatura", limited	17.03.06 17.03.06 5 years	max. 50,000 m3/year	1.8 ha
R. Grutchula gorge sand and gravel deposit exploration and mineral extraction (Chiatura district)	"Chiatura", limited	19.08.05 17.03.06 5 years	max. 8000 m3year	0.7 ha
Tinaantgori brick cley deposit exploration and mineral extraction (Sagarejo district)	"Koriat it ve dish Tijaret Sanai limited Shirket"	21.07.05 22.03.06 5 years	max. 108,000 t/year	15 ha
R. Kvirila bed dredging (Zestaphponi district)	"Skhivi", limited	19.08.05 27.03.06 10 years	max. 10,000 m3/year	1.8 ha
R. Alazani Shakriani section I sand and gravel deposit exploration and mineral extraction (Kvareli district)	Aadonisi, limited	19.08.05 18.05.06 10 years	max. 5000 m^3/year	3.8 ha
R. Kisiskhevi (section I) left floodplain terrace sand and gravel exploration and extraction (Telavi district)	"Servisi", limited	19.08.05 18.05.06 10 years	max. 10 000 m^3/year	3.38 ha
R. Alazani left bank floodplain terrace Shakriani section II sand and gravel exploration and extraction (Kvareli)	"Servisi", limited	19.08.05 18.05.06 10 years	max. 10 000 m3/year	3.78 ha
R. Shalauri gorge sand and gravel exploration and extraction (Telavi district)	"Servisi", limited	19.08.05 18.05.06 10 years	max. 10 000 m^3/year	2.83 ha
Tsitsabo Mta (Mount) limestone deposit II limestone exdtraction (Dedophlistskaro district)	"Tamaz sinjiaSvili", individual enterprenour	19.08.05 02.06.06 10 years	max. 40 000 m^3/year	15 ha
R. Kisiskhevi upper floodplain terrace sand and gravel exploration and extraction (Telavi, v. Kisiskhevi)	"Skhivi", limited	19.08.05 06.06.06 10 years	max. 10 000 m^3/year	3.78 ha
R. Kvirila floodplain terrace "Khokhuli"area sand and gravel extraction (Zestaphoni district, v. Meore Sviri)	"Skhivi", limited	19.08.05 06.06.06 10 years	max. 20 000 m^3/year	15.5 ha
Jvarisa caoline cley deposit Ojola and Skhunati sections' cley exploration and extraction (Tkibuli district)	"Keramika", limited	19.08.05 16.06.06 15 years	max. 50 000 t/year	20 ha
Kavisgora section limestone exploration and extraction (Terjola district)	"Monoliti", limited	10.06.05 20.06.06 10 years	min. 2500 m^3year	1.98 ha
"Kandara" section fire resistent cley extraction (Zestaphoni district, v. Shrosha south-west area)	"Tsetkhlgamdzle Naketobata Kombinati", limited	19.08.05 23.10.06 15 years	min. 500 m^3/year	16.35 ha
R. Iori Sartichala and Khashmi section sand and gravel extraction (Sagarejo district)	"Caucasavtomagistrali", joint stock	5/30/2006 , 20 years	50000 m^3/year	7 ha
Quarts sand extraction (Sachkhere district, v. Itavaza)	"E+B200lita-burji", limited	07.02.2007 20 years	Total extraction: 997500 m^3	5.25 ha
R. Kvirila floodplain terrace sand and gravel extraction (Sachkhere district, v. Tchala)	"Asotsiatsia Atu", union	06.02.2007 5 weli	Total extraction: 207000 m^2	5.18 ha
Limestone extraction (Kharagauli district, v. Bazaleti)	"Vladimer Gegeshidze", individual enterprenour	25.04.2006 20 years	2500 m^3/year	2 ha
R. Tskenistskali left bank sand extraction (Samtredial district, v. Nachkhetauri)	"QKvisha", limited	31.03.2006 10 years	3000 m^3/year	1 ha
Limestone extraction (Tsaktubo district, v. Khomuli)	"Minerali", limited	03.04.2006 5 years	10000 t/year	1.2 ha
Brick cley extraction (Sagarejo district)	"Nasadgomari", limited	20.04.2006 20 years	5000 m^3/year	8.6 ha
R. Rioni left banl sand and gravel extraction (Khobi district, v. Sagvichio)	"Giorgi-2005", limited	18.05.2006 10 years	3000 m^3/year	2 ha

R. Kvirila right bank sand and gravel extraction (Zestaphoni district, v. Meore Sviri)	"Zestafoni I", limited	16.05.2006 10 years	5000 m^3 year	8.6 ha
Cement limestone extraction (Terjola district, v. Gogna)	"Kankava", limited	11.05.2006 10 years	2000 t	1.5 ha
Fireresistent (ceramic) cley extraction (Sachkhere district, v. Perevi)	"DaviT Shukakidze", ind. Enterprenour	31.05.2006 10 years	200 t/year	0,3 ha
Barite tailings extraction (Oni district, v. Iri former enrichment plant territory)	"Gela Tchichinadze", individual enterprenour	22.05.2006 20 years	480 t/year	1.5 ha
R. Kvirila right bank sand and gravel extraction (Sachkhere district, confluenc of Kvirila and Tchikhura)	"Atu", Union	08.08.2006 5 years	12000 m^3/year	2 ha
R. Kvirila right bank sand and gravel extraction (Terjola district, v. Kvakhchiri)	"Gzamgebi", limited	05.06.2006 5 years	30000 m^3/year	15 ha
R. Odilauri limestone extraction (Terjola district,v. Odilauri)	"TeqnomSeni", limited	08.06.2006 5 years	500 m^3/year	2 ha
Lopota marble Vake-gora section - linse #1) murble extraction (Telavi district)	"Lopota", limited	14.06.06 10 years	1000 m^3/year	1.6 ha
Kokhi (Tchognari) limestone deposit facing limestone extraction (Terjola district, v. Tchognari)	"Elguja Dogonadze", individual enterprenour	20.06.06 5 years	500 m^3/year	0.8 ha
R. Iori right bank upper terrace sand and gravel extraction (Gardabani district)	"Alaverdi"	24.07.2006 5 years	16000 m^3/year	4.8 ha
Quartz sand extraction (Sachkhere district, v. Itavaza and Itskhisi)	"Itavaza", limited	25.07.2006 10 years	15000 m^3/year	6.05 ha
Mount Bedjitaant Gora north-east section brick cley extraction	"VaTo", limited	04.08.2006 10 years	500 m^3/year	1 ha
R. Alazani left bank sand and gravel extraction (Kvareli district)	"Mariam Lafauri", ind. Enterprenour	16.08.2006 5 years	600 m^3/year	0.9 ha
limestone extraction (Terjola district, v. Tchognari)	"Eklara", limited	19.09.2006 5years	500 m^3/year	1 ha
Teshenite extraction (Tskaltubo district, v. Ophurtchkheti)	"Lodebi", limited	14.08.2006 5 years	1000 m^3/year	2 ha
R. Tskenistskali sand and gravel extraction (Samtredia district, v. Ilori)	"Kvisha", limited	22.08.2006 10 years	4500 m^3/year	2.25 ha
R. Rioni right bank sand and gravel extraction (Bagdati district, v. Vartsikhe)	"TransvestinJineringi 12", joint-stock	08.09.2006 6 years	Total extraction 120000 m3	6 ha
Limestone extraction (Kharagauli district, v. Lashe)	"Kharagaulis avtotransi", joint-stock	15.09.2006 20years	Total extraction 20000 m3	1.5 ha
Sairme carbonate mineral water abstraction (Bagdati district, resort Sairme)	"Sairme mineral voters", limited	04.10.2006 25 years	for resort: 21m3/24 hours; Commercial: 37.5m3/24 hours	
Kvirila right and left banks sand and gravel extraction (Zestaphoni district, v. Kveda Kvaliti and Pirveli Sviri)	"Zestaphonis Sasargeblo Tsiagisuli - ImereTi I", joint-stock	14.09.2006 7 years	Total extraction 35000 m3	3.75 ha
R. Rioni right bank sand and gravel extraction (Senaki district)	"Arkeopolisi", joint-stock	12.09.2006 10 years	Total extraction 70000 m3	0.36 ha
R. Tekhuri right bank sand and gravel extraction (Senaki district, v. Dzveli Senaki)	"Arkeopolisi", joint-stock	12.09.2006 10 years	Total extraction 200000 m3	2 ha
Donguz-Tapa II murble-like limestone extraction (Signagi district, v. Bodbe)	"Nugzar KokiaSvili", ind. Enterprenour	26.09.2006 20 years	Total extraction 11000 m^3	3.1 ha
R. Alazani right bank sand and gravel extraction (Telavi district, v. Gulgula)	"DaviT dedabriSvili", ind. Enterprenour	26.09.2006 5years		1 ha
R. Tekhuri bank sand and gravel extraction (Senaki district, v. Gejeti)	"Baso", limited	26.09.2006 20 years	Total extraction: 100000 m^3	7.12 ha
Dorokha ridge northern slope limestone extraction (Tkibuli district, v. Gelati)	`GelaTi 97", limited	10.10.2006 5 years	Total extraction: 2500 m3	0.5 ha
Sand extraction (Chiatura district, v. Mgvimevi)	"Gambiti", limited	16.10.2006 20 years	Total extraction: 200000 m3	2.4 ha
Ilto-2 deposit sand and gravel extraction (Akhmeta district, v. Chachkhriala)	"Revaz Iukuridze", Ind. Enterprenour	09.11.2006 15years	Total extraction: 15000 m3	0.6 ha
Zemo Alvani sand and gravel extraction (Akhmeta district)	"Revaz Iukuridze", Ind. Enterprenour	09.11.2006 15years	Total extraction: 15000 m4	1.03 ha

Shukruti quartz sands (Chiatura district, v. Shukhruti area)	"Gorgian Sand Company", limited	23.10.2006 20 years	Total extraction: 400000 m3	12.4 ha
R. Dzirula right tributary "Gezerula" deposit gabro-diabase extraction (Zestaphoni district, v. Shrosha)	"Cholaburi", limited	19.10.2006 20 years	Total extraction: 40000 m3	3 ha
R. Tekhuri right and left banks sand and gravel extraction (Senaki district, v. Gejeti and Kveda Sorta)	"Nike", limited	20.10.2006 10 years	Total extraction: 130000 m3	2.56 ha
R. Tekhuri left bank sand and stone extraction (Senaki district, v. Shua Nosiri)	"Nike", limited	20.10.2006 10 years	Total extraction: 70000 m3	0.94 ha
R. Rioni righ bank sand and silt extraction (Senaki district)	"Nike", limited	20.10.2006 10 years	Total extraction: 30000 m3	1.06 ha
Quartz sand edxtraction (Tskaltubo district, v. Banoja)	"Akaki gureSiZe", Ind. Enterprenour	14.11.2006 10 years	Total extraction: 20000 m3	1 ha
R. Cholaburi bank sand and gravel extraction (Terjola district, v. Gvakniki)	"Cholaburi", limited	11.01.2007 10 years	Total extraction: 60000 m3	4.4 ha
Diorite extraction (Tskaltubo district, v. Jimastaro)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 100000 m3	10 ha
Teshenite extraction (Tsaltubo district, v. Ophurchkheti)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 100000 m3	9 ha
Diorite extraction (Tskaltubo district, v. Kvatiri)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 100000 m3	10 ha
Murble-like limestone extraction (Chiatura district, v. Salieti)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 200000 m3	20 ha
Marble-like limestone extraction (Chiatura district, v. Jokoeti)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 100000 m3	8 ha
Teshenite extraction (Tkibuli district, v. Lolasheni)	"Anre-2006", limited	27.11.2006 20 years	Total extraction: 100000 m3	4.7 ha
Teshenite extraction (Tsaltubo district, v. Ophurchkheti)	"GS", limited	19.12.2006 5 years	Total extraction: 2500 m3	0.6 ha
R. Kvirila floodplain terrace sand and gravel extraction (Terjola district, v. Nakhshirgele)	"Georgian Manganese", limited	04.01.2007 24.03. 2016	10000 m^3/years	1.5 ha
R. Kvirila right bank sand and gravel extraction (Sachkhere district, v. Sareki)	"Georgian Manganese", limited	04.01.2007 24.03. 2017	20000 m^3/years	0.65 ha
Limestone extraction (Akhmeta district, v. Tcharartala)	"Mshenebeli 80", limited	18.01.2007 5 years	Total extraction: 5000 m3	0.7 ha
R. Stori bank sand and gravel extraction (Telavi district, v. Pshaveli)	"Soso Otiashvili", wide profile company	05.02.2007 5 years	Total extraction: 10000 m3	1.56 ha
Tuff-breccia extraction (Tskaltubo district, v. Gvishtibi)	"Madani 2006", limited	06.02.2007 8 years	Total extraction: 16000 m3	1.5 ha
Sand extraction (Tskaltubo district, v. Banoja)	"Badri Leshkasheli", Ind. Enter.	08.02.2007 10 years	Total extraction: 20000 m3	1.5 ha
Sand extraction (Chiatura district, v. Katskhi)	"Ilarion Modebadze", Ind. Enter.	05.02.2007 20 years	Total extraction:50000 m3	1.86 ha
Limestone extraction (chiatura district, v. Tskhukveti)	"Magno", limited	17.02.2007 10 years	Total extraction: 9000 m3	0.88 ha
Quartz sand extraction (Sachkhere district, v. Itavaza)	"Asociacia Atu", Union	27.09.2007 20 years	Total extraction: 3000000 m3	17.28 ha
Ornamental granite extraction (Tkibuli district, v. Kursebi)	"Speqtri-7", limited	12.02.2007 20 years	Total extraction: 40000 m3	7.2 ha
Kvashava tuff-breccia extraction (Terjola district, v. Godogani)	"Alimi managase", Ind. Enter.	20.02.2007 10 years	Total extraction: 4000 m3	0.58 ha
R. Rioni floodplain terrace sand and gravel extraction (Samtredia district, v. Bashi)	"Pent Holdingi", limited	15.02.2007 5 years	Total extraction: 56000 m3	3.54 ha
Quartz sand extraction (Sagarejo district, v. Gombori)	"Geoprogress Group", limited	20.02.2007 10 years	Total extraction: 56000 m3	1.05 ha
R. Kvirila floodplain sand and gravel extraction near confluence of r. Cholaburi (Terjola district, v. Etseri)	"Borani", limited	20.03.2007 5 years	Total extraction: 50000 m3	2.01 ha
R. Kabali terrace sand and stone extraction (Lagodekhi district, v.	"Lagodekhavtogza", limited	19.03.2007 5 years	Total extraction: 53000 m3	3.12 ha

Giorgeti)				
Quarts sand extraction (Sachkhere district, v. Durevi)	"A Klasi", limited	01.03.2007 20 years	Total extraction: 600000 m3	11.4 ha
Darkveti II deposit quartz sand extraction (Chiatura district, Zodi community)	"Samsheneblo Firma Chiatura", limited	09.03.2007 10 years	Total extraction: 62000 m3	0.62 ha
R. Dzirula right bank granite extraction (Kharagauli district, v. Ubisa)	"Guram Kilaberidze", ind. enter.	10.04.2007 5 years	Total extraction: 100000 m3	4.49 ha
R. Rioni left bank sand and gravel extraction (Kutaisi, east to the Nikea street)	"Iberia-21", limited	20.03.2007 10 years	70000 m^3	7 ha
Abasha HPP ornamental limestone extraction (Martvili district, v. Lebachie)	"TsachaCkhuru", limited	30.03.2007 20 years	Total extraction: 16000 m3	0.66 ha
Brick cley extraction (Tskaltubo district, v. Ukaneti)	"Aguri", limited	25.04.2007 5 years	Total extraction: 10950 m3	1.5 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Akhalsopheli)	"Iberi"	19.04.2007 06.12.2026	Total extraction: 165000 m3	11 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Akhalsopheli)	"Bunebis Komagi", limited	19.04.2007 06.12.2026	Total extraction: 45000 m3	3 ha
R. Rioni right bank sand and gravel extraction (Oni district, v. Sori)	"Ambrolauris avtogza #10", limited	17.04.2007 18.04.2016	Total extraction: 60180 m3	10 ha
R. Rioni right bank sand and gravel extraction (Oni district, v. Kvishari)	"Ambrolauris avtogza #10", limited	17.04.2007 18.04.2017	Total extraction: 30550 m3	10 ha
Mujireti tuff-lava and tuff-breccia (facing granite) extraction (Terjola district, v. Mujireti)	"Skande", limited	17.04.2007 20 years	Total extraction: 50000 m3	7 ha
R. Argveta right bank sand and gravel extraction (Zestaphoni district, v. Pirveli Sviri)	"Sapovnela +", limited	07.05.2007 23.06.2026	Total extraction: 42000 m3	3.3 ha
R. Tskhenistskali sand and gravel extraction (Abasha district, v. Marani)	"Olimpi-2006", limited	01.05.2007 5 years	Total extraction: 20000 m3	1.322 ha
R. Tskhenistskali sand and gravel extraction (Abasha district, v. Gezati)	"Olimpi-2006", limited	01.05.2007 5 years	Total extraction: 20000 m3	1.222 ha
R. Khanistskali sand and gravel extraction(Bagdati district, v. Tskaltashua)	"BagdaTis Avtogza", limited	24.05.2007 5 years	Total extraction: 25000 m3	1.7 ha
R. Rioni sand and gravel extraction (Kut aisi surroundings)	"Gia Togonidze", wide profile company	03.05.2007 5 years	Total extraction: 80000 m3	4.7 ha
Limestone pebble and cobble extraction (Terjola district, v. Alisubani, Skande and Sazano)	"Shugladzee Korneli", ind. Enter.	04.05.2007 15 years	Total extraction: 46400 m3	0.74 ha
Sakasria murblelike limestone pebble extraction (Kharagauli district, v. Sakasria)	"Shalva Barbaqadze", ind. Enter.	04.05.2007 15 years	Total extraction:50000 m3	0.53 ha
Limestone (pebble) extraction (Terjola district, v. Tuzi)	"Shugladzee Korneli", ind. Enter.	04.05.2007 10 years	Total extraction: 10500 m3	0.65 ha
R. Kabali sand and gravel extraction (Lagodekhi district, v. Naendrovali)	"Roland DaviTaSvili", wide profile firm	08.05.2007 5 years	Total extraction:54638 m3	1.9 ha
Patardzeuli brick cley extraction (Sagarejo district, v. Patardzeuli)	"Kartuli Aguri", limited	14.05.2007 20 years	Total extraction:370000 m3	1.71 ha
Limestone pebble extraction (Martvili district, v. Inchkhuri)	"Tsachkhuru", limited	24.05.2007 20 years	Total extraction:30600 m3	0.66 ha
R. Abasha sand and gravel extraction (Abasha district, v. Dzveli Abasha)	"Abashis Sagzao Sammartvelo", limited	15.05.2007 5 years	Total extraction:10000 m3	1.02 ha
Cley-gypsum extraction (Sagarejo district, v. Bogdanovka)	Giorgi Zirakashvili, wide profile company	18.05.2007 20 years	Total extraction:75000t	4.1 ha
Tchermiskhevi sand and gravel extraction (Gurjaani district, v. Mukuzani)	"Caucasavtomagistrali", joint-stock	22.05.2007 5 years	Total extraction: 65000 m3	1.61 ha
Limestone pebble extraction (Sagerjo district, v. Krasnogorski)	"Naomari gora", limited	04.06.2007 10 years	Total extraction: 98400 m3	1.64 ha
Lukhuni arsenic deposit arsenic, antimony and gold extraction (Ambrolauri district)	"Madneuli", joint-stock	05.06.2007 25 years	Arsenic, total: 9534t, Antimony, total: 39500t, Gold, total: 1.4t	292.7 ha

R. Iori sand and gravel extraction (Sagarejo district, v. Khashmi)	"Samsheneblo Kompania Akhali Stili", limited	19.06.2007 5 years	Total extraction: 94860 m3	5.58 ha
Brick cley extraction (Sagarejo district, v. TskarosTavi)	"Samsheneblo Kompania Akhali Stili", limited	19.06.2007 15 years	Total extraction: 796768t	7.77 ha
Sand and gravel extraction (Dedoplistskaro district, v. Kvemo Kedi	"Duglas Tavadze", ind. Enter.	28.06.2007 5 years	Total extraction: 40500 m3	0.82 ha
R. Alazani sand and gravel extraction (Akhmeta district, v. Alvani)	"Omva", limited	29.06.2007 5 years	Total extraction: 16295 m3	0.81 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Nosiri)	"Fortuna-4", limited	12.07.2007 5 years	Total extraction: 80000 m3	5 ha
Legva mineral water extraction (Tkibuli district, v. Legva)	"Legva", limited	12.07.2007 25 years	4.5 m^3/24 hours	0.07 ha
Godogani limestone (ornamental, cement) extraction (Terjola district, v. Godogani)	"Georgian Murble", limited	03.08.2007 20.07.2026	Ornamental stones: 1000 m^3/year cement raw materials: 20,700 t/year	21.75 ha
R. Alazani sand and stone (C. Gurjaani)	Ivane Makharashvili, wide profile firn	16.07.2007 5 years	Total extraction: 82675 m3	3.46 ha
R. Iori Sartitchala section sand and gravel extraction (Sagarejo district, v. Sartichala)	"Burji", limited	24.07.2007 5 years	Total extraction: 638000 m3	14.5 ha
R. Iori sand and gravel extraction (Gardabani district, v. Sartichala)	"Samsheneblo-Sainvestitsio Kompania-Libo", limited	18.07.2007 5 years	Total extraction: 107640 m3	2.76 ha
R. Iori Khasmi sand and gravel extraction (Sagarejo district, v. Khashmi and Ujarma)	"Alaverdi", limited	25.07.2007 5 years	Total extraction: 9180 m3	0.54 ha
R. Cholaburi sand and gravel extraction (c. Terjola)	"Mshenproeqtkompania", limited	02.08.2007 5 years	Total extraction: 31500 m3	2.1 ha
R. Dogurashi right bank diabase extraction (Tsageri district)	"Georgian Marble", limited	03.08.2007 18.10.2026	Total extraction: 20000 m3	2.5 ha
Sand and gravel extraction (Martvili district, v. Metsitskhvaie)	`Martvilavtogza", limited	09.08.2007 5 years	Total extraction: 60600 m3	2.05 ha
R. Alazani sand and gravel extraction (c. Kvareli)	"Buba", limited	20.08.2007 5 years	Total extraction: 25200 m3	0.84 ha
Limestone (facing and cement) extraction (Terjola district, v. Tchognari)	"Georgian Manganese", limited	23.08.2007 20 years	1795350t-facing stone; 1795350t- cement material	23.2 ha
R. Ilto sand and gravel extraction (Akhmeta district)	"Chanchkeri"	16.08.2007 5 years	Total extraction: 29690 m3	1 ha
Brick cley extraction (Zestaphoni district, v. Dilikauri)	Amiran Chitorelidze, wide-profile firm	21.08.2007 15 years	Total extraction: 80600 m3	1.55 ha
R. Alazani sand and gravel extraction (Telavi district, v. Shakriani)	"Nodar SekhniaSvili"	24.08.2007 5 years	Total extraction: 12000 m3	0.4 ha
R. Cholaburi sand and gravel extraction (Zestaphoni district, v. Kveda Sakara)	"Grigol Meskhi", wide-profile firm	22.08.2007 5 years	Total extraction: 56700 m3	1.89 ha
R. Bursa sand and gravel extraction (Kvareli district, v. Sanavardo)	"Kvareli Stone", limited	23.08.2007 5 years	Total extraction: 171900 m3	5.79 ha
Quartz sand extraction (Sachkhere district, v. Itavaza)	"Karieri", limited	24.08.2007 30.08.2026	Total extraction: 192000 m^3	3.55 ha
Quartz sand extraction (Sachkhere district, v. Itavaza)	"Zemo ImereTi", limited	24.08.2007 30.08.2026	Total extraction: 383910 m^3	6.7 ha
R. Tchermiskhevi sand and gravel extraction (Gurjaani district, v. Kitaani)	"Kvirike", limited	07.09.2007 5 years	Total extraction: 90000 m^3	2.32 ha
Chalk extraction (Chiatura district, v. Tsirkvali)	"Geokaltsiti", limited	31.08.2007 20 years	Total extraction: 269200 t	18.15 ha
Cley gypsum extraction (Gardabani district, v. Sartichala)	"Irgu", limited	31.08.2007 10 years	Total extraction: 6825 t	0.63 ha
R. Alazani sand and gravel extraction (Telavi district, v. Saniore)	"Eldar Mamedov", ind. Enter.	14.09.2007 5 years	Total extraction: 12000 m3	1 ha
R. Kvirila sand and gravel extraction (Sachkhere district, v. Chikhi)	"Imedi 2006", limited	10.09.2007 5 years	Total extraction: 22800 m3	0.76 ha
R. Kvirila sand and gravel extraction (Sachkhere district, v. Chikhi)	"Gza", limited	10.09.2007 5 years	Total extraction: 73800 m3	1.8 ha
R. Turdoskhevi sand and gravel extraction (Telavi district, v. Vardisubani)	"gzamSeni 2005", limited	17.09.2007 5 years	Total extraction: 79120 m3	1.84 ha

R. Avniskhevi sand and gravel extraction (Kvareli district, v. Akhalsopheli)	"Korporatsia "Qindzmarauli", joint stock	04.10.2007	5 years	Total extraction: 34650 m3	2.31 ha
R. Alazani sand and gravel extraction (Akhmeta district, v. Mataani)	"Giorgi KazaraSvili", ind. Enterp.	25.09.2007	5 years	Total extraction: 26100 m3	0.87 ha
R. Rioni (Vartsikhe section) sand and gravel extraction (Tskaltubo district, v. Patriketi)	"GelaTi 2007". limited	03.10.2007	5 years	Total extraction: 474000 m3	15.8 ha
R. Iori sand and gravel extraction (Tianeti district, v. Lelovani)	"Skhivi", limited	26.09.2007	5 years	Total extraction: 21000 m3	0.7 ha
Tchermiskhevi sand and gravel extraction (Gurjaani district, v. Zegaani)	"Gia SamniaSvili", wide profile firm	26.09.2007	5 years	Total extraction: 15000 m3	0.5 ha
Akhtala mud extraction (Gurjaani, resort Akhtala)	"Kurorti Akhtala" joint-stock	02.10.2007	20 years	3.4 t/24 hours	0.754 ha
Antoki gorge sand and gravel extraction (Sagarejo district, v. Antoki)	"Nuovo Global", limited	08.10.2007	11.04.2012	Total extraction: 180000 m3	5.9 ha
R. Dzusi sand and gravel extraction (Terjola district, v. Sazano)	"Urali", limited	05.10.2007	5 years	Total extraction: 10500 m3	1.05 ha
Tkibuli-Shaori deposit coal extraction (Tkibuli district)	"Gi-Ii-Gi Goup"	24.10.2007	11.08.2011	1500 t/year	0.6 ha
Krasnagorski sand extraction (Sagarejo district, v. Krasnagorski)	"Naomari Gora~, limited	29.11.2007	20 years	Total extraction: 171000 m3	17.1 ha
Limestone pebble extraction (Martvili district, v. Salkhino)	"Iuri Tsulaia", ind. Enterp.	15.10.2007	20 years	Total extraction: 37400 m3	1.87 ha
R. Tekhuri sand and gravel extraction (Martvili district, v. Salkhino)	"Iuri Tsulaia", ind. Enterp.	15.10.2007	5 years	Total extraction: 29400 m3	0.98 ha
Limestone extraction (Amrolauri district, v. Baji)	"Nergebi", limited	12.10.2007	10 years	Total extraction: 18170 t	0.73 ha
R. Alazani sand and gravel (Kvareli district, v. Gavazi)	"Kvareli Stone", limited	22.10.2007	5 years	Total extraction: 147600 m3	4.92 ha
Quartz sand extraction (Sachkhere district, v. Savaneti)	"MSenebeli I", limited	18.10.2007	20 years	Total extraction: 209600 m3	1.9 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Dzveli Senaki)	"Esdako", limited	18.10.2007	5 years	Total extraction: 113400 m3	3.78 ha
R. Gombori sand extraction (Sagarejo district, v. Gombori)	"Kosmomze", limited	17.10.2007	5 years	Total extraction: 16700 m3	0.167 ha
Mujireti agate extraction (Tkibuli district, v. Mujireti)	"Koba Butskhrikidze", ind. Enterpr.	17.10.2007	5 years	Total extraction: 2328 kg	0.27 ha
R. Khanistskali sand and gravel extraction (Bagdati district, v. Rokiti)	"BagdaTis Avtogza", limited	18.10.2007	5 years	Total extraction: 18000 m3	1.8 ha
Bentonite cley extraction (Tskaltubo district, v. Banoja)	"Minerali", limited	18.10.2007	20 years	Total extraction: 16000 t	0.25 ha
Katskhi quartz sand extraction (Chiatura district, v. Katskhi)	Akaki Eenuqidze, wide profile firm	19.10.2007	20 years	Total extraction: 25660 m3	1.22 ha
Ophurchkheti teshenite extraction (Tskaltubo district, v. Ophurchkheti)	"Robert Tsirekidze", limited	19.10.2007	20 years	Total extraction: 69986 m3	1.94 ha
R. Cholaburi sand and gravel extraction (Tejola district, v. Sviri)	"Bazilika", limited	12.11.2007	5 years	Total extraction: 45000 m3	1.5 ha
R. Bursa sand and gravel extraction (c. Kvareli)	Corporation "Kindzmarauli", joint-stock	12.11.2007	5 years	Total extraction: 24120 m3	2.01 ha
R. Kvirila "Rodinouli" sand and gravel extraction (Terjola district, v. Nakhshirgele)	"G&T", limited	16.11.2007	5 years	Total extraction: 350000 m3	8,7 ha
Krasnogorski sand extraction (Sagarejo district, v. Krasnogorski)	"Nino Giorgadze", ind. Enterpr.	07.12.2007	5 years	Total extraction: 5500 m3	0.53 ha
Ophurchkheti teshenite extraction (Tskaltubo district, v. Ophurchkheti)	"Giorgi Iobidze", ind. Enterpr.	13.12.2007	5 years	Total extraction: 614000 m3	3.07 ha
R. Iori sand and gravel extraction (Tianeti district, v. Lelovani)	Zaur Philauri, wide profile firm	12.12.2007	5 years	Total extraction: 4500 m3	0.15 ha
Brick cley extraction (Sagarejo district, v. Tskarostavi)	"Kartuli Aguri", limited	07.12.2007	20 years	Total extraction: 351200 m3	8.78 ha
R. Rioni "sadmeli" sand and gravel extraction (Ambrolauri district, v. Sadmeli)	"Bukhuti Katsitadze"	20.12.2007	5 years	Total extraction: 15000 m3	1.5 ha

R. Tskhenistskali sand and gravel extraction (Abasha district, v. Patara Gezati)	"Morena 2007", limited	12.12.2007 5 years	Total extraction: 658500 m3	21.95 ha
R. Rioni sand and gravel extraction (Samtredia surroundings)	"Soso Tavadze", wide profile firm	11.12.2007 5 years	Total extraction: 30000 m3	1 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Kveda Sorta)	Levan Kilasonia, wide profile firm	21.12.2007 5 years	Total extraction: 150000 m3	5 ha
Vardisubani gorge sand and gravel (Telavi district, v. Vardisubani)	"Telavis Sagzao Sammartvelo", limited	28.12.2007 5 years	Total extraction: 10800 m3	0.9 ha
Chkhari-Ajameti manganese extraction (Terjola district, v. Nakhshirgele)	"Rusmetali", limited	21.12.2007 13.09.2027	Total extraction: 20000 t	3.55 ha
Chkhari-Ajameti manganese extraction (Terjola district, v. Nakhshirgele)	"KarTuli Tsementi", limited	27.12.2007 13.09.2027	Total extraction: 20000 t	2.84 ha
Tkibuli-shaori coal extraction (Tkibuli and Ambrolauri districts)	"Saqnakhshiri", limited	25.12.2007 45 years	Total extraction: 233 298 000 t	5,479.9 ha
R. Rioni "Sadmeli" sand and gravel extraction (Ambrolauri district, v. Sadmeli)	"Solomon Kereselidze", wide profile firm	26.12.2007 5 years	Total extraction: 17500 m3	0.58 ha
R. Alazani sand and gravel extraction(Kvareli district, v. Sanavardo)	"Kvareli Stone", limited	18.02.2008 5 years	Total extraction: 100000 m3	2.62 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Akhalsopheli)	"Bel-gegbeli", limited	18.01.2008 5 years	Total extraction: 67200 m3	2.24 ha
R. Tskhenistskali sand and gravel extraction (Khoni district, v. Kontuati)	"Rike 2007", limited	04.01.2008 5 years	Total extraction: 140700 m3	4.69 ha
"Zeda Beretisi" limestone pebble extraction (Sachkhere district, v. Shomakheti and Zeda Beretisi)	NaTia Chachua, wide profile firm	25.01.2008 20 years	Total extraction: 166200 m3	1.57 ha
R. Rioni "Bashi" section sand and gravel extraction (Samtredia district, v. Bashi)	"Pent Holdingi", limited	11.01.2008 5 years	Total extraction: 106800 m3	3.56 ha
R. Tskhenistksali "Ilori" sand and gravel extraction (Samtredia district, v. Ilori)	"Sulava Malkhazi", ind. Enterp.	22.01.08 5 years	Total extraction: 18000 m3	0.6 ha
R. Rioni sand and gravel extraction (Kutaisi surroundings)	"Sakartvelos Samsheneblo Masalebi", limited	25.01.08 5 years	Total extraction: 264300 m3	8.81 ha
R. Cholaburi sand and gravel extraction (Terjola district, v. Gvankiti)	"GEO-STONE", limited	29.01.08 5 years	Total extraction: 6 5400 m3	2.18 ha
R. Rioni right bank teshenite extraction (Tskatubo district, v. Gumati)	"Mozaika", limited	31.01.08 22.08.26	Total extraction: 19800 m	5.8 ha
R. Alazani Akhmeta and Khorbalo sections sand and gravel extraction (c. Akhmeta)	"Chanchkeri", limited	05.02.08 5 years	Total extraction: 29100 m3	0.97 ha
R. Tskenistskali bank sand and gravel extraction (Martvili district, v. Nageberavo)	"Stone Resource, limited	04.02.08 5 years	Total extraction: 127500 m3	4.25 ha
R. Rioni sand and gravel extraction (Samtredia surroundings)	"Soso Tavadze", wide profile firm	14.03.08 5 years	Total extraction: 15000 m3	0.5 ha
Kisiskhevi sand and gravel extraction (Telavi district, v. Kisiskhevi)	"Buba", limited	07.02.08 5 years	Total extraction: 37800 m3	1.26 ha
R. Tskenistskali sand and gravel extraction (Tsageri district, v. Tchanistavi)	Suliko Khabuliani, wide profile firm	11.02.08 5 years	Total extraction: 40000 m3	0.65 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Kvaliti)	Tengiz Kiknavelidze, wide profile firm	18.02.08 5 years	Total extraction: 42000 m3	1.4 ha
R. Tekhuri bank sand and gravel extraction (Senaki district, v. Nosiri and Gejeti)	Murad SamaTava, wide profile firm	18.02.08 5 years	Total extraction: 50400 m3	1.68 ha
Itavaza Quartz sand extraction (Sachkhere district, v. Argveti)	"Sand Company, limited	14.02.08 01.10.27	Total extraction: 200000 m3	1.26 ha
Inchkhuri limestone pebble extraction (Martvili district, v. Gachedili)	"Tariel Papava", ind. Enterpr.	05.03.08 15 years	Total extraction: 30600 m3	0.51 ha
R. Rioni sand and gravel (Bagdati district, v. Sarbevi)	"Tini 7", limited	11.03.08 5 years	Total extraction: 150000 m3	4.99 ha
"Djoshkha" limestone pebble extraction (Ambrolauri district, v. Zemo Djoshkha)	"Merani 2005", limited	06.03.08 20 years	Total extraction: 120000 m3	2 ha

R. Alazani sand and gravel extraction (Gurjaani surroundings)	"Kvirike", limited	14.03.08 5 years	Total extraction: 6000 m3	0.2 ha
Kisiskhevi sand and gravel extraction (Telavi district, v. Kisiskhevi)	"Satsarmoo Firma-Kakheti", limited	14.03.08 5 years	Total extraction: 150300 m3	5.01 ha
R. Rioni sand and gravel extraction (Vani surroundings)	"Mikheil Mskhiladze", ind. Enterpr.	14.03.08 5 years	Total extraction: 58500 m3	1.95 ha
R. Rioni sand and gravel extraction (Vani district, v. Tchagantkhvishi)	Mikheil Mskhiladze, ind. Enterpr.	14.03.08 5 years	Total extraction: 96300 m3	3.21 ha
Dapnari-1 limestone extraction (Samtredia v. Dapnari)	"Mikheil Mskhiladzee", ind. Enterpr.	14.03.08 20 years	Total extraction: 94875 t	1.1 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Dzveli Senaki)	"Nike", limited	14.03.08 5 years	Total extraction: 297900 m3	9.93 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Zigudari)	"Nike", limited	14.03.08 5 years	Total extraction: 68550 m3	2.285 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Akhalsopheli)	"Aisi-2005", limited	14.03.08 5 years	Total extraction: 72300 m3	2.41 ha
Quartz sand extraction (Chiatura districit, v. Katskhi)	"Merab Samkharadze", ind. Enterpr.	29.07.08 10 years	Total extraction: 34500 m3	1.98 ha
Kvachadala basalt lavabreccia extraction (facing) (Akhmeta district, v. birkiani)	"Kapani 2008", limited	24.09.08 13.09.27	Total extraction: 111600 m3	6.82 ha
"Artsivis Kheoba-2" cement limestone (Dedoplistskaro district, v. Tsiteli Tskaro)	"Artsivis Kheoba", limited	7/23/2008 20 years	Total extraction: 2282300 t	20.13 ha
R. Gubistskali "Ianeti" section sand and gravel extraction (Samtredia district, v. Ianeti)	Soso Tavadze, wide-profile firm	8/1/2008 5 years	Total extraction: 15000 m^3	0.5 ha
Kisiskhevi sand and gravel extraction (Telavi district, v. Kisiskhevi)	"Servisi", limited	8/21/2008 5 years	Total extraction: 164700 m^3	5.49 ha
Sand and gravel extraction (Gardabani district, v. Muganlo)	"iori 2008", limited	08.08.08 07.06.12	Total extraction: 103117 m3	12.4 ha
"Lebachie" limestone extraction (Martvili district, v. Lebachie)	"Alfa Mari", limited	24,09,08 15 years	Total extraction: 21000 m^3	0.35 ha
R. Alazani sand, gravel extraction (Akhmeta district, v. Kvemo Alvani)	Amiran Buachidze, wide profile firm	26.09.08 5 years	Total extraction: 19200 m^3	0.64 ha
R. Rioni sand and gravel extraction (Bagdati district, v. Vartsikhe)	"TransvestinJineringi 12", joint-stock	8/4/2008 5 years	Total extraction: 54900 m^3	1.83 ha
R. Tekhuri gold, cobalt, silver, lead, zink and copper mining (Martvili district)	"Sakartvelos SamTo Sakmianobis Kompania", limited	7/23/2008 20 years	gold: 22,8 t; cobalt: 6000 t; silver: 8,4 t; lead: 300000 t; zink: 370000 t; copper: 376000 t	1,607.28 ha
R. Iori sand and gravel extraction (Gardabani district, v. Sartichala)	"Aalaverdi", limited	24.09.08 5 years	Total extraction: 136800 m^3	4.56 ha
R. Cholaburi sand and gravel extraction (Terjola district, v. Etseri)	"Arsinvesti", limited	24,09,08 5 years	Total extraction: 28200 m^3	0.94 ha
#2 well thermal water abstraction (for greenhouse) (Senaki district, v. Akhalsopheli, Isula section)	Koba Gvazava, wide profile firm	24.09.08 25 years	300 m^3/24 hours	0.07 ha
R. Kvirila sand and gravel extraction (Terjola district, v. Nakhsirgele)	"Mozaika", limited	30.09.08 5 years	Total extraction: 61800 m^3	2.06 ha
R. Chkherimela sand and gravel extraction (Kharagauli district)	"Fushta", limited	24.09.08 5 years	Total extraction: 20000 m^3	0.57 ha
Chkhari-Ajameti manganese extraction (Terjola district, v. Dzevri and Chkhari)	"Rusmetali", limited	7/30/2008 20 years	Total extraction: 182215 t	11.88 ha
Chkhari-Ajameti manganese extraction (Terjola district, v. Dzevri and Chkhari)	"Adv-togo", limited	7/30/2008 20 years	Total extraction: 20246 t	0.75 ha
Silica manganese (tailing) recovery (Terjola district, v.. Nakhshirgele)	"Chiaturmanganum Georgia, limited	7/25/2008 20 years	Total extraction: 470783 t	6,34 ha
Tchrebalo gypsum extraction (Ambrolauri ditrict, v. Pirveli Tola)	"Kristali 07", limited	7/24/2008 15.10.17	Total extraction: 25760 t	0.14 ha
R. Turdoskhevi right bank sand and gravel extraction (Telavi district, v. Vardisubani)	B-I, limited	24,09,08 5 years	Total extraction: 27610 m3	3 ha
R. Askistskali left bank gypsum rocks extraction (Ambrolauri district, north to	Levan Katamadze, in d. Enterpr.	26,09,08 10 years	Total extraction: 2794 t	15 ha

v. Tchrebalo)					
R. Alazani "Kvemo Alvani sand and gravel extraction (Akhmeta district, v. Kvemo Alvani)	Amiran Buachaidze, wide profile firm	26.09.08	5 years	Total extraction: 9300 m^3	0.31 ha
Eklari limestone (ornamental) extraction (Terjola district, v. Tchognari)	"Anre 2006", limited	7/28/2008	20 years	Total extraction: 208800 m3	3.48 ha
R. Dzirula sand and gravel (Zestaphoni district, v. Kveda Tsiplvake)	"Teimuraz Peranidze, ind. Enterpr.	8/5/2008	5 years	Total extraction: 32800 m3	1.64 ha
Dzirovani agate extraction (Tkibuli district, v. Dzirovani)	Koba Ambroladze, wide profile firm	9/12/2008	20 years	Total extraction: 80.100t	2.67 ha
Bashi sand and gravel extraction (Samtredia district, v. Bashi)	Shota Chachua, wide profile firm	8/6/2008	5 years	Total extraction: 200000 m3	5.21 ha
R. Rioni :Znakva" sand and gravel extraction (Ambrolauri district, v. Bugeuli)	"Ambrolaurgza-7", limited	9/1/2008	5 years	Total extraction: 30000 m3	1 ha
Cement and cutting limestone deposit left section limestone extraction (Dedoplistskari district)	"Saqtsementi", limited	01.10.08	15.02.27	Total extraction: 29048000 t	26.7 ha
Facing limestone extraction (Terjola district, v. Kakabauri)	Anre-2006, limited	9/17/2008	20 years	Total extraction: 150000 m3	9.15 ha
R. Tskhenistskali sand and gravel extraction (Samtredia district, v. Tskhenisi)	"Bumeri", limited	30,09,08	5 years	Total extraction: 183600 m3	6.12 ha
R. Gubistskali sand and gravel extraction (Samtredia district, v. Ianeti)	"Goga Razmadze", wide profile firm	9/17/2008	5 years	Total extraction: 25200 m3	0.84 ha
"Pharnali" cement limestone extraction (Terjola district, v. Nakhshirgele)	"Mozaika", limited	07.10.08	20 years	Total extraction: 160310 t	0.82 ha
R. Kisiskhevi sand and gravel extraction (Telavi district, v. Kisiskhevi)	"Napha", limited	9/18/2008	5 years	Total extraction: 26400 m3	0.88 ha
R. Gubistskali sand and gravel extraction (Samtredia district, v. Ianeti)	Richard Sanikidze, wide profile firm	9/17/2008	5 years	Total extraction: 74700 m3	2.49 ha
Quartz sand extraction (Sachkhere district, v. Savane)	Aliko Nikuradze, wide profile firm	26.09.08	20 years	Total extraction: 231000 m3	2.31 ha
R. Gubistskali sand and gravel extraction (Samtredia district, v. Ianeti)	Konstantine Kopaleishvili", ind. Enerpr.	01.10.08	5 years	Total extraction: 130500 m3	4.35 ha
"Gogni" limestone extraction (terjola district, v. Gogni)	Kordi, limited	01.10.08	20 years	Total extraction: 100000 m3	1.77 ha
R. Kabali sand and gravel extraction	Andeziti, limited	09.10.08		Total extraction	2.74 ha
"Phereti" gypsum extraction (Vani district, v. Phereti)	Georgian Kontinentali 2008, limited	01.10.08	10 years	Total extraction: 21826 m3	1.13 ha
R. Cholaburi sand and gravel extraction (Terjola district, v. Argveti)	Bazilika, limited	10.10.08	5 years	Total extraction: 71400 m3	2.38 ha
Katskhi quartz sand extraction (Chiatura district, v. Katskhi)	`Ilarion Modebadze~, ind. Enterpr.	17.11.08	20 years	Total extraction: 73200 m3	1.22 ha
Darkveti quartz sand extraction (Chiatura district, v. Darkveta)	Katskhura 2007, limited	06.10.08	20 years	Total extraction: 178000 m3	1.78 ha
R. Rioni sand extraction (Khobi district, v. Nabada)	Black Sea Terminal, limited	06.10.08	5 years	Total extraction: 204600 m3	6.82 ha
R. Kvirila sand and gravel extraction (Terjola district, v. Simoneti)	Muradi Aphulava, ind. Enterpr.	24.10.08	5 years	Total extraction: 113700 m3	3.79 ha
R. Gubistskali sand and gravel extraction (Samtredia district, v. Ianeti)	ImTeza, limited	13.10.08	09.09.13	Total extraction: 88800 m3	2.96 ha
R. Kvirila sand and gravel extraction (Terjola district, v. Akhali Sviri)	"Cholaburi", limited	17,11,08	5 years	Total extraction: 58800 m3	1.96 ha
Katskhi quartz sand extraction (Chiatura district, v. Katskhi)	"Kordi+", limited	24.10.08	20 years	Total extraction: 168000 m3	2.4 ha
Brick cley (Gurjaani municipality, v. Darchieti)	Wide-profile Company: Givi Goginashvili,	24.10.08		Total extraction: 129,997 m3	2.11 ha
R. Rioni stone and gravel extraction (Ambrolauri district, v. Tchrebalo)	"Ambrolaurgza-7", limited	17.11.08	5 years	Total extraction: 30000 m3	1 ha
Mitsabogira brick cley extraction (samtredia district, v. Mitsabogira)	"Alati", limited	11.11.08	5 years	Total extraction: 18970 m^3	2.71 ha

Limestone extraction (Terjola district, Zeda Alisubani)	Borani, limited	13.11.08 5 years	Total extraction: 32000 m3	0.64 ha
Itavaza-1 quartz sand extraction (Sachkhere district, v. Itskisi)	Mshenebeli 1, limited	28.10.08 20 years	Total extraction: 118868 m^3	2.21 ha
R. Khanistskali sand and gravel extraction (Bagdati municipality, v. Vartsikhe)	"Magistrali", limited	11.11.08 5 years	Total extraction: 59700 m3	1.99 ha
Brick cley (Signagi municipality, v. Bodbiskhevi)	Wide-profile Company: Vasil Basilashvili	03.11.08	Total extraction: 44100 m3	0.63 ha
R. Chkhari "cholaburi" sand and gravel extraction (Terjola)	Borani, limited	13.11.08 5 years	Total extraction: 15000 m3	0.162 ha
Ilori sand and gravel extraction (Samtredia district, v. Ilori)	Malkhaz Sulava, wide profile firm	17.11.08 5 years	Total extraction: 15000 m^3	0,.44 ha
R. Rioni sand and gravel extraction (Tskaltubo district, v. Jimastaro)	Rio-investi, limited	17.11.08 5 years	Total extraction: 95000 m^3	2.93 ha
R. Rioni sand and gravel extraction (Tskaltubo district, v. DjJoneti and Ofurchkheti)	Rio-investi, limited	17.11.08 5 years	Total extraction: 138300 m^3	4.61 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Dzveli Senaki)	"Arqeopolisi", joint-stock	17.11.08 5 years	Total extraction: 1000000 m^3	3.36 ha
Extraction of limestone on the right section of the limestone deposit (Dedoplistskaro district)	“Kartuli pholadi”, limited	118.11.08-15.02.27	Total extraction 12670000 t	8.45 ha
R. Rioni sand and gravel extraction (Oni district. V. Nakieti)	Orba 2008, limited	20.11.08 5 years	Total extraction: 10200 m^3	0.34 ha
Naboslevi teshenite (facing) extraction (Tkibuli district, v. Kursebi)	Milistskaro, limited	26.11.08 20 years	Total extraction: 52000 m^3	0.52 ha
R. Rioni sand and gravel extraction (Tskaltubo district, v. Ontchieshi)	Gza, limited	27.11.08 5 years	Total extraction :20700 m^3	0.67 ha
R. Rioni contruction sand extraction (Khobi district, v. Patara Poti)	"Eegrisi+", limited	08.12.08 5 years	Total extraction: 120000 m^3	3.94 ha
Sand and gravel of the Ujarma section of the Sartitchala deposit, right bank of r. Iori (Sagarejo district)	“NP Invest Group”	08.12.08 06.02.16	Total extraction: 450000 m3	10 ha
R. Rioni Vartsikhe sand and gravel extraction (Vani district, v. Zeindari)	Gelati 2007, limited	08.12.08 09.10.13	Total extraction: 110100 m3	3.67 ha
Tchrebalo gypsum extraction (Ambrolauri district, v. Djoshkhi)	"Tetri qvebi 2008, limited	08.12.08 10 years	Total extraction: 47552.5 t	0.66 ha
Chiatura manganese extraction (Chiatura and Sachkere districts)	Georgian Manganese, limited	03.12.08 19.12.46	2008-2011: 1600000t; Next years: 400000 t; Min. 200000 t to process in Georgia	16,430 ha
Khontchoiri limestone pebble extraction (Ambrolauri district, v. Khontchoiri)	"Gegeshidze Irakli", ind. Enterpr.	22.12.08 20 years	Total extraction: 8400 m^3	0.28 ha
Sand and gravel (Gardabani municipality, v. Sartitchala)	Bakhtiar Novruzoki, wide-profile company	30.12.08, 5 years	Total extraction: 5000 m3	0.12 ha
"Zvare" mineral water abstraction (Kharagauli district, v. Zvare)	"Zvare", limited	31.12.08 25 years	35 m3/24 hours	0.84 ha
R. Tskenistskali sand and gravel extraction (Abasha district, v. Marani)	Olimpi 2006, limited	19.02.09 5 years	Total extraction: 100000 m^3	1.86 ha
Dilikauri quartz diorite extraction (Zestaphoni district, v. Dilikauri)	Mirza Ergemlidze, wide profile firm	26.01.09 20 years	Total extraction: 389400 m^3	3.245 ha
R. Rioni sand and gravel extraction (Terjola district, v. Sarbevi)	"Dieli+", limited	19.02.09 5 years	Total extraction: 354300 m^3	11.8 ha
Sand extraction (Sagarejo municipality, v. Iormuganlo)	Leila Otiashvili, wide-profile company	30.01.09, 20 years	Total extraction : 150000 m3	5 ha
Teshenite extraction (Tkibuli district, v. Bueti and Tsutskhvati)	"Graniti", limited	04.02.09 27.09.26	Total extractio :150000 m3;	2.6 ha
Daphnari limestone extraction (Samtredia district, v. Daphnari)	Minashvili Mzisana, ind. Enterpr.	20.02.09 10 years	Total extraction: 105825 m^3	1.66 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Sorta)	"Gia Panfilov", wide profile company	27.02.09 20.12.12	Total extraction: 49500 m3	1.65 ha
Tchrebalo gypsum extraction (Ambrolauri district, v. Tola)	"Ekologia da resursebi", limited	10.03.09 20 years	Total extraction: 589838 t	4.53 ha

R. Rioni sand and gravel extraction (Tskaltubo district, v. Sarbevi)	"TransvestinJineringi 12", joint-stock	16.03.09 5 years	Total extraction: 180000 m^3	3.9 ha
Vartsikhe sand and gravel (Bagdati district. V. Vartsikhe)	Tvaradze, limited	13.03.09 5 years	Total extraction: 73200 m^3	2.44 ha
Katskhura murble-like limestone (Chiatura district, v. Katskhi)	"Imerimpeksi", limited	02.04.09 20 years	Total extraction:205472 m3	14,08 ha
R. Turdoskhevi sand and gravel (Telavi municipality, v. Vardisubani)	"Serpantini", limited	08.04.09 01.08.16	Total extraction:20700 m^3	1.6 ha
Ferroalloy plant tailings mining (Zestaphoni)	"Ekometali", limited	15.04.09 5 years	Total extraction:24000 t	1.15 ha
R. Iori sand and gravel extraction (Sagarejo district, v. Sartichala)	Akhali Samsheneblo Teqnologiebi, limited	14.04.09 24.07.12	Total extraction: 157500 m3	3.5 ha
Gadidi tuff-breccia and tuff- sandstone extraction (Vani district, v. Gadidi)	Lasha Lejava, wide profile firm	01.06.09 10 years	Total extraction: 20000 m^3	0.4 ha
R. Tskenistskali sand and gravel extraction (Lentekhi district, v. Khophuri)	Tsekuri, limited	01.06.09 5 years	Total extraction: 44800 m^3	1.43 ha
Dilikauri quartz diorite extraction (Zestaphoni district, v. Dilikauri)	Dilato Jgufi, limited	05.06.09 20 years	Total extraction: 43800 m^3	0.73 ha
Okhomira teshenite (facing) extraction, Tkibuli district, v. Okhomira	Okhomira 2009, limited	05.06.09 27.03.19	Total extraction: 156000 m^3	1.04 ha
Itavaza-1 quartz sand extraction (Sachkhere district, v. Itskisi)	Geo KvarTsi, limited	15.06.09 20 years	Total extraction: 150000 m^3	3 ha
Etseri quartz sand extraction (Chiatura district, v. Etseri)	Abesadze Murmani, ind. Enterpr.	17.06.09 20 years	Total extraction: 72000 m^3	0.9ha
R. Kvirila sand and gravel extraction (Sachkere district, v. Chikha)	"Atu", Union	18.06.09 5 years	Total extraction: 304500 m^3	10.15 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Priveli Sviri)	Delta Sviri, limited	19.06.09 5 years	Total extraction: 120000 m^3	3.79 ha
Quartz sand extraction (Sachkhere district, v. Savane)	Karveli, limited	19.06.09 08.12.26	Total extraction: 91300 m^3	1.66 ha
R. Chelti sand and gravel (Kvareli municipality, v. Shilda)	"Saqartvelos Marani", limited	08.07.09 03.06.14	Total extraction: 11100 m^3	0.37 ha
Itavaza quartz sand extraction (Sachkhere district, v. Itskisi)	Karveli, limited	09.07.09 10.03.29	Total extraction: 24500 m^3	0.35 ha
Limestone from the right section of the deposit (Dedoplistskaro municipality)	"Saqtsementi", limited	09.07.09 15.02.11	Total extraction: 12610000 t	8.45 ha
Lentekhi sandstone extraction (Lentekhi)	Tsekuri, limited	20.07.09 2 years	Total extraction: 4750 m^3	0.095 ha
R. Tskenistskali sand and gravel extraction (Tsageri district, v. Bardnala)	Tsekuri, limited	20.07.09 5 years	Total extraction: 30000 m^3	0.97 ha
Sand and gravel of the r. Iori (Tianeti, v. Akhalsopheli)	Lazare Tsikhelashvili, wide profile firm	20.07.09 5 years	Total extraction: 5700 m^3	0.19 ha
Quarts sand (Tianeti municipality, v. Evdjenti)	Individual enterprenour, Avtandil Doliashvili	12.10.09 10 years	Total extraction: 74200 m3	1.06 ha
R. Abasha sand and gravel extraction (Martvili district, v. Zemo Nagvzao)	"Martvilavtogza, limited	24.07.09 5 years	Total extraction: 22200 m^3	0.74 ha
R. Kvirila sand and gravel extraction (Terjola municipality, v. Bardubani)	Delta Sviri, limited	24.07.09 5 years	Total extraction: 400000 m^3	22.97 ha
R. Rioni sand and gravel extraction (Vani district, v. Salkhino)	"Phutkaradzee Giorgi", ind. Enterpr.	27.07.09 5 years	Total extraction: 99000 m^3	3.29 ha
R. Alazani sand extraction (Lagodekh,i v. Heretiskari)	Vepkhvia Vepkhvadze, wide-profile company	27.07.09 5 years	Total extraction: 30000 m^3	0.75 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Akhalsopheli)	"Demur Janashia, ind. Enterpr.	27.07.09 5 years	Total extraction: 10000 m^3	0.2 ha
R. Iori sand and gravel (Sagarejo municipality, v. Khashmi)	Timali, limited	18.12.09 15.08.12	Total extraction: 187212 m3	7.49 ha
R. Iori sand and gravel (Gardabni municipality v. Muganlo)	Timali, limited	18.12.09 23.04.12	Total extraction: 50,836 m3	2.55 ha
R. Iori sand and gravel (Gardabni municipality v. Sartichala)	Timali, limited	24.12.09 21.11.12	Total extraction :96281 m3	3.74 ha
"MagraneTi" sand and gravel extraction (Tianeti district, v. Magraneti)	"Akhalmsheni+", limited	28.07.09 2 years	Total extraction: 85000 m^3	1.59 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Dabla- Gomi)	"Bunebis qomagi", limited	30.07.09 5 years	Total extraction: 25800 m^3	0.86 ha

R. Rioni sand and gravel extraction (Kutaisi)	Servisi, limited	05.08.09 5 years	Total extraction: 50100 m^3	1.67 ha
R. Rioni sand and gravel extraction (Kutaisi surroundings)	"Universali-G", limited	06.08.09 18.08.13	Total extraction: 200000 m3	2.63 ha
R. Dzirula sand and gravel extraction (Zestaphoni district, v. Dzirula)	"Khidmsheni #2", limited	07.08.09 17.10.13	Total extraction: 11300 m3	0.74 ha
R. Dzirula sand and gravel extraction (Zestaphoni district, v. Dzirula)	"Khidmsheni #2", limited	07.08.09 18.09.13	Total extraction:10200 m3	0.51 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Sviri)	"Sapovnela +", limited	10.08.09 5 years	Total extraction: 460000 m^3	8.39 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Priveli Sviri)	"SaqarTvelos Rkinigza", limited	10.08.09 2 years	Total extraction: 40000 m^3	3.03 ha
Abasha sand and gravel extraction (Abasha district, v. Dzveli Abasha)	Roberti Tchanturia, ind. Enterpr.	10.08.09 5 years	Total extraction: 30000 m^3	0.67 ha
R. Rioni sand extraction (Samtredia district, v. Sajavakho)	"Ulevi', limited	14.08.09 5 years	Total extraction: 350000 m^3	3.87 ha
Darkveti quartz sand extraction (Chiatura district, v. Darkveta)	"Darkveti-2009", limited	23.09.09 12.11.28	Total extraction: 186000 m^3	1.24 ha
R. Kvirila sand and gravel extraction (Terjola district, v. Kveda Simoneti)	Mze, limited	16.09.09 5 years	Total extraction :129000 m^3	4.3 ha
Teshenite extraction (Tskaltubo district, v. Ophurtchkheti)	"Justani", limited	23.09.09 20 years	Total extraction: 40500 m^3	0.81 ha
Quartz sand extraction (Chiatura district, v. Navardzeti)	"Dautashvili Zaqaria", ind. Enterpr.	21.09.09 20 years	Total extraction: 318000 m^3	2.12 ha
Kursebi teshenite (Tkibuli district, v. Kursebi)	"X GROUP", limited	21.09.09 20 years	Total extraction: 106800 m^3	1.69 ha
R. Rioni \`Dzveli Rioni" sand extraction (Khobi district, v. Patara Photi)	"Prime Betoni, limited	28.09.09 5 years	Total extraction: 100000 m^3	1.59 ha
R. Alazani sand and gravel (Kvareli, v. Gavazi)	Besik Pheikrishvili, wide profile firm	28.09.09 5 years	Total extraction: 21000 m^3	0.67 ha
R. Rioni \`Dzveli Rioni" sand extraction (Photi surroundings)	"Rioni +", limited	28.09.09 5 yers	Total extraction: 45000 m^3	1.5 ha
Limestone extraction (Terjola district, v. Gogna)	"Georgian Mining +", limited	28.09.09 12.06.16	5000 t/year	2 ha+E344
Limestone extraction (Terjoloa district, v. Nakhshirgele)	"Georgian Mining +", limited	28.09.09 08.05.27	Total extraction: 136330 t	3 ha
Katskhi quartz sand extraction (Chiatura district, v. Katskhi)	"Ilarion Modebadze", Ind. Enter.	04.10.09 09.06.18	Total extraction: 111300 m^3	1.23 ha
R. Tskhenistskali sand and grave extraction (Tsageri district, v. Makhura)	Tsekuri, limited	04.10.09 5 years	Total extraction: 31500 m^3	1.05 ha
Quartz sand extraction (Tianeti municipality, v. Evdjenti)	Individual enterprenour, Avtandil Doliashvili	12.10.09 10 years	Total extraction: 74200 m^3	1.06 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Shua Nosiri)	"Prime Betoni", limited	15.10.09 04.10.12	Total extraction: 66407 m3	2.34 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Sviri)	Davit Getsadze, wide profile firm	26.10.09 20.12.12	Total extraction: 131100 m3	4.37 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Shua Bashi)	"Resursi 2009", limited	26.10.09 25 06.13	Total extraction: 135175 m^3	4.69 ha
R. Alazani sand and gravel extraction (Kvareli municipality, v. Akhalsopheli)	Roki, limited	03.11.09 5 years	Total extraction: 45000 m^3	1.5 ha
R. Kvirila sand and gravel extraction (Terjoloa district, v. Nakhshirgele)	"Nugzar Papuashvili, ind. Enterpr.	06.11.09 25.09.13	Total extraction: 118800 m3	3.96 ha
Zemo Nakalakari sand and gravel extraction (Tianeti district, v. Zemo Nakalakari)	"Akhalmsheni +", limited	16.11.09 2 years	Total extraction: 30900 m^3	1.03 ha
Ornamental limestone extraction (Kharagauli district, v. Khoriti)	"Ramaz Osanadze", ind. Enterpr.	17.11.09 01.10.29	Total extraction: 14200 m^3	0.8 ha
Qvachadala lavabreccia mining (Akhmeta district)	"Melkhi, limited	17.11.09 08.12.26	Total extraction: 50000 m3	3.99 ha
Qvachadala lavabreccia mining (Akhmeta district)	"Kapani 2008", limited	17.11.09 08.12.26	Total extraction: 50000 m3	4.01ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Akhalsopheli)	"Venera", limited	17.11.09 5 years	Total extraction: 15000 m^3	0.5 ha

R. Rioni sand extraction (Senaki district, v. Tchalkadidi and Mukhuri)	"Demur Janashia, ind. Enterpr.	17.11.09 5 years	Total extraction: 12000 m^3	0.4 ha
R. Rioni sand extraction (Senaki district, v. Tchalkadidi surroundings)	"Avangardi-XXI", limited	07.12.09 5 years	Total extraction: 32100 m^3	1.07 ha
Kursebi teshenite (facing) extraction (Tkibuli municipality, v. Koka surroundings)	"Lolasheni 2009", limited	25.12.09 20 years	Total extraction: 83000 m^3	0.83 ha
"MagraneTi" sand and gravel (Tianeti district, v. Magraneti)	Vadja Uratadze, wide profile company	25.12.09 5 years	Total extraction: 2100 m^3	0.21 ha
Tkibuli-Shaori coal mining (Tkibuli district)	"Saqnakhshiri (GIG group), limited	30.12.09 14.08.36	2010-2011: no less than 110000 t/y ; remaining years: without any limit	8 ha
Dzveli Senaki limestone pebble extraction (Senaki district, v. Dzveli Senaki)	"Indiko", limited	31.12.09 10 years	Total extraction: 360000 m^3	3.6 ha
R. Rioni sand and gravel extraction (Kutaisi surroundings)	Raindi Saralidze, wide profile firm	05.01.10 18.12.14	Total extraction: 31200 m^3	1.04 ha
R. Tsivi left bank #2/49 well thermal water extraction (Senaki district, v. Sakharbedio)	Edisher Sanikidze, wide profile firm	14.01.10 25 years	864 m3/24 hours	0.07 ha
Tskhenistskali sandstone extraction (Tsageri district, v. Zubi)	"Khidmsheni"	20.01.10 5 years	Total extraction: 2550 m^3	0.51 ha
R. Alazani sand and gravel (Signagi municipality, v. Sakobo)	Tamaz SpanderaSvili, wide-profile company	20.01.10 5 years	Total extraction: 15000 m^3	0.5 ha
R. Abashistskali sand and gravel extraction (Abasha district, v. Sephieti)	"AgriGeorgia", limited	20.01.10 5 years	Total extraction: 51000 m^3	1.7 ha
Kisiskhevi sand and gravel extraction (Telavi district, v. Tsinandali)	"Skhivi", limited	20.01.10 5 years	Total extraction: 58500 m^3	1.95 ha
Tkibuli colored sandstone extraction (Tkibuli surroundings)	Saqnakhshiri (GIG group), limited	20.01.10 20 years	Total extraction: 57840 m^3	0.75 ha
R. Turdoskhevi sand and gravel (Telavi municipality, v. Vardisubani)	"Serpantini", limited	28.01.10 5 years	Total extraction: 80000 m^3	2.57 ha
R. Tskalitsitela teshenite (facing) extraction (Tkibuli district, v. Naboslevi)	Giorgadze Levani, ind. Enterpr.	01.02.10 5 years	Total extraction: 2490 m^3	1.66 ha
Limestone extraction (Senaki district, v. Kotianeti)	"Arqeopolisi", joint-stock	12.02.10 5 years	Total extraction: 54500 m^3	1.09 ha
Dzveli Senaki limestone extraction (Senaki district, v. Dzveli Senaki)	"Arqeopolisi", joint-stock	12.02.10 5 years	Total extraction: 165000 m^3	1.65 ha
R. Dzirula sand and gravel extraction (Zestaphoni district, v. Ilemi)	Jemal Suliashvili, wide profile firm	18.03.10 5 years	Total extraction: 3000 m^3	0.1 ha
R. Rioni sand extraction (Senaki district, v. Tchalkadidi)	"Manuchar Kozmava", ind. Enterpr.	23.03.10 5 years	Total extraction: 30300 m^3	1.01 ha
Mineral water of Nakhechi Khevi (Kvareli surroundings)	Irakli Mirzikashvili, wide profile company	23.03.10 20 years	0.25 m3/24 hours	0.07 ha
R. Rioni Amagleba ssection sand and gravel extraction (Vani district, v. Amagleba and Kveda Bzvani)	Lasha Lejava, wide profile firm	05.04.10 25.05.22	Total extraction: 1053000 m3	35.1 ha
Sakatsia sand and gravel extraction (Ambrolauri district, v. Sakatsia)	"Arqeopolisi", joint-stock	14.04.10 5 years	Total extraction: 29100 m^3	0.97 ha
Teshenite extraction (Tskaltubo district, v. Ophurtchkheti)	Gela Bobokhidze, wide profile firm	14.04.10 5 years	Total extraction: 750000 m^3	3.75 ha
Lopota murble extraction (Telavi municipality, v. Laphankuri)	"Lopota", joint-stock	14.04.10 20 years	Total extraction: 73000 m^3	0.67 ha
R. Cholaburi sand and gravel extraction (Zestaphoni district, v. Argveta)	Levan Baramadze, ind. Enterpr.	14.04.10 5 years	Total extraction: 60000 m^3	1.98 ha
R. Kvirila sand and gravel extraction (Chiatura district, v. Darkveti)	"Monolitmsheni", limited	22.04.10 5 years	Total extraction: 5100 m^3	0.17 ha
Sand and gravel (Telavi municipality, v. Vardisubani)	B-I, limited	30.04.10 27.08.12	Total extraction: 60655 m^3	2.2 ha
Limestone extraction (Martvili district, v. Salkhino)	"Salkhino", limited	30.04.10 5 years	Total extraction: 18300 m^3	0.61 ha
R. Tskhenistskali sand and gravel extraction (Khoni district, v. Kontuati)	G&G, limited	30.04.10 5 years	Total extraction: 100000 m^3	2.88 ha

"Khashmi" sand and gravel (Gardabani district, v. Muganlo)	"IMP", limited	10.05.10 5 years	Total extraction: 120000 m^3	3.45 ha
Itavaza quartz sand (Sachxere distric, v. Savane)	Geo KvarTsi, limited	10.05.10 5 years	Total extraction: 62400 m^3	1.04 ha
R. Kabali sand (lagodekhi district, v. Ganjali)	"IMP", limited	10.05.10 5 years	Total extraction: 250000 m^3	8.05 ha
Djoneti porphirite extraction (Tskaltubo district, v. Djoneti)	Murtaz Gvelebiani, wide profile company	11.05.10 5 years	Total extraction: 25000 m^3	0.5 ha
Itavaza III quartz sand extraction (Sachkhere district, v. Savane)	Pharsadan Todadze, ind. Enterp.	11.05.10 5 years	Total extraction: 18600 m^3	0.31 ha
R. Tekhuri floodplain terrace sand and gravel extraction (Senaki district, v. Nosiri)	Murad Shamatava, wide profile firm	11.05.10 20 years	Total extraction: 42494 m^3	1.8 ha
Limestone from Dedoplistskaro limestone deposit north-west section (Dedoplistskaro)	"Terjola-Karieri", limited	13.05.10 22.08.26	Total extraction: 32797000 t	33.92 ha
R. Alazani sand and gravel (Kvareli municipality, v. Shakriani)	"DaviT Dzneladze", ind. Enterpr.	27.05.10 5 years	Total extraction: 17890 m^3	1 ha
R. Djruchula sand and gravel extraction (Chiatura district, v. Sareki)	"Monolitmsheni", limited	02.06.10 5 years	Total extraction: 10000 m^3	0.33 ha
Ujarma sand and gravel extraction (Sagarejo district, v. Ujarma)	"IMP", limited	02.06.10 5 years	Total extraction: 636600 m^3	21.22 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Pirveli Sviri)	"Skhivi", limited	04.06.10 5 years	Total extraction: 45600 m^3	1.52 ha
Qroli limestone extraction (Kharagauli district, v. Qroli)	"Bazaleti", limited	14.06.10 5 years	Total extraction: 10000 m^3	0.1 ha
R. Rioni sand and gravel extraction (Kutaisi, v. Sarbevi)	Mzia Sigua, wide profile firm	14.06.10 5 years	Total extraction: 255 300 m^3	8.51 ha
R. Tskhenistskali sand and gravel extraction (Abasha district, v. Marani)	Benia Pitava, wide profile firm	14.06.10 5 years	Total extraction: 60000 m^3	2 ha
R. Buja sand and gravel extraction (Chiatura district, v. Qvatsikhe)	"Kvali 2009, limited	14.06.10 5 years	Total extraction: 50100 m^3	1.67 ha
Sand and gravel extraction (Sagarejo municipality, v. Khashmi)	"Eurobilding 21", limited	15.06.10 07.09.12	Total extraction:16 5000 m3	5.5 ha
Vartsikhe-2 sand and gravel extraction (Bagdati district, v. Vartsikhe)	Markoz Bulukhia, wide profile firm	17.06.10 09.08.12	Total extraction: 110000 m3	10.36 ha
R. Chkherimela sand and gravel extraction (Kharagauli surroundings)	Geo-Plaza, limited	21.06.10 5 years	Total extraction: 65400 m^3	2.1 ha
Peat extraction (Martvili district, v. Didi Tchkoni and Djinota)	Vakhtang Abzianidze, wide profile firm	22.06.10 10 years	Total extraction: 13300 t	16.33 ha
Peat extraction (Martvili district, v. Didi Tchkoni and Djinota)	Vakhtang Abzianidze, wide profile firm	22.06.10 20 years	Total extraction: 184500 t	86.36 ha
Quartz sand extraction (Chiatura district, v. Darkveti)	"Darkveti-2009", limited	24.06.10 12.11.28	Total extraction: 187500 m^3	1.25 ha
R. Kabali sand and gravel (Lagodekhi municipality, v. Naendrovali)	"Fauna", limited	29.06.10 5 years	Total extraction: 20700 m^3	0.69 ha
Kursebi ceramic cley extraction (Tkibuli district, v. Kursebi)	"Boran maining", limited	06.07.10 20 years	Total extraction: 468540 t	8.22 ha
Muganlo gravel (Gardabani district, v. Muganlo)	"New Road Group", limited	06.07.10 1 year	Total extraction: 75200 m^3	1.88 ha
R. Tskhemistskali sand and gravel extraction (Khoni district, v. Vemo Khuntsi)	"Martvilavtogza", limited	09.07.10 5 years	Total extraction: 61200 m^3	2.04 ha
Lebarde mineral water abstraction (Martvili district, v. Lebarde)	"Martvilis Tsklebi", limited	13.07.10 06.04.34	16 m3/24 hours	0.14 ha
R. Kabali sand and gravel (Lagodekhi municipality, v. Giorgeti)	Imedi 2010, limited	13.07.10 09.06.13	Total extraction: 22500 m^3	0.8 ha
R. Kabali sand and gravel (Lagodekhi municipality, v. Kabali)	New Energy, limited	13.07.10 17.02.14	Total extraction: 359100 m^3	11.97 ha
Satchurias gele teshenite (facing) extraction (Tkibuli district, v. Okhomira)	Merab Kublashvili	15.07.10 20 years	Total extraction: 84804 m^3	0.43 ha
Quartz sand (molding and glass production) extraction (Sachkhere	"Mshenebeli 1", limited	16.07.10 20 years	Total extraction: 118800 t	0.66 ha

district, v. Bajiti)				
Gypsum extraction (Ambrolauri district, v. Tchrebalo)	"Nergebi", limited	16.07.10 10 years	Total extraction: 52225 t	0.28 ha
Gypsum extraction (Ambrolauri district, v. Tchrebalo)	Super Gypsum, cooperative	16.07.10 29.09.19	Total extraction: 53000 t	0.28 ha
Silica manganese waste collection, recovery (Samtrediadistrict, v. Ilori and Khujulauri)+A1065	"ChiaturmanganumGoerigia " , limited	23.07.10 5 years	Total extraction: 30060 t	4.16 ha
R. Tskenistskali sand and gravel extraction (Khoni district, v. Ivandidi)	"Tereks-XI", limited	28.07.10 18.04.13	Total extraction: 352462 m^3	10.18 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Shua Bashi)	"Tereks-XI", limited	28.07.10 26.01.14	Total extraction: 215575 m^3	7.91 ha
R. Rioni "Vartsikhe" sand and gravel extraction (Bagdati district, v. Vartsikhe)	Fazisi, limited	28.07.10 03.12.12	Total extraction: 39000 m3	2.3 ha
Itavaza quartz sand extraction (Section #3, Sachkhere district, v. Itavaza)	DaviT MosiaSvili, wide profile firm	28.07.10 10 years	Total extraction: 18900 m^3	0.27 ha
Shkmeri mangaese extraction (Oni district, v. Shkmeri)	"Rusmetali", limited	05.08.10 18.11.28	Total extraction: 1090686t	86.06 ha
R. Rioni sand and gravel extraction (Tskaltubo district, v. Jeimastaro)	"Rio-investi", limited	05.08.10 5 years	Total extraction: 21300 m^3	0.71 ha
R. Kvirila sand and gravel extraction (Terjola district, v. Ajameti)	Rezo Bogveradze, wide profile firm	05.08.10 5 years	Total extraction: 62100 m^3	2.07 ha
Mukhi-Tsesi gypsum-anhyidrite extraction (Ambrolauri district, v. Mukhli)	"Shoda", limted	05.08.10 20 years	Total extraction: 32568 t	1.18 ha
R. Abashistsali sand and gravel extraction (Abasha, v. Sabokuchao)	"Megzeve 2010", limited	09.08.10 5 years	Total extraction: 30300 m^3	1.01 ha
R. Ninos Khevi sand and gravel Lagodekhi municipality, v. Tsodniskari)	Imedi 2010, limited	31.08.10 2 years	Total extraction: 9000 m^3	0.3 ha
R. Ritseula sand and gravel extraction (Ambrolauri district, v. Sadmeli)	Georgian International Energy Corporation, limited	13.09.10 5 years	Total extraction: 6000 m^3	0,2 ha
Itavaza quartz sand extraction (Section #4, Sachkhere district, v. Itavaza)	"Ako", limited	03.09.10 18.09.28	Total extraction: 131204 m^3	0,93 ha
R. Turdoskhevi sand and gravel Telavi municipality, v. Vardisubani)	Telavi Road Division, limited	03.09.10 19.05.16	Total extraction: 18000 m^3	1.26 ha
Murble-like limestone (facing) (Chiatura, v. Salieti)	"Marmoroso", limited	09.09.10 01.08.2027	Total extraction: 199300 m^3	3.56 ha
"Khoriti" murble-like limestone extraction (Kharagauli, v. Khoriti)	"Pavle Kikalishvili", ind. Enterpr.	25.11.10 25.11.30	Total extraction: 58388 m^3	1.75 ha
R. Gombori sand and gravel (Sagarejo, v. Otaraani)	“Gzamsheni-4”, limited	14.09.10 5 years	Total extraction: 92400 m^3	3.08 ha
R. Iori Otaraant sand and gravel (Sagarejo, v. Otaraanti)	“Gzamsheni-4”, limited	14.09.10 5 years	Total extraction: 11400 m^3	0.38 ha
R. Chkherimela sand and gravel extraction (Kharagauli district, v. Nebodziti)	"Fushta", limited	27.09.10 03.12.12	Total extraction: 18000 m3 no more than6000 m3/year	0,371 ha
R. Chailuri sand and gravel (sagarejo municipality, v. Manavi)	Sakartvelos Rkinigza , limited (Georgian railway)	27.09.10 5 years	Total extraction: 103800 m^3	3.46 ha
R. Rioni sand and gravel extraction (Oni municipality, v. Lagvanta)	"Orba 2008", limited	01.10.10 5 weli	Total extraction: 80000 m^3	0.92 ha
Tsutskvati basalt extraction (Tkibuli district, v. Tsutskvati)	Georgian group, limited	08.10.10 03.02.15	Total extraction: 30000 m^3	2.36 ha
Tsutskvati basalt extraction (Tkibuli district, v. Tsutskvati)	Vitali Tsirekidzee, wide profile firm	08.10.10 03.02.15	Total extraction: 170000 m^3	4.78 ha
#4 well thermal water extraction for greenhouse (V. Zana, Senaki district)	Zana-eko, limited	12.10.10 18.06.33	400 m^3/24 hours	0.07 ha
Amashuketi limestone extraction (Khraragauli dstrict)	"Kozmani", limited	18.10.10 20.01.26	Total extraction: 24000 m^3	19.2 ha
Skindori limestone pebble extraction (Chiatura district, v. Skindori)	"Katskhura 2007", limited	25.11.10 08.09.28	Total extraction: 1983000 m^3	6.61 ha
Sartitchala limestone extraction(Sagarejo, v. Sartitchala)	Zviad Jikia, wide-profile company	05.11.10 05.11.25	Total extraction : 145883 t	1.31 ha
Doberazeni limestone extraction	"Martvilavtogza", limited	03.11.10 15.07.19	Total extraction: 40500 m^3	0.81 ha

(Martvili district, v. Doberazeni)				
Gvedi limestone extraction (Khoni district, v. Gvedi)	"Zaur Kurashvili", ind. Enterp.	15.11.10 04.06.28	Total extraction: 105669 m^3	0.47ha
Sartitchala sand (Gardabani district, v. Sartitchala)	"G-Construction", limited	01.12.10 01.12.30	Total extraction :708000 m^3	23.6 ha
"Khoriti" murble-like limestone extraction (Kharagauli district, v. Khoriti)	"Ilia Bluashvili", ind. Enterp.	13.12.10 13.12.30	Total extraction: 11465 m^3	0.51 ha
Geguti sand and gravel extraction (Tskaltubo district, v. Geguti)	"Mzleveli - 2010", limited	10.12.10 10.12.15	Total extraction: 60000 m^3	2 ha
R. Tskhenistskali sand and gravel extraction (Khoni district, v. Ivandidi)	"Sara 2010", limited	14.12.10 19.10.12	Total extraction: 134100 m^3	4.47 ha
Tchrebalo gypsum extraction (Ambrolauri district, v. Tola)	"Super Gypsum", cooperative	14.12.10 15.10.17	Total extraction: 25760 t	0.14 ha
Moliti marble-like limestone (Kharagauli district, v. Moliti)	Georgian Mining Co. Limited	12.01.11 12.01.31	Total extraction: 79100 m^3	1.13 ha
Samtredia thermal water abstraction (well#1) (Samtredia)	Thermal Water Georgia, limited	12.01.11 12.01.36	2765 m3/24 hours	0.07 ha
Gogoni limestone extraction (Tkibuli district, v. Gogoni)	"Saba+", limited	02.02.11 02.02.16	Total extraction: 23000 m^3	0.46 ha
Teshenite extraction (Tskaltubo district, v. Ophurtchkheti)	Giorgi Koridze, wide profile firm	02.02.11 02.02.16	Total extraction: 138000 m^3	1.38 ha
R. Rioni sand and gravel extraction (Samtredia district, v. Akhalsopheli)	"DasavleTi", limited	02.02.11 02.02.16	Total extraction: 27300 m^3	0.91 ha
R. Kviria "Bardubani" sand and gravel extraction (Terjola district, v. Bardubani)	"Temur Berdzenishvili, wide profile firm	04.02.11 04.02.16	Total extraction: 220000 m^3	6.67 ha
R. Kvirila sand and gravel extraction (Zestaphoni district, v. Priveli Sviri)	"Imereti-1", limited	08.02.11 08.02.16	Total extraction: 35000 m^3	1.13 ha
"Khoriti" marble-like limestone extraction (Kharagauli district, v. Khoriti)	"GEORGIAN MARBLE"	08.02.11 08.02.31	Total extraction: 64989 m^3	1.96 ha
Chkhari sand and gravel extraction (Terjola district, v. Ruphoti)	"Korneli Shugladze", ind. Enterp.	10.02.11 10.02.16	Total extraction: 15600 m^3	0.52 ha
R. Turdoskhevi sand and gravel (Telavi, v. Vardisubani)	"Artozani", limited	10.02.11 10.02.16	Total extraction : 60000 m^3	2 ha
R. Rioni sand and gravel extraction (Kutaisi surroundings)	Gela Jintchaaradze, wide profile firm	10.02.11 10.02.16	Total extraction: 80000 m^3	1.89 ha
R. Rioni sand and gravel extraction (Kutaisi, v. Geguti)	"Samsheneblo Masalebi - 2011", limited	11.02.11 1.02.16	Total extraction: 67800 m^3	2.26 ha
R. Rioni sand and gravel extraction (Kutaisi, v. Geguti)	"Saqmilsadenmsheni, limited	18.02.11 18.02.16	Total extraction: 300000 m^3	7.97 ha
R. Rioni sand and gravel extraction (Ambrolauri district, v. Dzirageuli)	Ilia Tchelidze, wide profile firm	18.02.11 18.02.16	Total extraction: 30000 m^3	1 ha
R. Tekhuri sand and gravel extraction (Senaki district, v. Akhalsopheli)	"Big Georgia", limited	18.02.11 18.02.16	Total extraction: 71400 m^3	2.38 ha
Sartitchala limestone extraction (Sagarejo, v. Sartitchala)	"Transhi", limited	18.02.11 18.02.31	Total extraction: 70112 t	0.8 ha
R. Rioni sand and gravel extraction (Ambrolauri district, v. Khvantchkara)	"Elithausi 2008", limited	18.02.11 18.02.16	Total extraction: 45000 m^3	1.27 ha
R. Rioni "Kvatskhuti" sand and gravel extraction (Ambrolauri district, v. Kvatskhuti)	"Rusmetali", limited	18.02.11 18.02.16	Total extraction: 51600 m^3	1.72 ha
R. Rioni sand and gravel extraction (Khobi district, v. Patara Poti)	"Egrisi+"	07.03.11 09.08.12	Total extraction: 67500 m^3	2.25 ha
R. Rioni sand extraction (Khobi district, v. Patara Photi surroundings)	"Bilderi 2007", limited	07.03.11 09.08.12	Total extraction: 104100 m^3	3.47 ha
R. Rioni sand and gravel extraction (Kutaisi surroundings)	Gocha Katsadze, wide profile firm	07.03.11 07.03.16	Total extraction: 20700 m^3	0.69 ha

ANNEX 4. RENEWABLE ENERGY RESOURCES

Table 1. Theoretical Technical Hydropower Potential of the Rivers of the Alazani Basin

River	Installed capacity: MW	Power output: mln kwh
Telavi municipality		
Stori	33.3	193.9
Chakhuriskhevi	20.1	115.8
Lopota	8	46.4
Usakhelo	7.9	46.2
Didkhevi	8.8	50.3
Turdo	11.7	67.2
Kisiskhevi	5.4	30.7
Tsivi	3.6	21.3
Sub-total	*98.8*	*571.8*
Akhmeta municipality		
Pirikitis Alazani	10.7	67.5
Chigostskali	5	29.9
Khikhos Alazani	7.9	49.6
Larovnis Tskali	3.6	22.5
Tushetis Alazani	25.7	160.8
Alazani	18.5	107.7
Tsovatistskali	4.3	27.1
Samkuristskali	11.9	69.6
Ortskali	6	34.8
Khevistchala	3.1	17.8
Samkuriskhevi	4.9	27.4
Ilto	22.1	128.8
Orvili	5.1	28.5
Khevgrdzeli	2.1	11.7
Khodasheniskhevi	12.9	75.3
Sub-total	*143.8*	*859*
Kvareli municipality		
Lopota	17	98.9
Intsoba	11.7	68.1
Chelta	16.1	94.4
Sephora	13.9	80.3
Duruji	15.8	89.1
Bursa	6	33.5
Avaniskhevi	15.3	89.4
Shorakhevi	14.8	84.9
Areshi	1.8	10.9
Sub-total	*112.4*	*649.5*
Lagodekhi municipality		
Kabali	11.6	66.5
Areshi	6.9	40.3
Apheni	2.5	13.9
Tchartali	9.7	54

Baisubani	8.5	49.5
Shromiskhevi	8.2	47.6
Lagodekhistskali	8.6	49.7
Sub-total	*56*	*321.5*
Gurjaani municipality		
Tchermiskhevi	3.2	18.4
Sub-total	*3.2*	*18.4*
TOTAL	414.2	2420.2

Table 2. Theoretical Technical Hydropotential of the Rivers of the Iori River Basin

River	Installed capacity: MW	Power output: mln kwh
Tianeti municipality		
Iori	22.2	127.2
Begelaskhevi	2.2	11.8
Babkhiskhevi	9.4	53.4
Sagami	2.6	15.4
Kusno	1.3	7.9
Adedi	0.6	3.2
Sub-total	*38.3*	*218.9*
Sagarejo municipality		
Gombori	3.2	18.4
Sub-total	*3.2*	*18.4*
Total	41.5	237.3

Table 3. Theoretical Technical Hydropotential of the Rivers of the Rionbi River Basin

River	Installed capacity: MW	Power output: mln kwh
RACHA-LECHKUMI AND KVEMO SVANETI		
Ambrolauri municipality		
Lukhuni	29.1	161.9
Kajiani	5.5	31.3
Veleula	5.2	30.4
Ritseula	9.3	51.7
Askistskali	9.4	53.2
Adedi	0.6	3.2
Sub-total	*59.1*	*331.7*
Oni municipality		
Rioni	11.4	63.3
Zophkhitura	5.5	30.7
Tchangtchakhi	23.4	129.9
Sontarula	2.5	14.3
Kheva (Khari)	7.6	42.4

Chveshura	9.2	51.6
Sakaura	33.7	187.5
Gharula	16.8	93.4
Jejora	34	189.1
Sub-total	*144.1*	*802.2*
Lentekhi municipality		
Tskhenistskali	15	84
Koruldashi	17.6	97.4
Ghobishuri	14.8	80.9
Mukhra	16.2	91.2
Judari	12.5	69.8
Khophuri	23.3	129.8
Laskanura	44.8	249.4
Kheledula	23.6	131.4
Lektareshi	17.9	100.2
Sub-total	*185.7*	*1034.1*
Tsageri municipality		
Lajanura	17.3	96.1
Usakhelo	4.2	24.1
Jonoula	18.4	102.1
Sub-total	*39.9*	*222.3*
Total	428.8	2390.3
IMERETI		
Tkibuli municipality		
Lekhadiri	10.9	22.8
Tskaltsitela	28.1	57.2
Tchala	15	30.9
Dzusa	14.9	30.1
Sub-total	*68.9*	*141*
Sachkhere municipality		
Tcherula	17.2	36.2
Jrutchula	26.1	54.6
Chikhura	33.9	70.1
Ghebura	22.8	47.3
Dumala	2.1	4.5
Gvizga	25.7	53.1
Dzirula	17.8	36.5
Kvirila	49.8	101.3
Sub-total	*195.4*	*403.6*
Chiatura municipality		
Buja	16.9	34.6
Sadzalikhevi	4.9	10
Dumala	8.4	17.2
Sub-total	*30.2*	*61.8*
Terjola municipality		
Tskaltsitela	16.8	34.3
Tchishura	3.3	6.6

Dzusa	8	16.4
Dzevrula	20.5	41.5
Cholaburi	4.2	8.8
Chkhara	7.6	15.4
Sub-total	*60.4*	*123*
Bagdati municipality		
Khanistskali	13.8	76.5
Sakraula	8.4	46.6
Laishura	14	78
Quershaveti	18.9	105.3
Tsablarastskali	37.1	207.5
Sub-total	*92.2*	*513.9*
Vani municipality		
Sulori	18.8	106.4
Kumuri	22.2	122.9
Sub-total	*41*	*229.3*
Zestaphoni municipality		
Buja	4.8	26.9
Cholaburi	0.7	6
Dzusa	3.2	6.6
Sub-total	*8.7*	*39.5*
Kharagauli		
Sakraula	26.7	55.7
Rikotula	3.9	8.2
Dumala	16.8	34.7
Bdjoliskhevi	51.8	105.7
Khelmosula	4	8.5
Tchkherimela	18.6	38.2
Dzirula	16.4	33.6
Sub-total	*138.2*	*284.6*
Tskaltubo municipality		
Gubistskali	11.2	62.8
Lekhidari	6.1	34.3
Sub-total	*17.3*	*97.1*
Khoni municipality		
Okatser	13.2	74.1
Sub-total	*13.2*	*74.1*
Samtredia municipality		
Khevistskali	3.8	21.1
Sub-total	*3.8*	*21.1*
Total	669.3	1989
SAMEGRELO-ZEMO SVANETI		
Martvili municipality		
Tsivi	2	11.3
Tekhuri	18	100.5
Abasha	16.6	92.9
Chkhorotsku	16.1	89.7

Tsachkhura	10.4	58.8
Nogela	1.3	7.6
Sub-total	64.4	360.8
Senaki municipality		
Zana	***0.4***	2.1
Sub-total	*0.4*	*2.1*
Khobi municipality		
Zana	1.9	10.1
Sub-total	*1.9*	*10.1*
Chkhorotsku municipality		
Zana	0.1	0.8
Sub-total	*0.1*	*0.8*
Total	64.9	363.7
GRAND TOTAL	1163	4743

Figure 1. Map of the Wind Power Potential per Square Meter

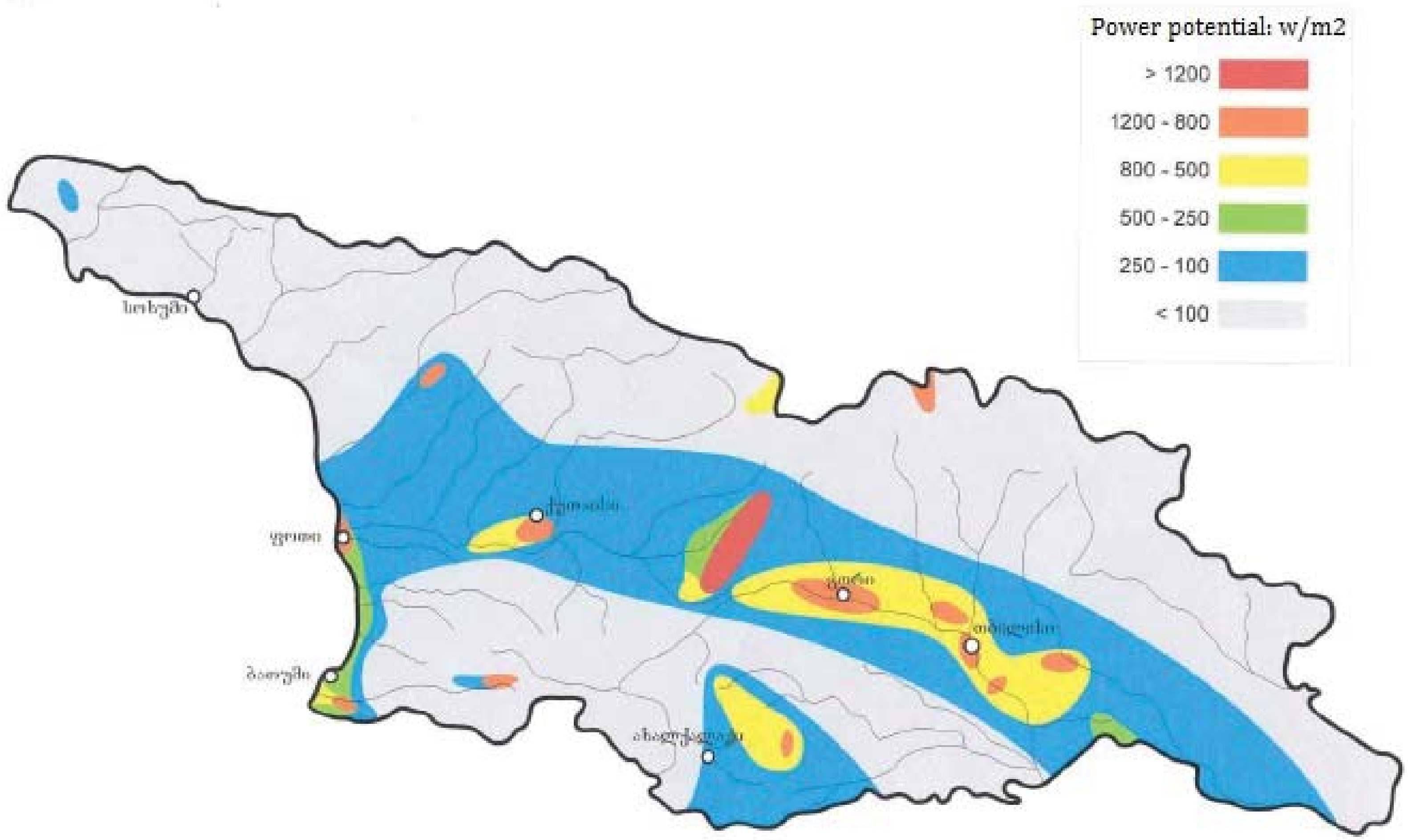


Figure 2. Map of the Average Annual Wind Velocity

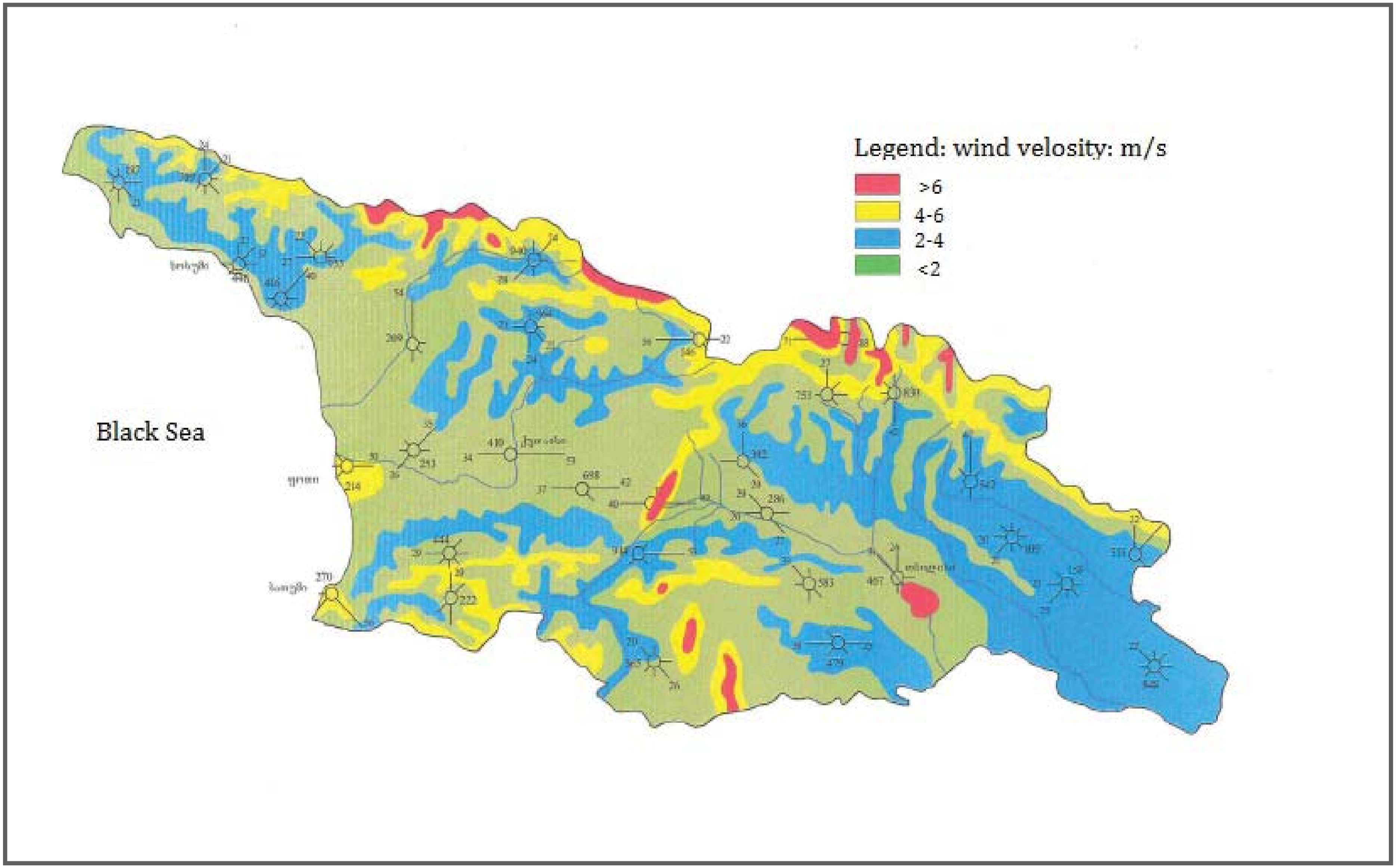


Figure 3. Map of the Location of Potential Wind Power Plants

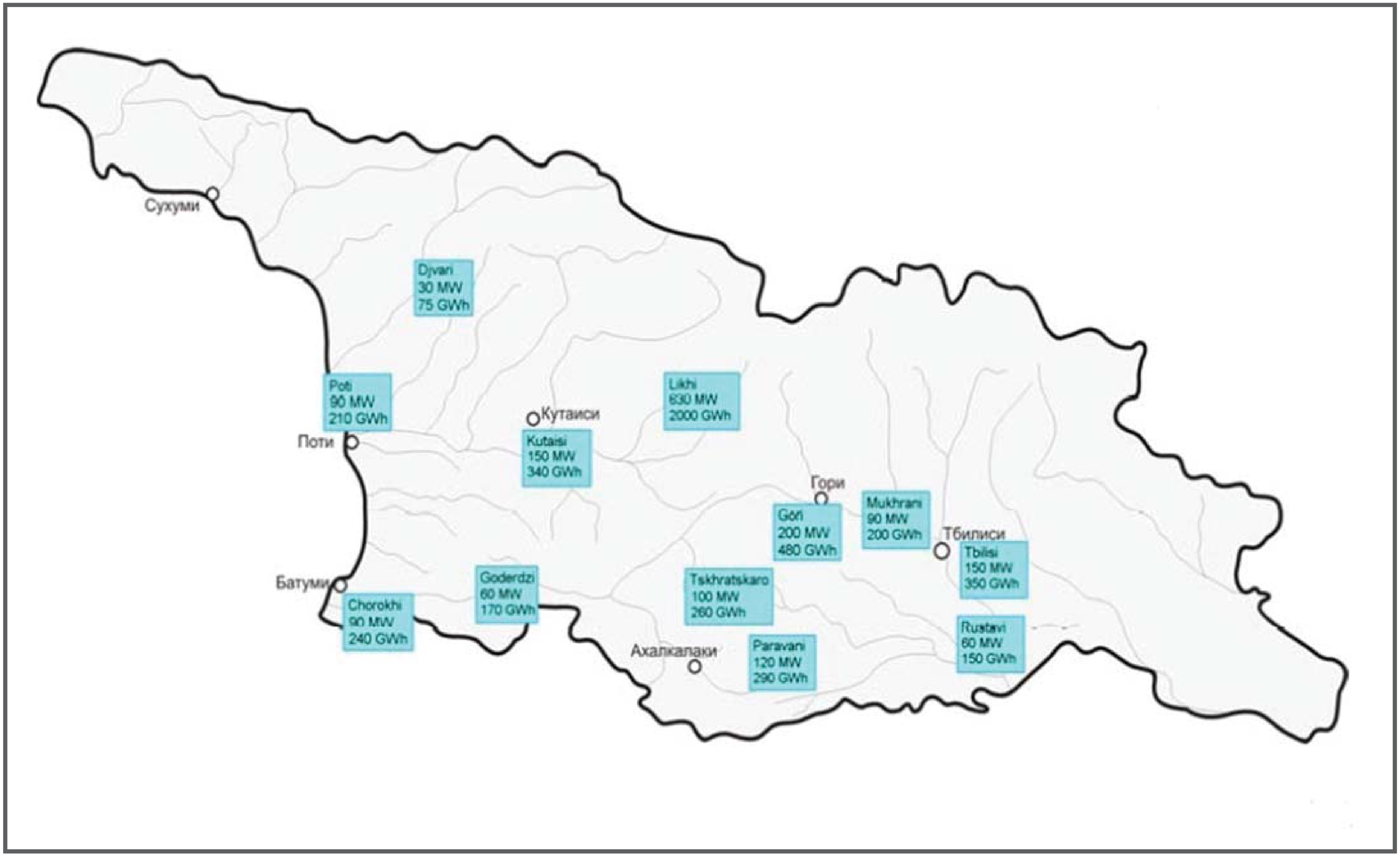


Figure 4. Map of the Solar Radiation

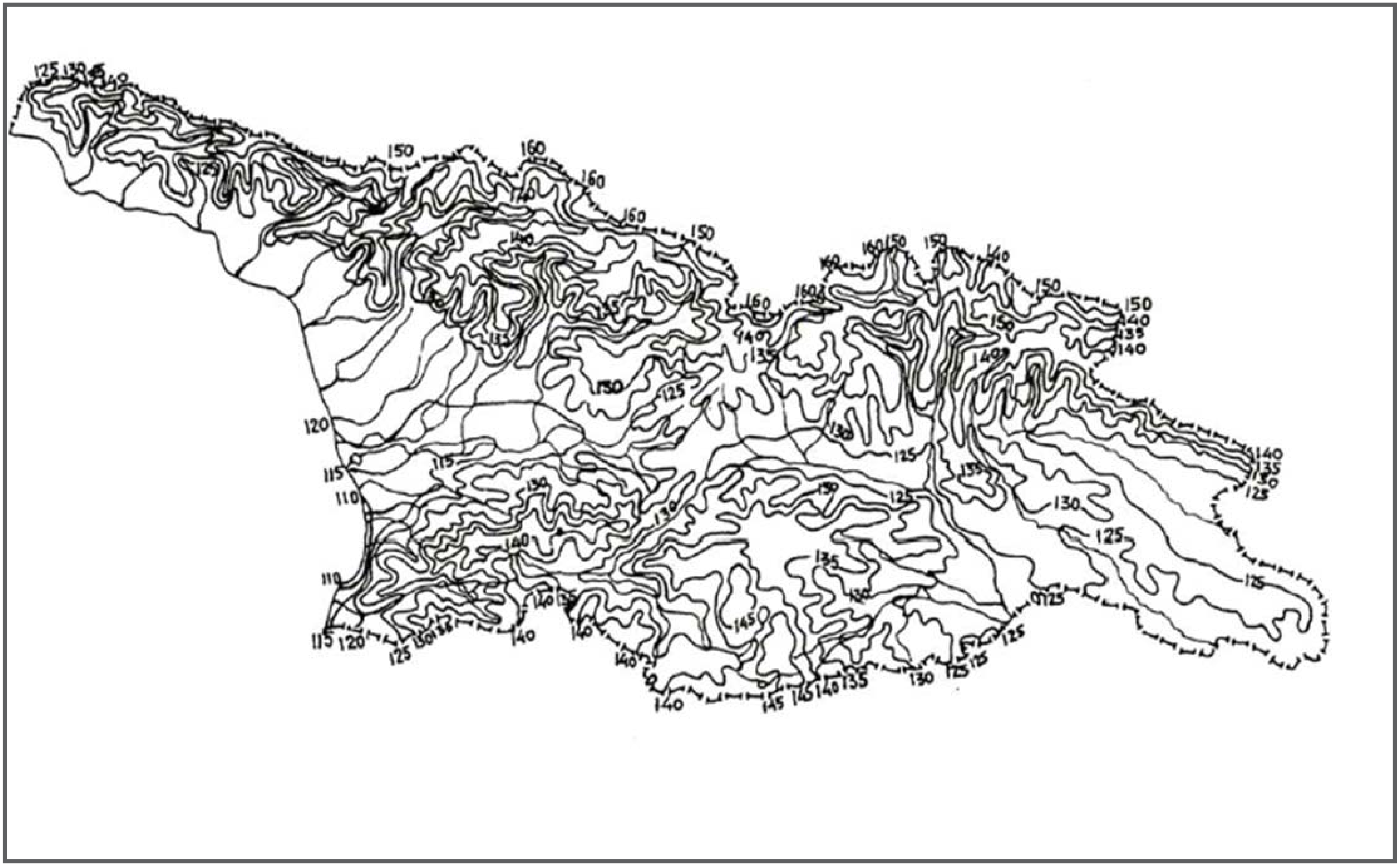


Figure 5. Map of the Solar Thermal Potential: kcal/sm^2

3.5) Average annual radiation 3.5 kwh/m^2 during 24 hours=1278 kwh/ m^2 annually; 3.8) Average annual radiation 3.8 kwh/m^2 during 24 hours=1387 kwh/ m^2 annually; 4.2) Average annual radiation 4.2 kwh/m^2 during 24 hours=1533 kwh/ m^2 annually; 4.5) Average annual radiation 4.5 kwh/m^2 during 24 hours=1643 kwh/ m^2 annually;5.3) Average annual radiation 5.3 kwh/m^2 during 24 hours=1935 kwh/ m^2 annually;

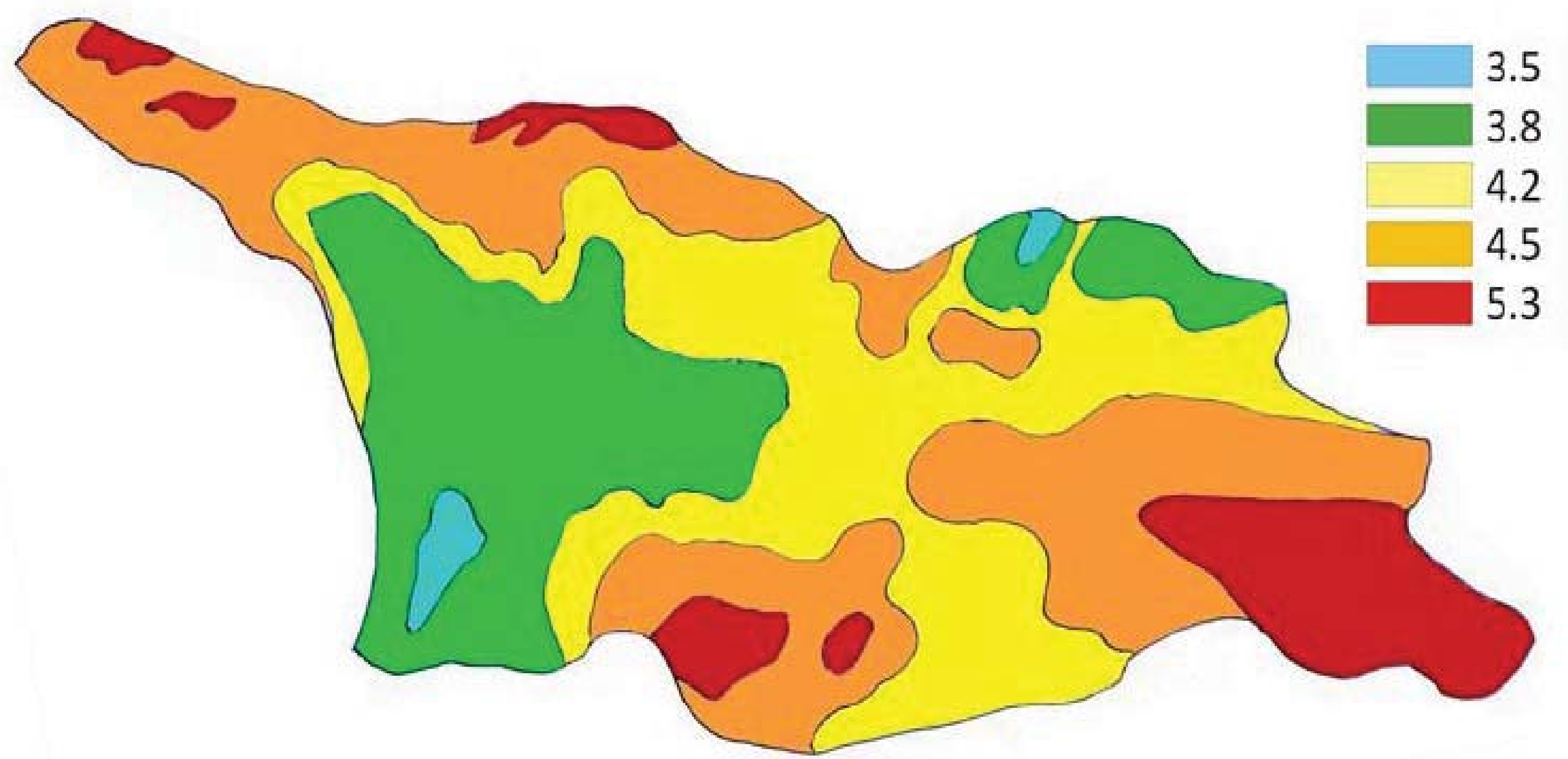


Table 4. Geothermal Hotwater Resources of Georgia

Name of the Site	Number of Wells	Flow Rate (m^3/h)	Avarage water temp. (C)	Thermal Capacity (MW)[1]
Tbilisi	6	400	65	23.8
Zugdidi-Tsaishi	16	1000	85	74.4
Qwaloni	4	400	90	32.5
Drana	2	60	96	5.2
Kindgi	14	1170	104	113.5
Moqwi	11	550	95	48
Okhurei	3	450	103	37.9
Tskaltubo	15	800	30	14.
Samtredia	1	125	61	5.9
Vardzia	4	77	60	3.6
Gagra	3	40	38-43	0.8
Besleti	2	15	39-41	0.25
Tkvarcheli	2	29	35-38	0.35
Rechkhi	1	45	77	2.6
Saberio	1	51	34	0.5
Torsa	1	4.5	63	0.2
Okros Satsmisi	1	4.3	63	0.2
Khobi	1	18.8	82	1.1
Bia	1	108	65	4.8
Japshakari	1	5	64	0.2
Zeni	1	15.5	80	0.9
Zana	1	16.7	100	1.4
Menji	3	240	57-65	9.2
Isula	1	15.4	75	0.9
Nokalakevi	2	29.1	80-82	1.8
Vani region	3	89.6	52-60	3.2
Vani	2	115.8	60	4.5
Amagleba	1	14.4	41	0.3
Simoneti	1	21.7	42	0.4
Abastumani	3	43.3	48	1.1
Tmogvi	1	21.7	62	1.75
Nakalakevi	3	33.1	34-58	0.9
Aspinza	1	36	42	0.64
Tsokhisjvari	1	41.7	32	0.34
Borjomi	25	22.4	30-41	0.4
Akhaldaba	4	20.8	33-42	0.26
Tsromi	5	30.5	39-55	1.03
Agara	1	10.8	82	0.7
Khvedureti	2	5.83	45-49	0.15
Ujarma	1	2.1	42	0.04
Torgvas –abano	1	33.3	35	0.4
Tsnori	1	36	37	0.5
Heretiskari	2	138	34-37	1.65
Total	156	6386		402

ANNEX 5. HYDROLOGY

Figure 1. Hydrological Map of the Alazani River Basin

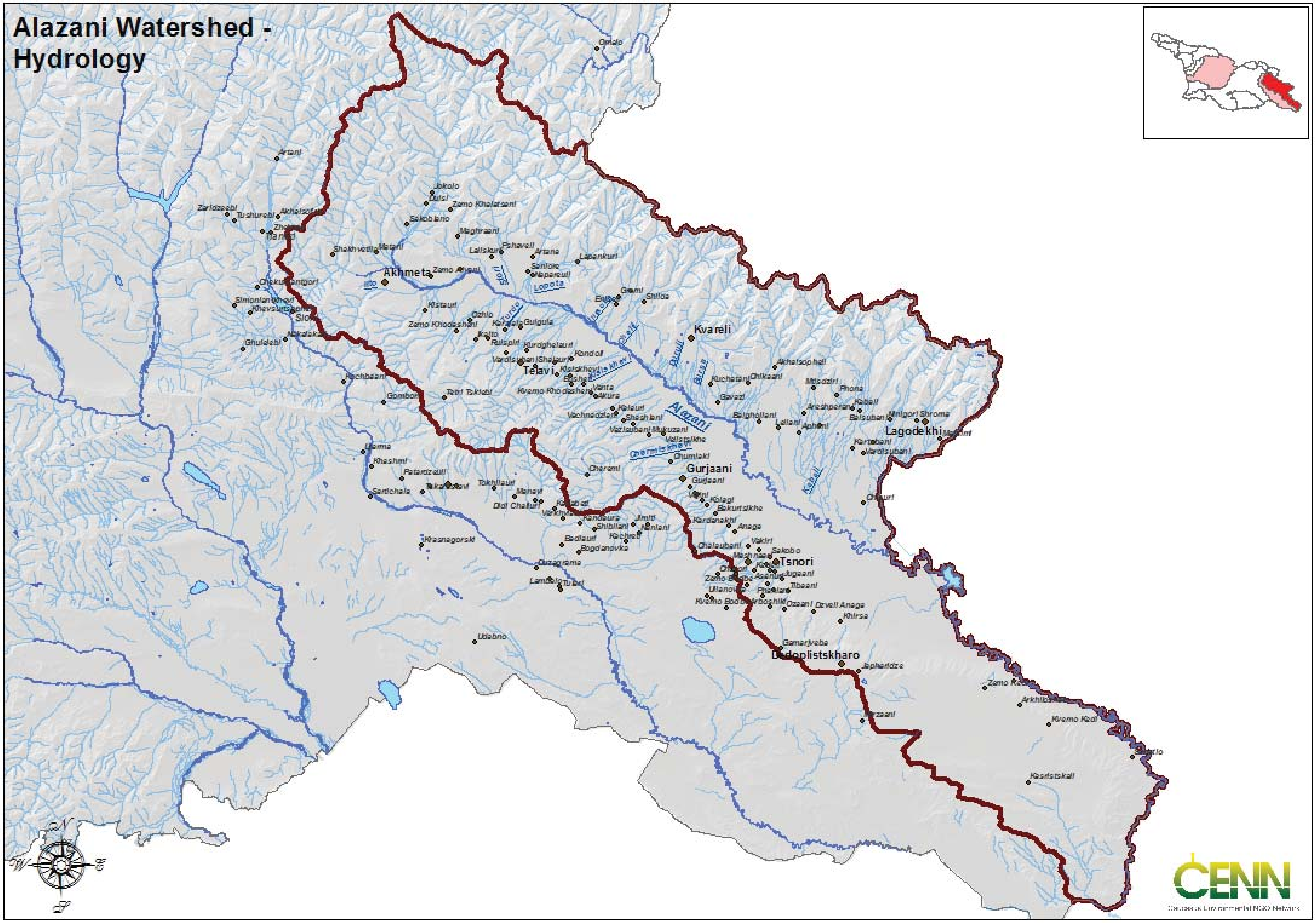


Figure 2. Hydrological Map of the Iori Basin

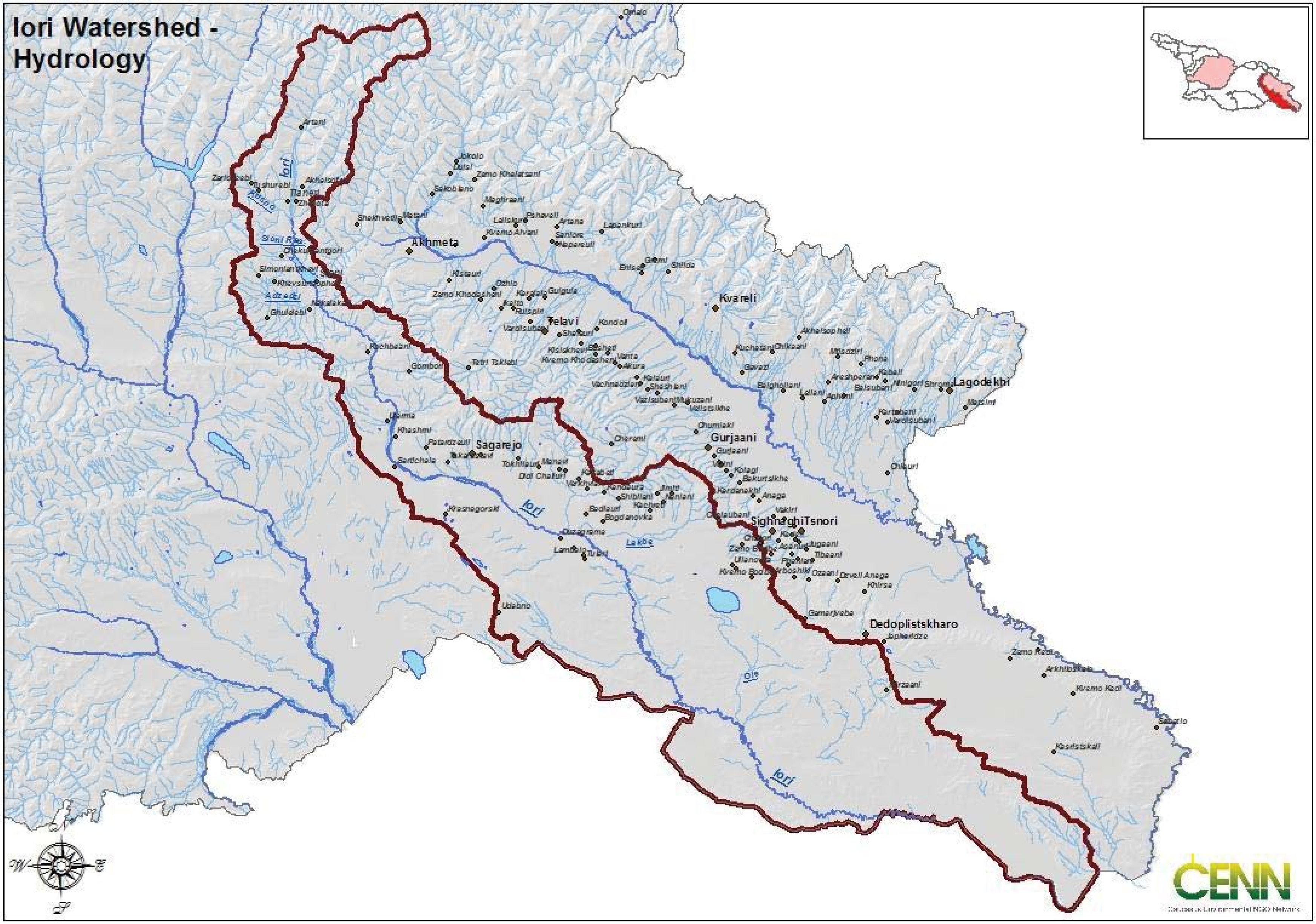


Figure 3. Hydrological Map of the Rioni Basin

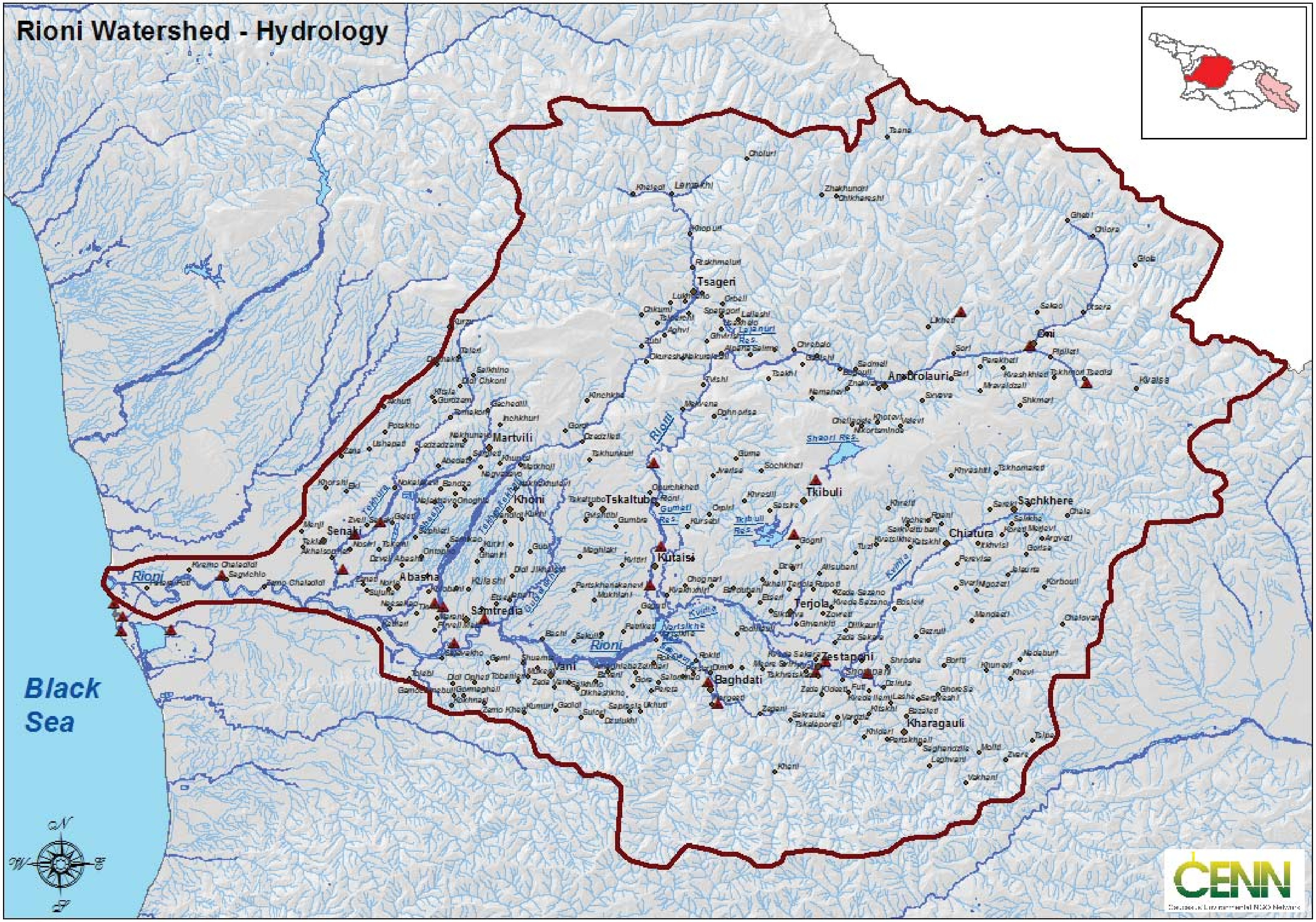


Figure 4. Watersheds (micro-catchments) of Alazani-Iori and Rioni River Basins (10km or longer rivers)

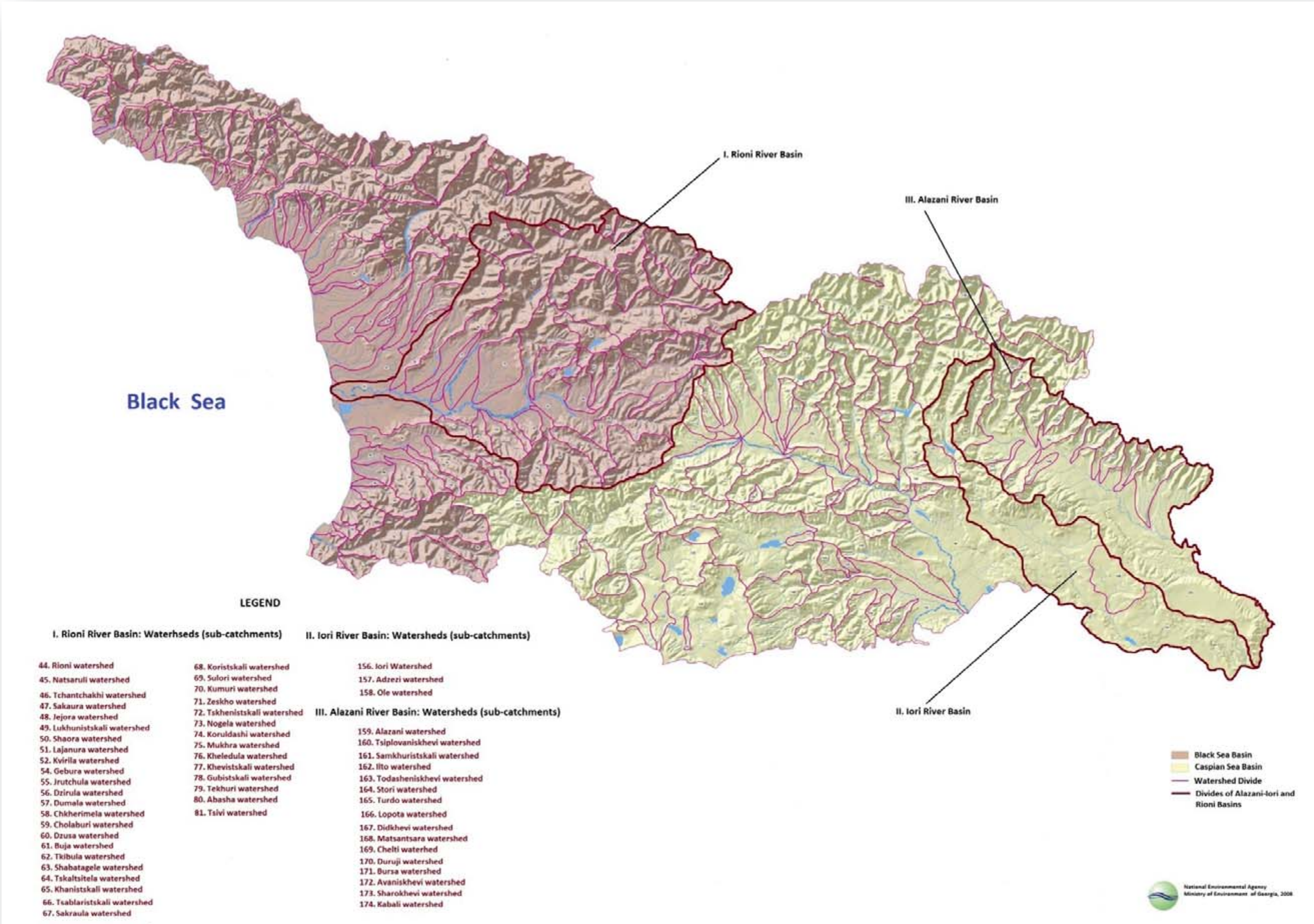


Figure 5. Flow Module of the Alazani River Basins

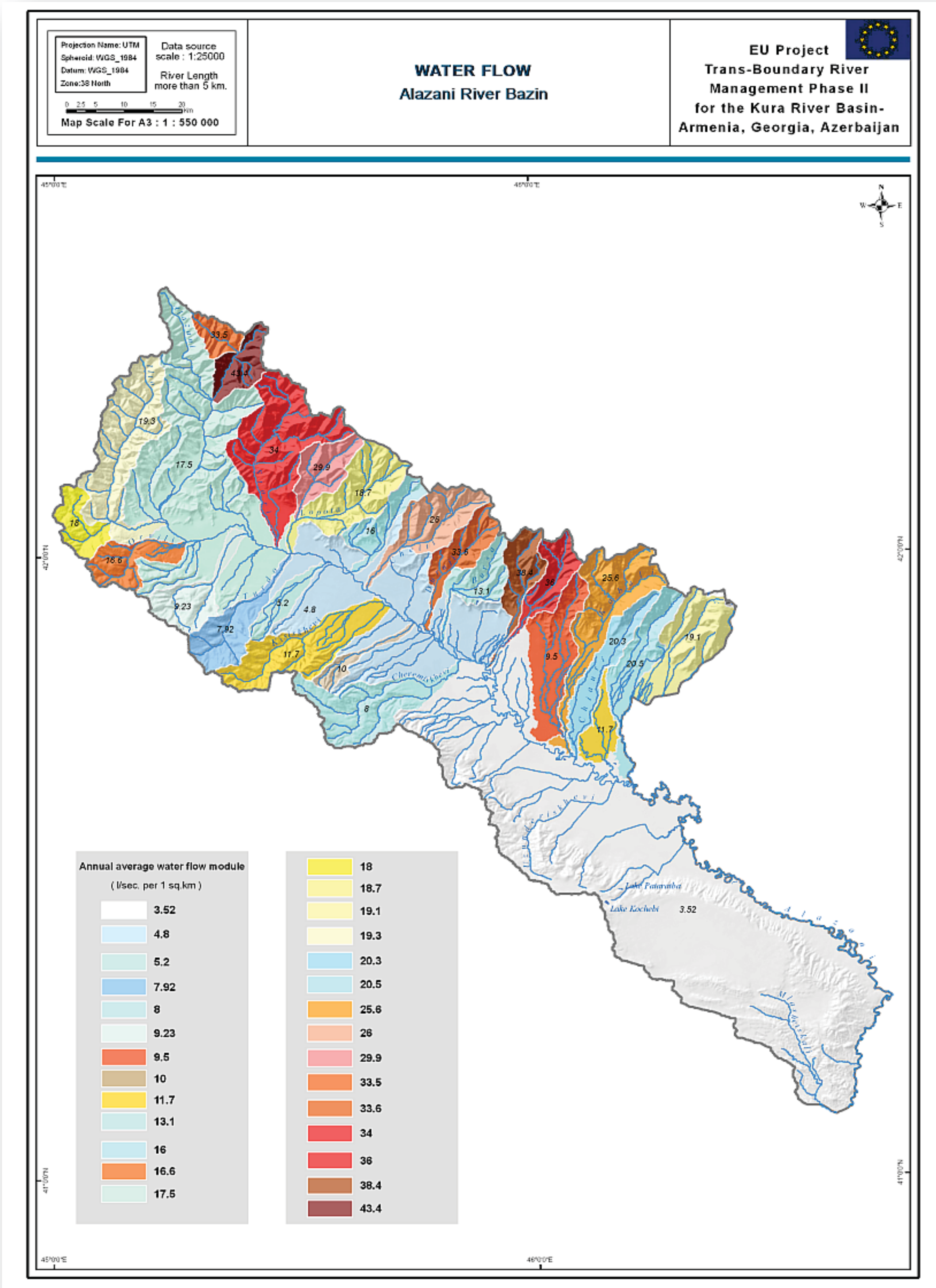


Table 1. Main Hydrological Feature of the River Alazani

Feature	Control station					
	v. Birkiani	v. Shakriani	v. Chiauri	v. Zemo Kedi	In 2 km below mouth of r. Agrichai	mouth
Area of watershed, km^2	282	2190	4530	7450	11600	11800
Average altitude of basin, m	2200	1260	980	900	-	-
Average annual flow of water m^3/sec:						
Average long-term	14.4	45.2	71.4	-	112	-
75% probability	12.6	37.6	57.2	-	91.9	-
97% probability	9.96	27.8	40	-	65.8	-
Maximum flow of water m3/sec						
Average long-term	88.0	319	395	479	397	-
1% probability	496	1086	1232	1312	1114	1133
2% probability	418	917	1040	1107	940	956
5% probability	310	679	770	820	696	708
10% probability	264	577	654	697	592	602
Minimum average monthly flow of water, m3/sec						
Average long-term	4.66	16.3	20.9	-	60.0	-
75% probability	5.50	12.4	12.4	-	50.6	-
97% probability	2.70	7.8	5.07	-	37.9	-

Table 2. Main Hydrological Feature of the River Iori

Feature	Control station					
	v. Ukugmarti	v. Orkhevi	v. Paldo	v. Salakhli	v. Usuflo	mouth
Area of watershed, km^2	498	587	970	4190	4550	4650
Average altitude of basin, m	1640	1580	1430	780		
Average annual flow of water m3/sec:						
Average long-term	10.7	11.2	18.4	17.4	15.6*	15.1*
75% probability	8.86	9.27	15.7	14.9	13.4	12.6
97% probability	6.45	6.75	11.9	11.5	10.3	9.32
Maximum flow of water m^3/sec						
Average long-term	125	114	-	119	-	-
1% probability	637*	677*	822*	804*	832	838
2% probability	537*	571*	694*	679*	702	707
5% probability	398*	423*	514*	503*	520	524
10% probability	338*	360*	437*	427*	442	445
Minimal average monthly flow of water, m3/sec						
Average long-term	1.63	1.93	-	-	-	-
75% probability	2.6	2.3	-	-	-	-
97% probability	1.8	1.2	-	-	-	-

*Value of flow is digressed due to the water abstraction for irrigation purpose

Table 3. Average Annual Run-off, m3/s, Iori, Upstream (Calculated values)

site	Provision (probablity) %						
	10	25	50	75	80	90	95
Lelovani	14.7 m3/s	12.6 m3/s	10.7 m3/s	9.12 m3/s	8.78 m3/s	7.92 m3/s	7.28 m3/s
Dam	16.0 m3/s	13.7 m3/s	11.7 m3/s	9.94 m3/s	9.57 m3/s	8.63 m3/s	7.94 m3/s

Table 4. Monthly Distribution of the River Run-off, m3/s, Iori, Upstream

%	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
25	5.61	6.13	11.8	23.2	29.1	22.4	16.1	11.8	11.3	10.1	9.68	7.18	13.7
50	4.57	4.92	9.10	22.8	26.9	21.4	12.6	9.24	8.37	7.96	7.06	5.48	11.7
75	3.64	3.83	6.82	22.0	24.8	20.5	9.56	7.02	5.97	6.10	4.96	4.08	9.94

Table 5. Main Hydrological Ffeature of the River Rioni

Feature	Control station									
	v. Gebi	v. Glola	v. Utsera	v. Oni	v. Khidikari	v. Alpana	v. Namokhvani	Up to dam of the Rioni HPP	Kutaisi	v. sakocha-kidze	Poti
Area of watershed, km^2	222	629	707	1060	2010	2230	3450	3510	3540	13300	13400
Average altitude of basin, m	2370	2420	2490	2260	2040	1810	1720	1690	1660		1084
Average annual flow of water m^3/sec:											
Average long-term	10.3	27.9	30.6	43.6	73.8	102	126	127	134	406	409
75% probability	8.61	22.7	25.6	38.2	63.3	89.4	111	111	121	357	360
97% probability	6.36	15.9	18.9	31.4	48.7	73.4	90.2	87.2	102	288	290
Maximum flow of water m^3/sec											
Average long-term	46.3	125	-	191	350	569	678	662	-	1600	-
1% probability	202	368	393	494	693	1570	1760	1790	1806	3730	3747
2% probability	176	318	341	428	601	1361	1525	1551	1565	3233	3247
5% probability	135	245	262	329	462	1047	1173	1193	1204	2487	2498
10% probability	115	208	223	280	393	890	997	1014	1023	2114	2123
Minimum average monthly flow of water, m3/sec											
Average long-term	-	5.15	-	10.7	18.8	25.4	40.5	36.1	-	-	-
75% probability	1.55	4.21	4.45	8.06	7.69	28.3	5.89	37.2	37.9	-	81.74
97% probability	1.08	2.95	3.12	5.64	2.38	9.81	25.1	26	26.5	-	53.95

Table 6. Major Hydrological Characteristics of Rivers of the Alazani River Basin

River and range of the tributary				Distanse from the mouth km	Length km	Location (districts)	Area of watershed km^2	Average altitude of the water shed m	Average annual flow of water, near the mouth m^3/sec (average long term)
The Mtkvari River (Mingechauri res.)	I	II	III						
Alazani				660	351	Akhmeta, Telavi, Kvareli, Gurjaani, Lagodekhi, Signagi, Dedoplistskali	11800	1335	112
	Tsiplovaniskhevi			351	24	Akhmeta	92	2136	3.08
	Samkuristskali			351	18	Akhmeta	121	2590	5.03
	Ilto			324	43	Akhmeta	337	1250	6.50
	Khodashniskhevi			305	31		90.6	1156	0.84
	Stori			300	38	Telavi	281	1610	9.55
	Turdo			298	28	Telavi	114	1240	1.14
	Lopota			296	33	Kvareli, Telavi	263	1400	6.58
		DiDkhevi		6	19	Telavi	94.6	1490	2.84
	Matsantsara			289	21	Telavi	50	1490	0.26
	Chelti			280	28	Kvareli	144	1420	3.74
	Duruji			268	26	Kvareli	91.2	1350	0.16 - 5.31*
	Bursa			262	27	Kvareli	84	900	0.11-0.89*
	Avaniskhevi			250	28	Kvareli	185	1590	2.98-5*
		Shoro-khevi		4	24	Kvareli	85	1270	1.12-2.72*
	Kabali			207	48	Lagodekhi	391	850	3.19-2.2*
	Matsimi			163	39	Lagodekhi	326	1008	1.08
		Lagodekhi stskali		12	31	Lagodekhi	98	1189	-

* Figures don't characterize a long-term river flow

Table 7. Major Hydrological Characteristics of River Ilto

Feature	Control station				
	gage height on 1200 m	v. Chaptala	before the mouth of Khevgrzeli	after the mouth of Khevgrzeli	Mouth
Area of watershed, km^2	27.6	178	300	308	337
Average altitude of basin, m	1900	1470	1320	1260	1250
Average annual flow of water m3/sec:					
Average long-term	1.18	4.64	6.55	6.04	6.50
75% probability	1.03	4.35	5.76	5.27	5.67
97% probability	0.82	3.45	4.57	4.18	4.50
Maximum flow of water m^3/sec					
Average long-term	-	-	-	-	-
1% probability	166	405	509	517	539
2% probability	140	342	429	436	455
5% probability	104	253	318	323	337
10% probability	88.4	215	270	274	286
Minimal average monthly flow of water, m3/sec					
Average long-term	-	-	-	-	-
75% probability	0.34	1.44	1.91	1.75	1.89
97% probability	0.19	0.82	1.09	1	1.08

Table 8. Major Hydrological Characteristics of River Stori

Feature	Control station					
	gage height on 1290 m	before mouth of Nameless river	After mouth of Nameless river	v. Lechuri	v. Pshaveli	Mouth
Area of watershed, km^2	41.0	78.4	134	203	225	281
Average altitude of basin, m	2500	2230	2200	1850	1780	1610
Average annual flow of water m3/sec:						
Average long-term	2.31	4.06	6.91	8.04	8.89	9.55
75% probability	1.93	3.39	5.78	6.96	7.43	7.98
97% probability	1.42	2.50	4.26	5.23	5.48	5.89
Maximum flow of water m^3/sec						
Average long-term	-	-	-	60.4	-	-
1% probability	202	275	355	429	450	494
2% probability	170	232	300	362	379	417
5% probability	126	172	222	268	281	309
10% probability	107	146	189	228	239	263
Minimal average monthly flow of water, m3/sec						
Average long-term	-	-	-	-	-	-
75% probability	0.74	1.30	2.21	2.93	2.93	3.15
97% probability	0.42	0.74	1.26	1.67	1.67	1.80

Table 9. Major Hydrological Characteristics of Rivers of the Iori River Basin

River and range of the tributary				Distanse from the mouth km	Length km	Location (districts)	Area of watershed km^2	Average altitude of the water shed m	Average annual flow of water , near the mouth m^3/sec (average long term)
Mtkvari River (Mingechavir res.)	I	II	III						
Iori				668	320	Tianeti, Gardabani, sagarejo, Signagi, dedoplitskaro	4650	1357	15.1
	Adzedzi			259	16	Tianeti	162	1240	2.19
	Ole			118	29	Signagi, Dedoplistskaro	395	590	0.98

Table 10. Major Hydrological Characteristics of Rivers of the Rioni River Basin

River and range of the tributary				Distanse from the mouth km	Length km	Location (districts)	Area of watershed km^2	Average altitude of the water shed m	Average annual flow of water , near the mouth m^3/sec (average long term)
Black Sea	I	II	III						
Rioni				0	327	Photi, Khobi, Senaki, Abasha, Samredia, Vani, Tskaltubo, Tsageri, Ambrolauri, Oni	13400	1084	409
	Natsarula			286	14	Oni	52	2435	2.05
	Chanchakhi			285	20	Oni	185	2500	7.77
	Sakao			270	30	Oni	169	200	7.65
	Jojora			267	50	Oni	438	1865	11.8
	Lukhunis-tskali			248	39	ambrolauri	293	1750	12.1
	Sharaula			213	22	ambrolauri	231	1340	12.0
	lajanura			209	32	Tsageri	296	1490	10.3
	Kvirila			139	140	Sachkhere, Chiatura, Zestafoni	3690	790	87.2
		Gvizga		117	19	Sachkhere	79	1348	2.28
		Gedura		113	13	Sachkhere	112	1620	3.29
		Jruchula		94	21	Sachkhere, Chiatura	210	1200	5.94

		Dzirula		47	83	Sachkhere, Kharagauli, Zestafoni	1270	850	32.4
			Dumala	28	34	Sachkhere Chiatura, Kharagauli	124	730	2.88
			Chkhe-rimela	9	39	Kharagauli, Zestajoni	490	1000	13.6
		Cholabu-ri		23	20	Terjola, Zestafoni	565	590	11.4
			Dzusa	20	25	Tkibuli, Tejola, Zestajponi	111	720	2.55
			Buja	20	42	Ambrolauri, Chiatua, Terjola, Zestafoni	186	700	4.18
			Tkibuli	2	31	Ambrilauri, Tkibuli, Terjola	146	640	7.04
		Cheshu-ra		10	15	Terjola, Tkibuli	42	375	1.76
		Tskaltsi-tela		6	49	Tkibuli, Tskaltubo, Bagdati	239	440	10.3
	Khanitskali			138	57	Bagdati	914	1180	22.8
		Tsablarst skali		24	29	Bagdati, vani	230	1600	6.16
		Sakreula		18	52	Kharagauli, Bagdati	219	1020	5.34
	Koristskali			128	28	Vani, Bagdati	178	462	0.59
	Sulori			113	34	Vani	189	800	5.9
	Kumuri			110	28	Vani	83.7	452	-
	Gubistrkali			104	36	Samtredia, Khobi, Tskatubo	442	150	16.4
	Tskhenitskali			88	176	Lentekhi tsageri khoni, Martvili, Abasha, Samtredia	2120	1660	90.4
		Zeskho		157	19	Lentekhi	150	2500	7.65
			Kordul-ashi	5	11	Lentekhi	77	2557	4.16
		Mukhra		126	13	Lentekhi	53	2351	2.46
		Kheledu-la		110	34	Lentekhi	315	2000	14.4
	Khevistskali			84	32	Chokhatauri, Samtredia	97	315	3.1
	Nogela			74	59	Abasha, Martvili	130	70	4.86
	Tekhuri			57	101	Martvili, Senaki	1040	730	43.7
		Abasha		6	66	Martvili, abasha, Senaki	350	320	11.9
	Tsivi			46	60	Martvili, Senaki	199	140	6.17

Table 11. Main hydrological characteristic of the river Tskhenitskali

Feature	Control station						
	Marked level on 1290 m	before mouth of r.Chkhorotsku	After mouth of r.Chkhorotsku	v. Salkhino	v. Nakalakevi	afer the mouth of r. Abasha	Mouth
Area of watershed, km^2	68.6	153	209	420	558	677	1040
Average altitude of basin, m	2090	1850	1750	1430	1160	970	730
Average annual flow of water m3/sec:							
Average long-term	5.95	12.2	16.3	27.3	30.2	32.4	43.7
75% probability	5.19	10.6	14.2	23.8	26.6	28.3	38.2
97% probability	4.12	8.44	11.3	18.5	20.8	22.4	30.2
Maximum flow of water m^3/sec							
Average long-term	-	-	-	-	242	-	-
1% probability	300	472	564	831	980	1086	1389
2% probability	260	410	489	720	849	941	1204
5% probability	200	315	376	554	653	724	926
10% probability	170	268	320	471	550	615	787
Minimal average monthly flow of water, m3/sec							
Average long-term	-	-	-	-	-	-	
75% probability	1.25	2.82	3.75	6.28	6.90	7.12	8.74
97% probability	0.82	1.86	2.48	4.14	4.55	4.70	5.77

Table 12. Main hydrological characteristic of the river Lukhunistskali

Feature	Control station						
	v. Luji	v. Leksuri	v. Lentekhi	v. Hagomari	v. Zubi	v.khidi	Mouth
Area of watershed, km^2	506	760	1200	1450	1700	1950	2120
Average altitude of basin, m	2240	2160	2110	2040	1930	1800	1660
Average annual flow of water m3/sec:							
Average long-term	23.0	31.9	48.4	62.8	74.0	81.7	90.4
75% probability	19.7	28.8	42.2	55.2	67.2	70.7	78.9
97% probability	15.2	24.1	33.5	44.5	57.9	59.2	62.6
Maximum flow of water m^3/sec							
Average long-term	130	-	-	321	-1173	414	-
1% probability	318	753	972	1088	1017	1287	1332
2% probability	276	653	842	942	782	1115	1154
5% probability	212	502	648	725	665	858	888
10% probability	180	427	551	616		729	755
Minimal average monthly flow of water, m3/sec							
Average long-term	5.50	-	13.4	14.8	18.2	25.5	-
75% probability	3.90	6.16	10.0	12.8	16.0	19.5	19.9
97% probability	2.73	4.31	6.97	8.93	11.2	13.6	13.9

Table 13. Main hydrological characteristic of the river Tekhuri

Feature	Control station				
	gage height on 1800 m	Marked level on 900 m	Before the mouth of r.Kheoris tskali	afer the mouth of r. Kheoritskali	Mouth
Area of watershed, km^2	21.2	180	209	257	293
Average altitude of basin, m	2370	2030	1870	1840	1750
Average annual flow of water m3/sec:					
Average long-term	0.98	8.12	9.20	11.2	12.1
75% probability	0.82	6.79	7.69	9.36	10.1
97% probability	0.60	5.01	5.68	6.91	7.46
Maximum flow of water m^3/sec					
Average long-term	-	-	-	-	-
1% probability	53.7	182	195	219	237
2% probability	46.5	157	169	190	205
5% probability	35.8	121	130	146	158
10% probability	30.4	103	110	124	134
Minimal average monthly flow of water, m3/sec					
Average long-term	-	-	-	-	-
75% probability	0.15	1.58	2.01	2.52	2.99
97% probability	0.10	1.11	1.41	1.76	2.09

Table 14. Main hydrological characteristic of the river Jojora

Feature	Control station			
	gage height 1700 m,	v. Sheubani	v. Pipileti	Mouth
Area of watershed, km^2	56	217	408	438
Average altitude of basin, m	2780	2220	1930	1865
Average annual flow of water m3/sec:				
Average long-term	3.08	7.29	11.8	12.2
75% probability	2.57	6.09	9.86	10.2
97% probability	1.9	4.5	7.28	7.52
Maximum flow of water m^3/sec				
Average long-term	-	-	49.8	-
1% probability	93.3	201	300	294
2% probability	80.9	174	260	255
5% probability	62.2	134	200	196
10% probability	52.9	114	170	167
Minimal average monthly flow of water, m3/sec				
Average long-term	-	-	-	-
75% probability	0.24	1.69	3.84	4.12
97% probability	1.18	2.69	2.88	0.17

Table 15. Main hydrological characteristic of the river Tskaltsitela

Feature	Control station				
	gage height 500m,	Upstream from mouth of the river Chala	Downstream from the mouthof the river Chala	v. Kvakhchiri	Mouth
Area of watershed, km^2	5	78	146	221	239
Average altitude of basin, m	750	520	575	480	440

Average annual flow of water m3/sec:					
Average long-term	0.26	3.53	6.82	9.72	10.3
75% probability	0.21	2.82	5.45	7.77	8.23
97% probability	0.14	1.93	3.72	5.31	5.62
Maximum flow of water m^3/sec					
Average long-term	-	-	-	-	-
1% probability	-	208	297	375	390
2% probability	-	181	257	325	338
5% probability	-	139	198	250	260
10% probability	-	118	168	212	221
Minimal average monthly flow of water, m3/sec					
Average long-term	-	-	-	-	-
75% probability	0.038	0.49	0.95	1.26	1.34
97% probability	0.018	0.22	0.44	0.58	0.62

Table 16. Main hydrological characteristic of the river Khanistskali

Feature	Control station						
	gage height 1567 m	before r. Karshaveti mouth	After r. Karshavet mouth	brfore r. tsablaratskali mouth	v. Maiakovski	v. Didvela	Mouth
Area of watershed, km^2	18.7	215	336	411	655	907	914
Average altitude of basin, m	2200	1560	1540	1430	1230	1190	1180
Average annual flow of water m3/sec:							
Average long-term	0.59	5.72	8.9	10.8	16.6	22.8	22.8
75% probability	0.52	4.99	7.77	9.43	14.5	19.9	19.9
97% probability	0.41	3.96	6.16	7.47	11.5	15.8	15.8
Maximum flow of water m^3/sec							
Average long-term							
1% probability	-	-	-	-	125	-	-
2% probability	49.9	200	256	290	374	448	453
5% probability	43.3	173	222	251	324	389	393
10% probability	33.3	133	171	193	249	299	302
Minimal average monthly flow of water, m3/sec	28.3	113	145	164	212	254	257
Average long-term	-	-	-	-	-	-	-
75% probability	0.13	1.37	2.14	2.60	3.66	5.01	5.03
97% probability	0.06	0.63	0.98	1.20	1.68	2.30	2.31

Table 17. Main hydrological characteristic of the river Kvirila

Feature	Control station						
	v. Sachkhere	t. Chiatura	v. Rkvia	v. Zestaphoni	v. Nakhshirgele	Near the mouth	Mouth
Area of watershed, km^2	533	883	1050	2490	3230	3620	3630
Average altitude of basin, m	1320	1200	1110	960	840	790	790
Average annual flow of water m3/sec:							
Average long-term	15.4	20.7	29.4	61.7	84.3	87.2	87.4

75% probability	13.2	17.8	25.4	53.4	72.9	75.4	76.3
97% probability	10.2	13.7	19.9	41.7	57.0	58.9	60.5
Maximum flow of water m^3/sec							
Average long-term	-	166	-	514	-	-	
1% probability	336	820	897	1456	1647	1792	1818
2% probability	291	711	777	1262	1427	1554	1576
5% probability	224	547	598	971	1098	1195	1212
10% probability	190	465	508	825	933	1016	1030
Minimal average monthly flow of water, m3/sec							
Average long-term	-	-	-	-			-
75% probability	3.53	5.47	6.17	12.8	13.8	14.8	14.9
97% probability	1.62	2.52	2.84	5.90	6.36	6.83	6.84

Table 18. Main hydrological characteristic of the river Dzirula

Feature	Control station						
	Marked level on 1037 m	before r. Rikotula mouth	After r. Rikotula mouth	after r. Dumala mouth	before r. Chkherimela mouth	v. Tseva	Mouth
Area of watershed, km^2	17.0	220	295	516	688	1190	1270
Average altitude of basin, m	1650	940	940	860	790	880	850
Average annual flow of water m3/sec:							
Average long-term	0.51	5.94	7.96	13.4	16.8	26.6	32.4
75% probability	0.44	5.18	6.95	11.7	14.7	23.0	28.3
97% probability	0.35	4.11	5.51	9.27	11.6	17.9	22.4
Maximum flow of water m^3/sec							
Average long-term	-	-	-	-	-	279	-
1% probability	84.9	374	442	603	902	964	990
2% probability	43.6	324	384	523	608	836	858
5% probability	56.6	249	295	402	468	643	660
10% probability	48.1	212	251	342	398	546	561
Minimal average monthly flow of water, m3/sec							
Average long-term	-	-	-	-	-	-	-
75% probability	0.12	1.13	1.51	2.27	2.83	5.62	5.51
97% probability	0.055	0.52	0.69	1.04	1.30	2.58	2.53

ANNEX 6. SOCIO-ECONOMIC CONTEXT

Figure 1.1 Map of the 2007 Population Density of Georgia

Figure 1.2 Map of the Population Density of Georgia (2009)

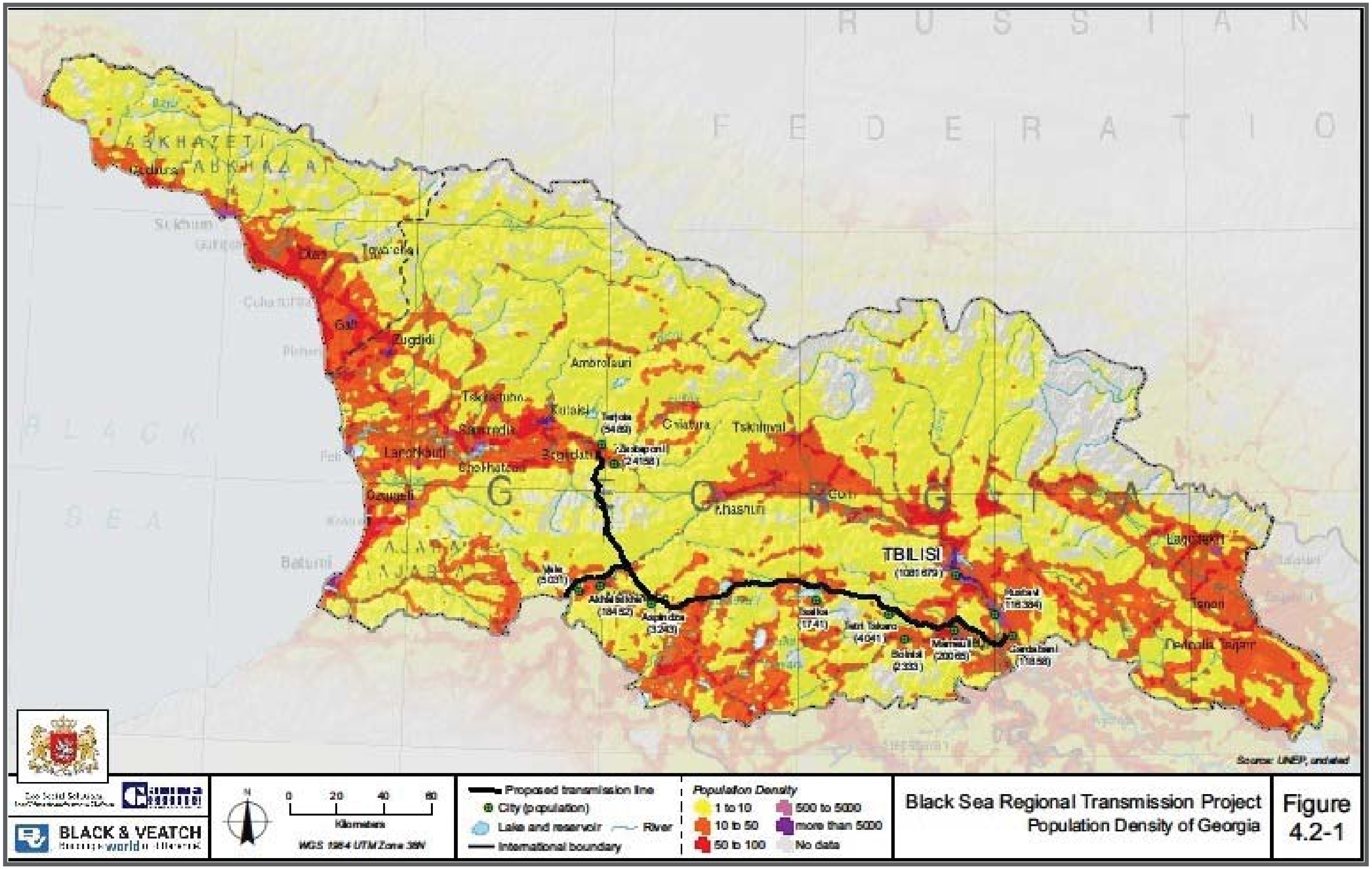


Table 1 Population size of Alazani, Iori and Rioni River Basins

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
RIONI RIVER BASIN											
Racha-Lechkhumi and Kvemo Svaneti sub-total	**52.5**	**51.7**	**51.0**	**50.2**	**49.7**	**49.1**	**49.1**	**48.6**	**48.2**	**47.7**	**47.6**
Ambrolauri municipality	16.0	16.4	16.1	15.8	15.7	15.4	15.3	15.1	14.9	14.7	14.5
Lentekhi municipality	9.8	9.2	9.0	8.9	8.8	8.8	8.9	8.9	8.9	8.9	9.0
Oni municipality	12.1	9.6	9.3	9.2	9.0	8.9	8.9	8.8	8.7	8.5	8.5
Tsageri municipality	14.6	16.5	16.6	16.3	16.2	16.0	16.0	15.8	15.7	15.6	15.6
Samegrelo-Zemo Svaneti sub-total	**179.8**	**177.7**	**186.1**	**184.8**	**183.7**	**184.0**	**186.1**	**185.6**	**185.0**	**185.0**	**186.3**
Poti	45.2	45.2	47.1	46.7	46.5	46.7	47.3	47.3	47.4	47.5	47.7
Abasha municipality	27.4	26.4	28.7	28.4	28.1	28.1	28.2	28.1	27.9	27.8	27.8
Martvili municipality	41.1	41.3	44.6	44.3	44.0	44.2	44.8	44.6	44.4	44.4	44.7
Senaki municipality	52.5	51.2	52.1	51.8	51.5	51.4	52.2	52.0	51.7	51.7	52.3
Khobi municipality	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.8
Imereti sub-total	**715.8**	**707.4**	**699.7**	**694.9**	**690.2**	**689.0**	**700.1**	**697.6**	**694.2**	**693.5**	**700.4**
Kutaisi	190.7	187.5	186.0	184.7	183.8	184.5	190.1	189.7	188.6	188.6	192.5
Bagdati municipality	29.9	29.5	29.2	29.0	28.7	28.4	29.0	28.8	28.6	28.5	28.7
Vani municipality	35.6	34.9	34.5	34.3	34.0	33.9	34.2	33.9	33.7	33.7	33.8
Zestaphoni municipality	78.3	76.9	76.2	75.7	75.2	75.0	75.6	75.4	75.2	75.1	75.4
Terjola municipality	48.5	46.0	45.5	45.2	44.8	44.7	45.3	45.1	44.8	44.7	45.0
Samtredia municipality	62.5	61.2	60.5	60.1	59.7	59.6	60.4	60.2	59.9	59.8	60.3
Sachkhere municipality	44.6	47.4	46.8	46.5	46.2	46.2	46.4	46.5	46.6	46.9	47.3
Tkibuli municipality	32.8	32.4	31.2	30.9	30.6	30.3	30.6	30.4	30.2	30.0	30.1
Tskaltubo municipality	75.3	74.5	73.9	73.4	72.9	72.7	73.9	73.6	73.2	73.0	73.6
Chiatura municipality	58.5	57.0	56.3	55.9	55.5	55.2	55.6	55.3	55.0	54.8	55.0
Kharagauli municipality	25.9	28.2	27.9	27.7	27.5	27.3	27.6	27.5	27.4	27.4	27.5
Khoni municipality	33.2	31.9	31.7	31.5	31.3	31.2	31.4	31.2	31.0	31.0	31.2
Guria sub-total											**1.7**
Chokhatauri municipality (Kokhnati community)			1.7								
TOTAL											**936.0**
ALAZANI RIVER BASIN											
Kakheti Region											
Akhmeta municipality	40.6	41.9	41.6	41.2	40.9	40.8	41.7	41.6	41.5	41.5	42.0

Gurjaani municipality (excluding Kachreti, Jimiti and Naniani)	72.8	73.1	72.6	71.9	71.5	70.9	70.9	70.5	70.2	69.9	63.5
Dedoflistskaro municipality (excluding Mirzaani, Japharidze)	32.0	31.0	30.8	30.5	30.3	30.2	30.8	30.6	30.3	30.2	29.8
Telavi municipality	74.1	71.1	70.6	70.0	69.7	69.5	70.6	70.4	70.0	69.8	70.5
Lagodekhi municipality	49.3	51.4	51.1	50.7	50.4	50.4	50.9	51.0	51.1	51.3	51.8
sagarejos municipality	58.0	59.8	59.2	58.7	58.3	58.4	58.8	58.8	58.7	59.0	59.4
Signagi municipality (excluding Bodbe, Ulianovka)	44.6	43.9	43.6	43.3	43.0	42.8	43.9	43.6	43.1	42.8	38.4
Kvareli municipality	41.2	38.0	37.7	37.5	37.2	36.9	37.2	37.1	37.0	36.9	37.1
TOTAL											**392.5**
IORI RIVER BASIN											
Kakheti Region sub-total											**71.4**
Gurjaani municipality(Kachreti, Jimiti and Naniani)			6.443								6.443
Dedoplistsaro municipality (Mirzaani, Japaridze)			0.7								0.7
Sagarejo municipality	58.0	59.8	59.2	58.7	58.3	58.4	58.8	58.8	58.7	59.0	59.4
Signagi municipality (Bodbe, Ulianovka)			4.9								4.9
Mtskheta-Mtianeti region sub-total											**13.2**
Tianeti municipality	14.2	14.1	14.0	13.9	13.3	13.2	13.4	13.3	13.1	13.1	13.2
Kvemo Kartli region region sub-total											**10.6**
Gardabani municipality (Sartichala Muganlo)			10.6								10.6
TOTAL											**95.2**

Figure 2. Population Density of the Alazani River Basin

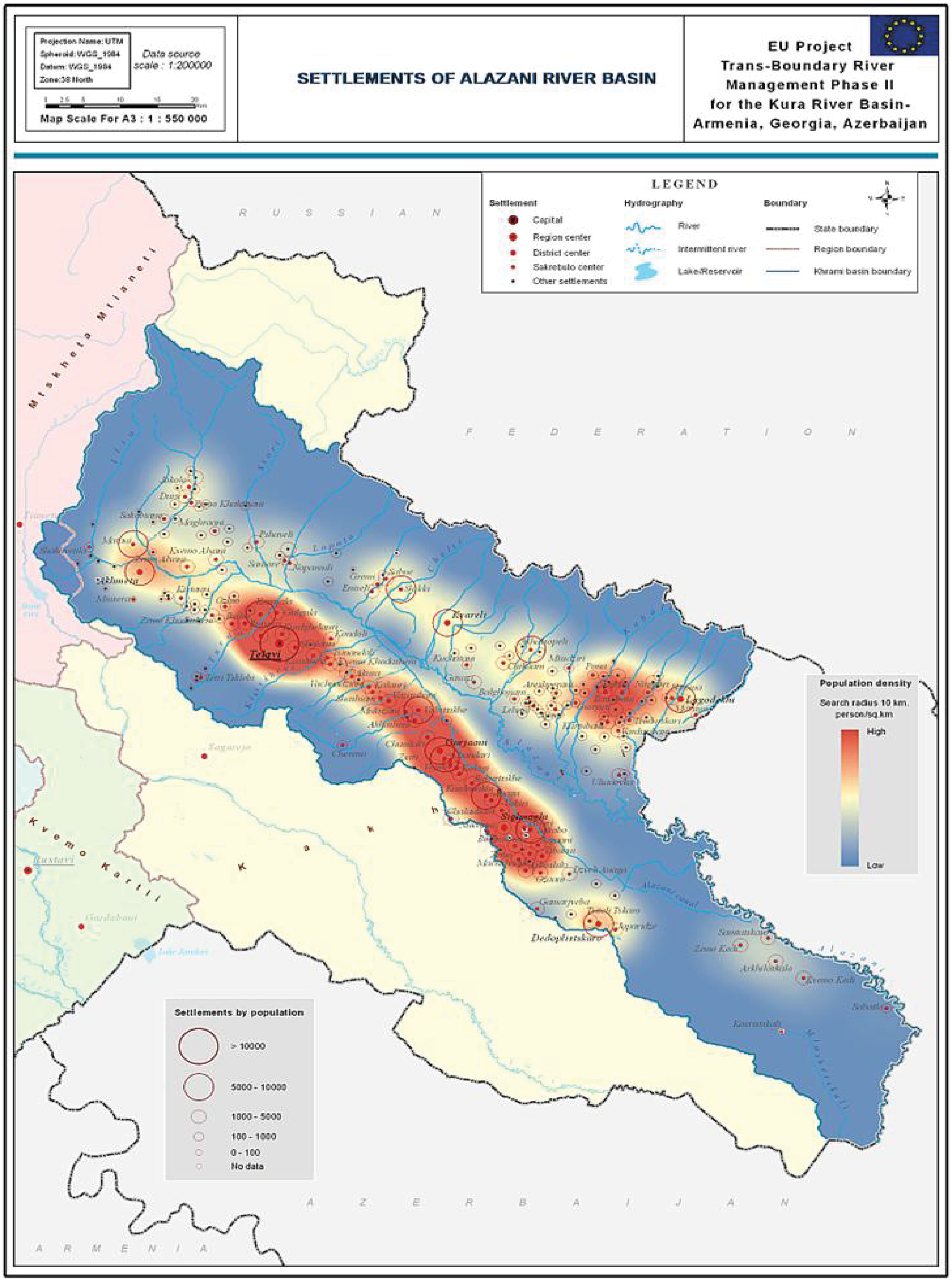


Figure 3. Poverty Level in Georgia

Region	Poverty Level, %
Kakheti	50.2
Tbilisi	30.2
Shida Kartli	47.2
Kvemo Kartli	52.5
Samtskhe-Javakheti	32.6
Adjara	52.5
Guria	47.8
Samegrelo	41.1
Imereti	31.4
Mtskheta-Mtianeti	52.2

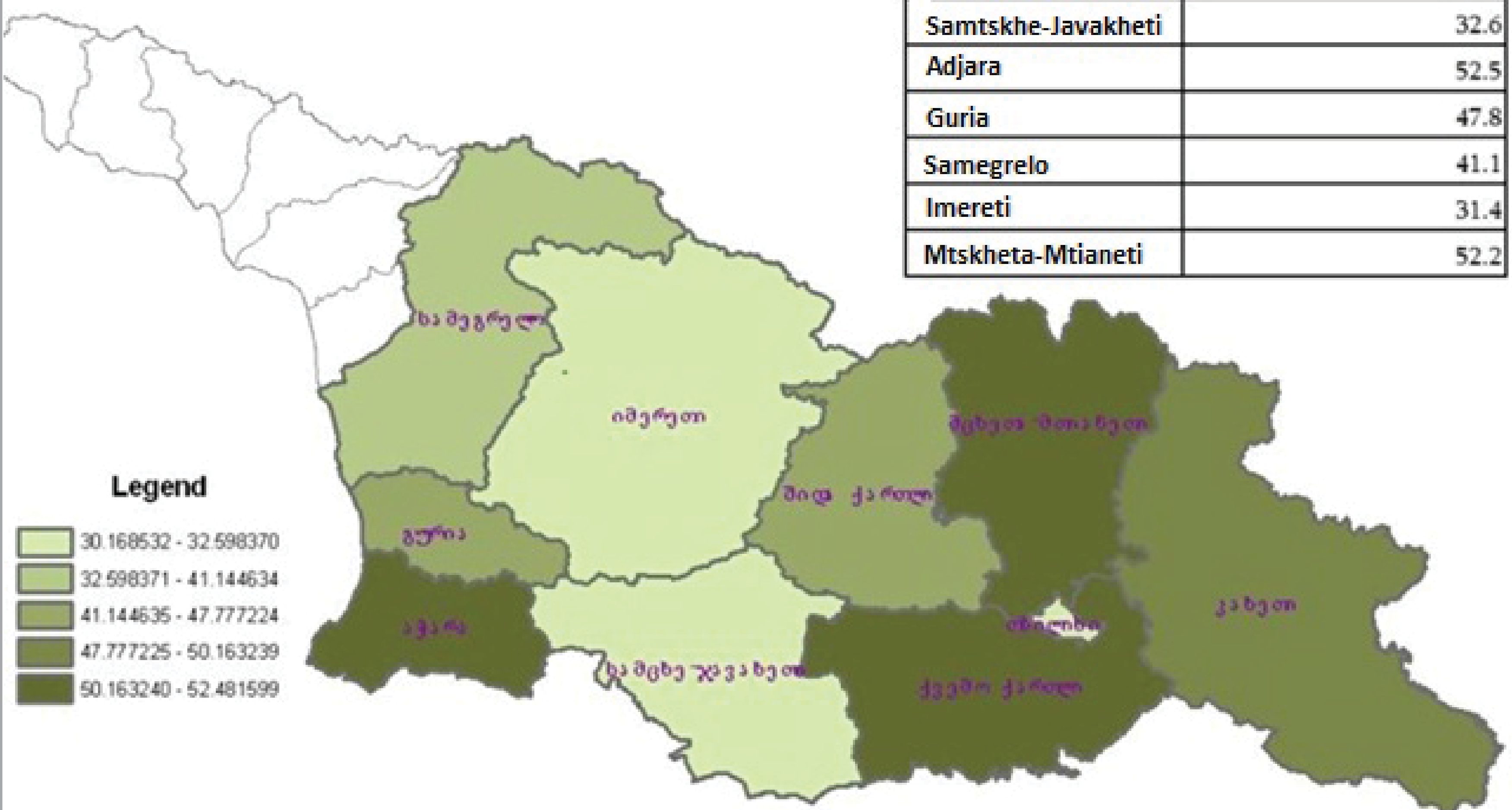
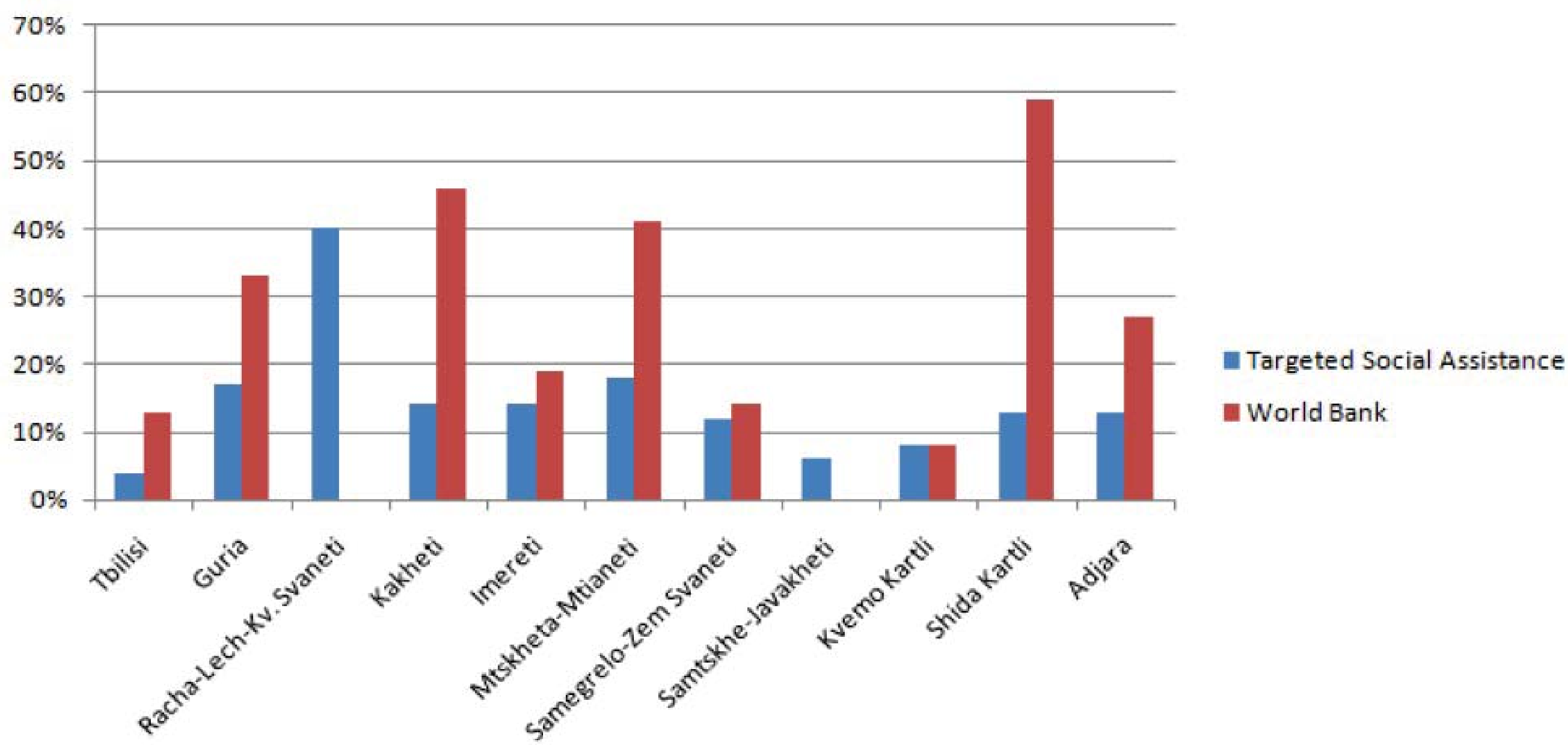
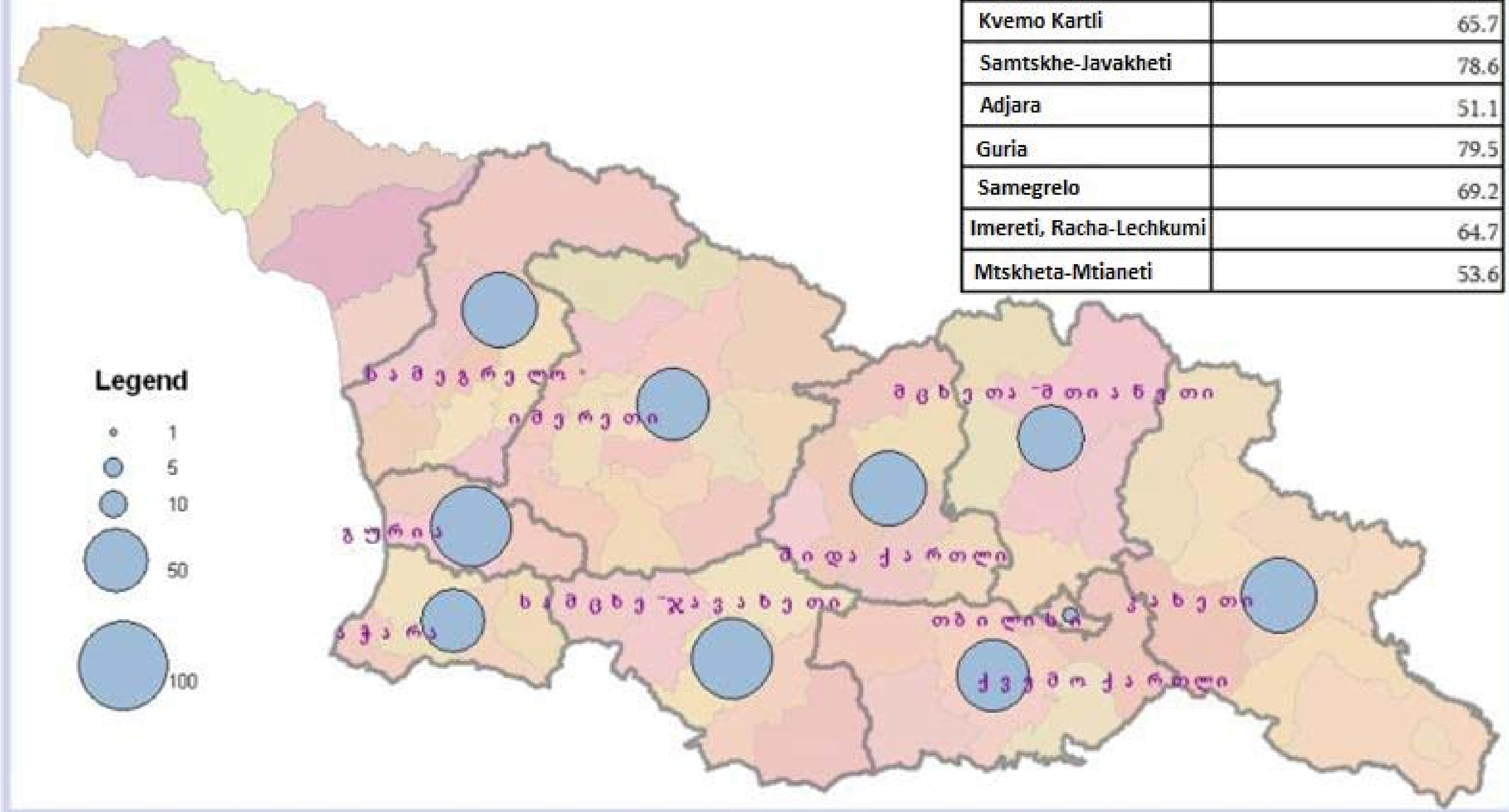


Figure 4. Percentage of Households Receiving Targeted Social Assistance Compared to Percentage of Households Counted as "Poor"



Reference: Based on World Bank LSMS (2007) and Targeted Social Assistance Figures (2009)

Figure 5. Agriculture % Share of Total Employment



Region	Agriculture % share
Kakheti	72.9
Tbilisi	2.8
Shida Kartli	69.9
Kvemo Kartli	65.7
Samtskhe-Javakheti	78.6
Adjara	51.1
Guria	79.5
Samegrelo	69.2
Imereti, Racha-Lechkumi	64.7
Mtskheta-Mtianeti	53.6

Figure 6. Land Tenure in the Aknmenta District

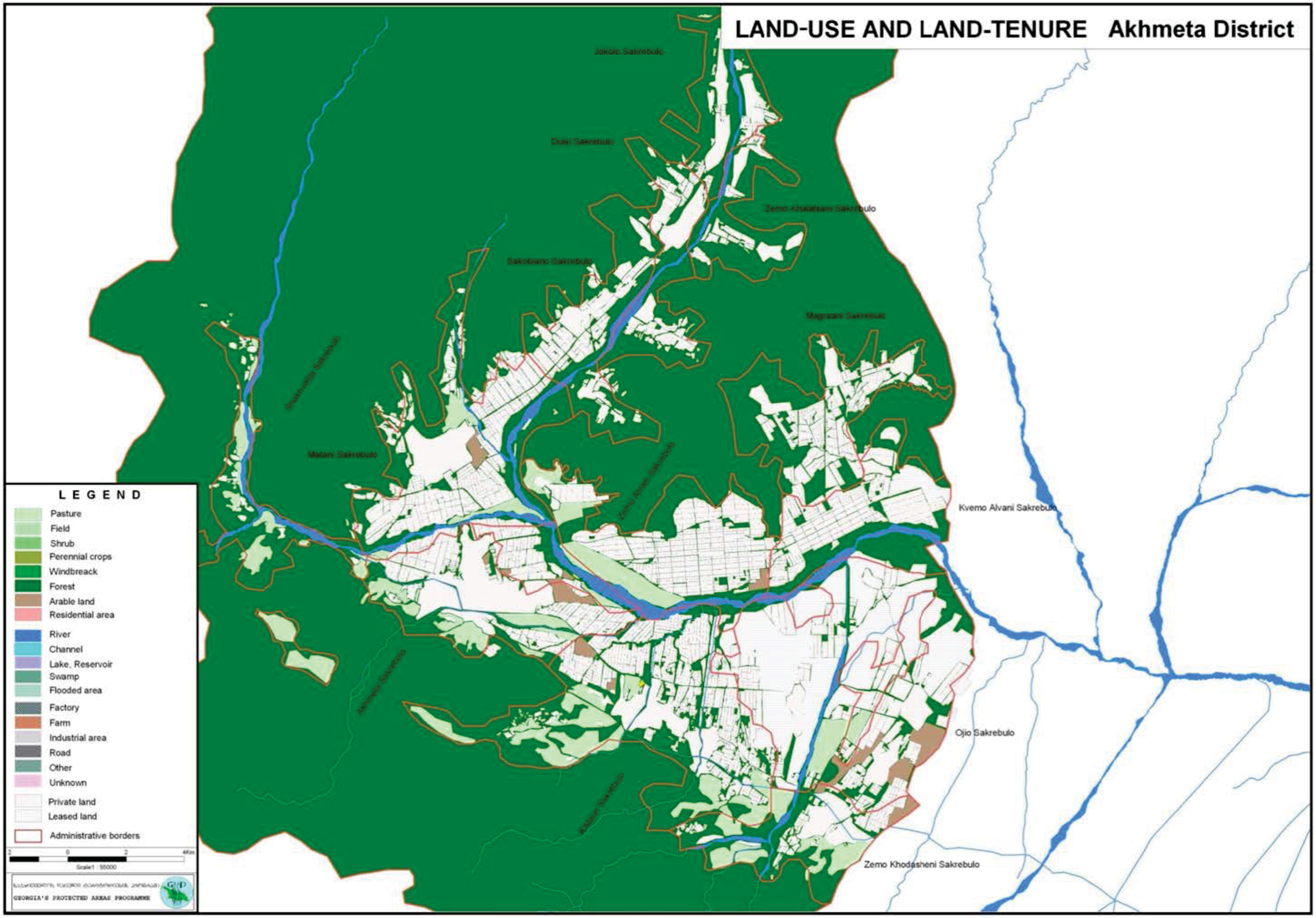


Figure 7. Land Tenure in Telavi District

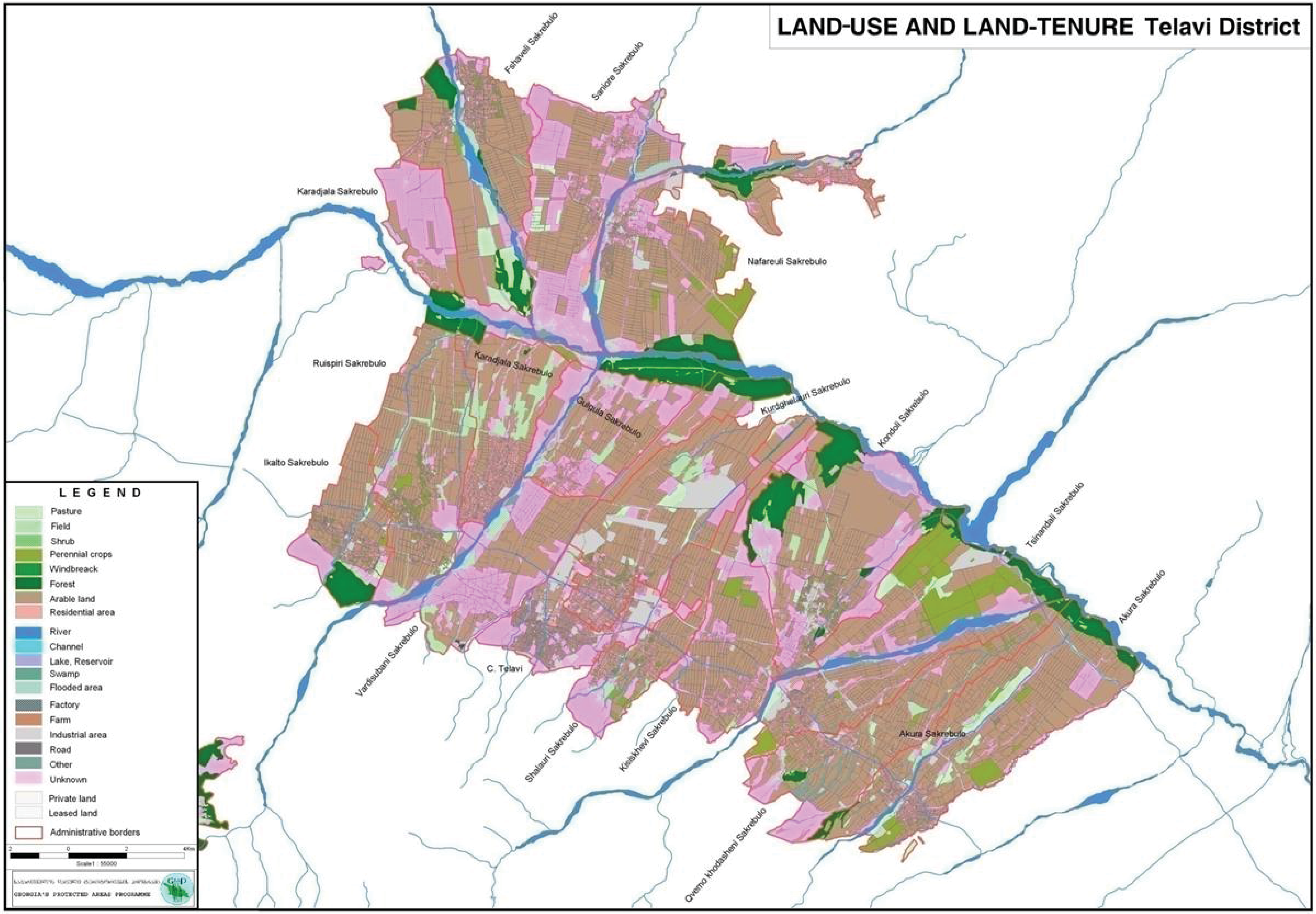


Figure 8. Land Tenure in Kvareli District

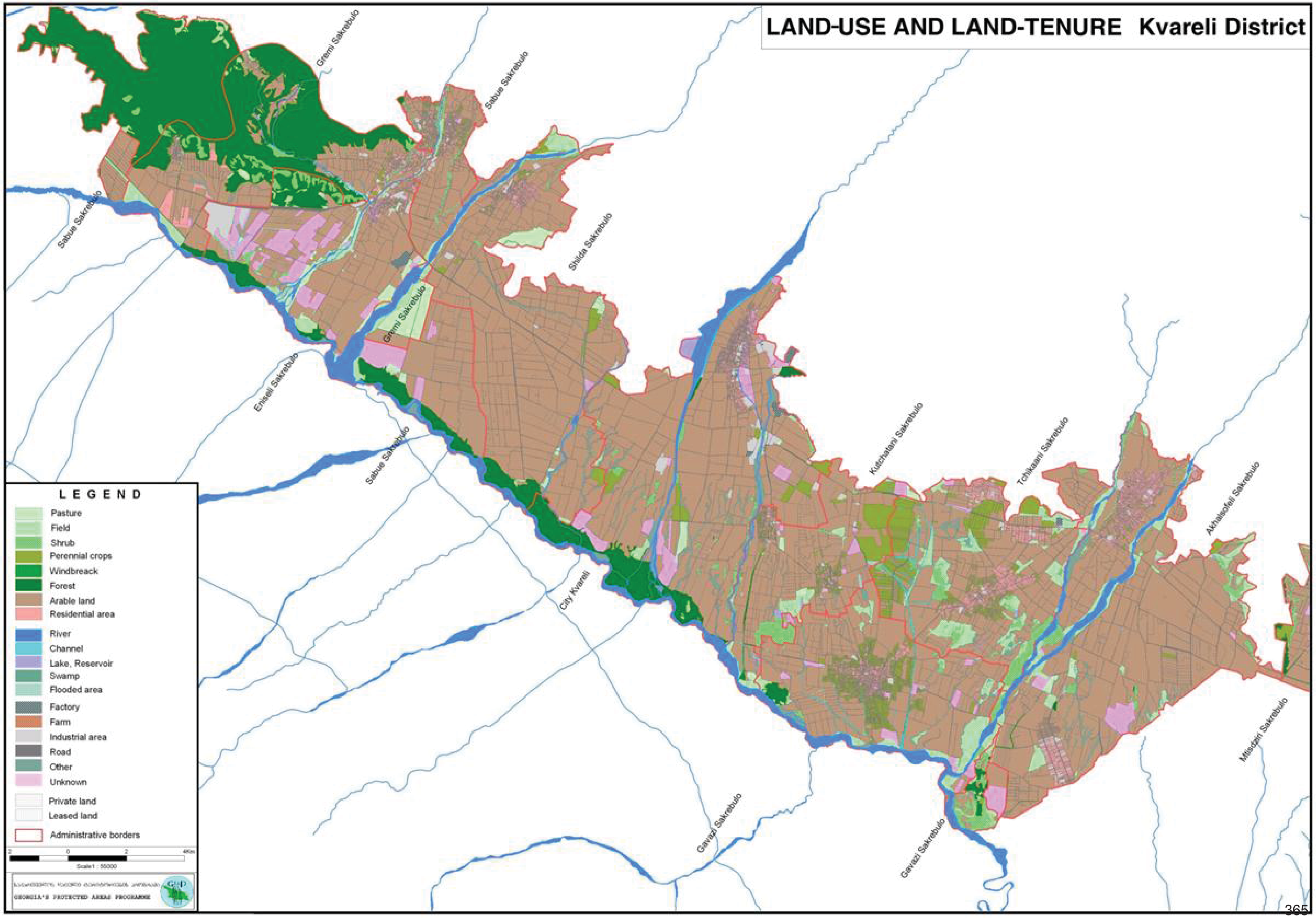


Figure 9. Land Tenure in Lagodekhi District

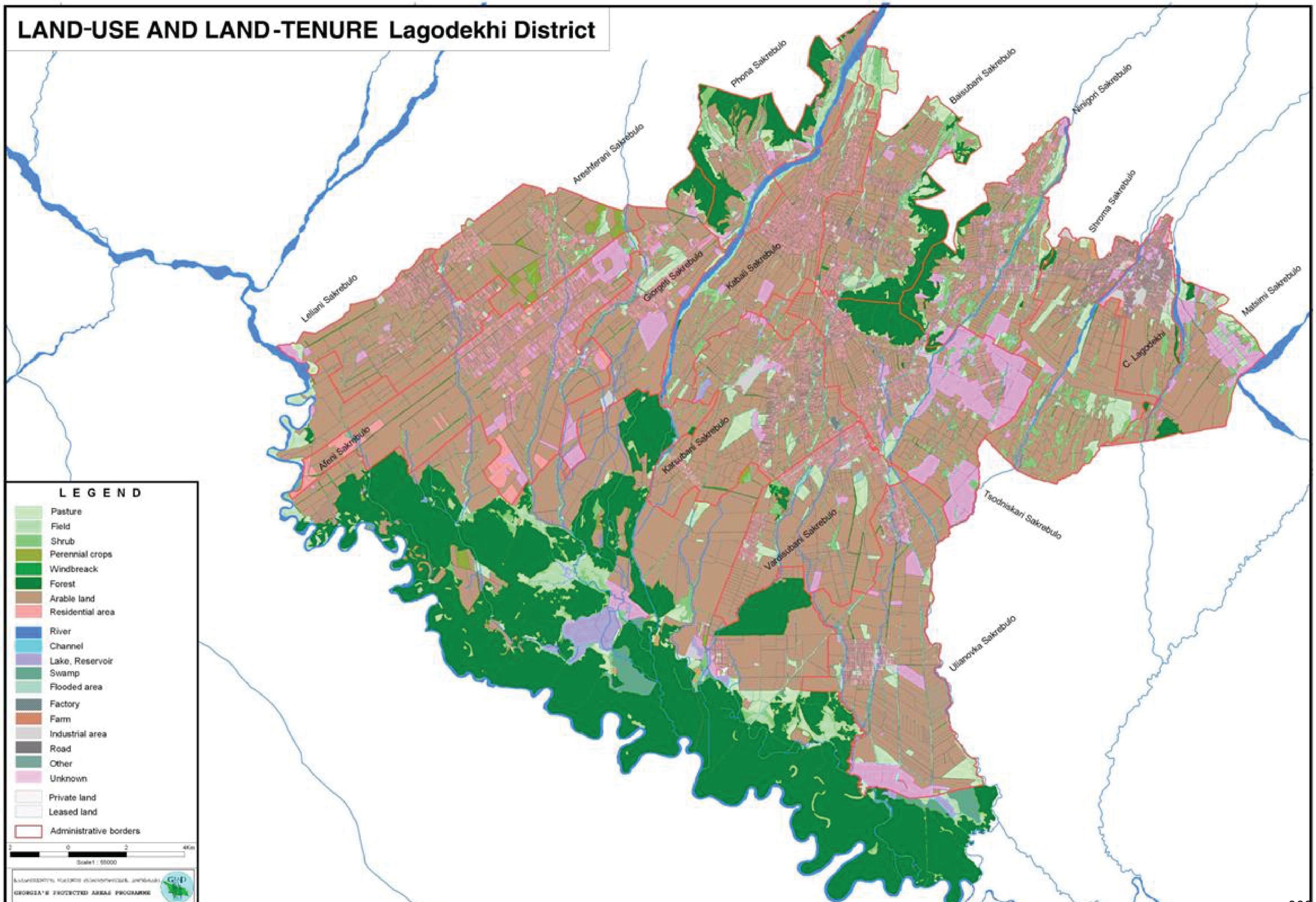


Figure 9. Land Tenure in Dedoplistskaro District

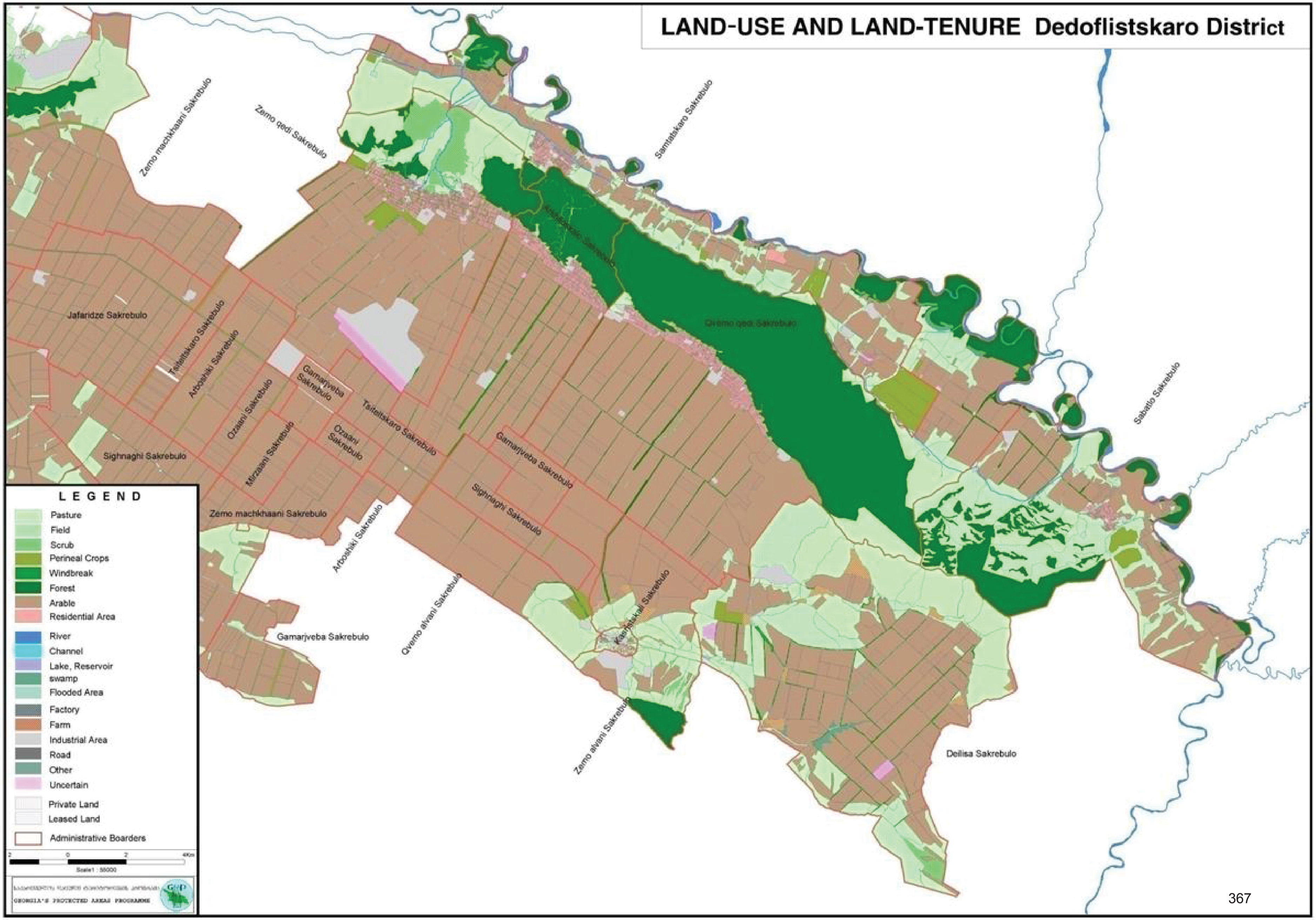


Table 2. Sown Areas in Holdings of all Categories by Districts (hectares)

Districts	2004	2005
ImereTi	**72082**	**71371**
Tkibuli	3162	3161
Tskaltubo	11665	12424
Chiatura	6652	6538
BaRdaTi	4817	4654
Vani	5720	5201
Zestaphoni	6228	5748
Terjola	7408	8020
Samtredia	8062	8477
Sachkhere	7796	6658
Kharagauli	4703	4683
Khoni	5869	5807
Samegrelo and Zemo Svaneti	**54,314**	**56068**
Abasha	10568	10631
Martvivli	8190	8712
Senaki	7735	7676
Khobi	9397	10400
Guria		
Chokhatauri	4139	3829
Rachalechkhumi-qvemo svaneti	8280	5999
ambrolauri	3400	1504
Lentekhi	972	624
Oni	1067	1126
Tsageri	2841	2745
Mtsekheta -Mtianeti		
Tianeti	6556	3040
kvemo Kartli		
Gardabani	27585	26902
Kakheti	**140770**	**152171**
Akhmeta	14015	13166
Gurjaani	13027	15400
Dedoplistskaro	43405	45520
Telavi	8668	7586
Lagodekhi	14812	13028
Sagarejo	15682	18673
Signagi	22453	29118
Kvareli	8708	9680

Table 3. Production of Cereals and Beans

	Cereals and Beans, Total							
Districts	Sown area, ha		Harvested area, ha		Harvest, tons		Average yield, t/ha	
	2004	2005	2004	2005	2004	2005	2004	2005
Imereti	**62616**	**62684**	**61718**	**62438**	**129063**	**135530**	**2.1**	**2.2**
Tkibuli	3042	3041	2980	3041	5090	6167	1.7	2.2
Tskaltubo	8698	8924	8698	8924	15401	12908	1.8	1.4

Chiatura	6290	6115	6290	6105	11563	10239	1.8	1.7
Bagdati	4519	4366	4507	4365	10368	10882	2.3	2.5
Vani	4375	4254	4375	4254	12460	9735	2.8	2.3
Zestaphoni	5495	5363	5478	5335	9795	21933	1.8	4.1
Terjola	6750	7360	6650	7160	13290	18080	2	2.5
Samtredia	7152	7795	7152	7788	15970	11311	2.2	1.5
Sachkhere	6856	5920	6856	5920	13648	12182	2	2.1
Kharagauli	4220	4200	4220	4200	8078	7780	1.9	1.9
Khoni	5219	5346	452	5346	13400	14313	3	2.7
Samegrelo and Zemo Svaneti								
Abasha	9731	9977	9731	9977	8769	18138	0.9	1.8
Martvili	7990	8404	7990	8393	13587	11866	1.7	1.4
Senaki	7051	7098	7051	7098	14741	14428	2.1	2
Khobi	8660	9620	8660	9620	23775	29199	2.7	3
Guria								
Chokhatauri	3639	3429	3639	3375	5057	5498	1.4	1.6
Racha-lechkhumi qvemo svaneti	6912	5040	6912	4934	9495	12496	1.4	2.5
Ambrolauri	3050	1339	3050	1335	4076	5105	1.3	3.8
Lentekhi	554	410	554	328	522	303	0.9	0.9
Oni	615	681	615	661	393	1313	0.6	2
Tsageri	2693	2610	2693	2610	4504	5775	1.7	2.2
Mtsekheta -Mtianeti								
Tianeti	2720	1749	2720	1676	3611	2329	1.3	1.4
kvemo Kartli								
Gardabani	12855	11041	12580	11041	24175	21977	1.9	2
Kakheti	87681	93472	85161	93159	172078	189513	2	2
Akhmeta	11080	9576	9900	9552	20460	21155	2.1	2.2
Gurjaani	7012	5850	6637	5850	11938	11370	1.8	1.9
Dedoplistskaro	23968	27400	23862	27340	43951	51447	1.8	1.9
Telavi	5866	5303	5864	5303	17672	14515	3	2.7
Lagodekhi	**9254**	**7412**	**9166**	**7293**	**24169**	**16344**	**2.6**	**2.2**
Sagarejo	**9470**	**12821**	**9470**	**12820**	**13608**	**22014**	**1.4**	**1.7**
Signagi	**14380**	**18600**	**14124**	**18600**	**28298**	**37660**	**2**	**2**
Kvareli	**6651**	**6510**	**6138**	**6401**	**11982**	**15008**	**2**	**2.3**

Table 4. Fruit Production

Districts	Fruit Production (tons)	
	2004	**2005**
Imereti	**27121**	**50573**
Tkibuli	1364	2736
Tskaltubo	3157	6242
Chiatura	1896	4124
BagdaTi	2183	4150
Vani	2116	4592
Zestaphoni	2635	4604

Terjola	3441	6720
Samtredia	617	3525
Sachkhere	6082	6742
Kharagauli	2581	4867
Khoni	1049	2271
Samegrelo and Zemo Svaneti		
Abasha	453	1401
Martvili	6262	7025
Senaki	459	848
Khobi		
Guria	2019	2604
Chokhatauri	3721	5260
Racha-lechkhumi qvemo svaneti	1876	4828
Ambrolauri	763	2690
Lentekhi	270	238
Oni	160	360
Tsageri	683	1540
Mtsekheta -Mtianeti		
Tianeti	2136	3338
kvemo Kartli		
Gardabani	1076	2154
Kakheti	12067	22254
Akhmeta	1809	1855
Gurjaani	1669	2978
Dedoplistskaro	562	895
Telavi	2819	2922
Lagodekhi	1525	2273
Sagarejo	1021	3146
Signagi	2246	2613
Kvareli	416	5572

Table 5. Meat Production

Districts	Meat Production (in-slaughtered weight), tons														Livestock Numbers as of 1 January							
	Meat, total		of which												Of which							
			Beef		Pork		Mutton		All kinds of poultry		Rabbit		Other kinds of livestock		Cattle		Milkers		Pigs		Sheep and goats	
Year	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Imereti																						
Total	20716	20092	9776	9005	7319	7408	384	483	3137	3101	88	63	12	32	269459	271984	143515	141342	103237	99713	45016	39477
Kutaisi	98	154	44	95	30	34	4	2	20	23					2000	1268	1600	1125	500	344	210	126
Tkibuli	813	639	318	164	419	387	11	10	63	77	2	1			9928	10591	4945	7533	4438	4996	732	739
Tskaltubo	2798	2933	1599	1552	814	929	24	49	348	394	11	5	2	4	45950	47356	20665	21252	18261	12140	5530	3118
Chiatura	2178	1940	1005	762	776	761	70	104	317	306	10	6		1	2798	2680	11430	11135	9800	9544	8950	9236
BagdaTi	1324	1282	483	454	571	549	36	36	226	234	8	7		2	16959	16765	7890	7725	7281	7326	3355	2986
Vani	1724	1451	792	514	666	662	37	42	216	222	13	8		3	22400	27132	9900	10507	8140	9537	3670	3620
Zestaphoni	2378	2287	1083	918	692	779	34	45	559	536	10	8		1	26919	26383	14926	14850	9911	11583	4249	3671
Terjola	2401	2532	1121	1281	874	823	51	67	345	349	10	11		1	34147	33734	23773	22098	10286	11756	6915	4749
Samtredia	1870	1889	925	979	633	618	26	21	277	262	4	1	5	8	22830	20575	14234	12960	8299	5732	1728	1785
Sachkhere	1822	1785	817	765	642	719	63	72	288	220	12	8		1	20477	24412	12735	12762	8560	10833	6548	6070
Kharagauli	1702	1388	955	725	594	504	19	20	128	129	6	7		3	20985	21387	9020	9385	8000	6967	1700	1868
Khoni	1608	1812	634	796	608	643	9	15	350	349	2	1	5	8	18883	15531	12397	10010	9761	8355	1229	1479
Samegrelo and Zemo Svaneti																						
t. Poti															1800	1760	1400	1443	1200	1301	100	45
Abasha	5158	2260	884	1004	974	879	2	2	293	363			5	12	23807	21839	12791	12909	17120	10500	101	247
Martvili	2599	2822	1070	1005	1037	1218	36	61	450	528			6	10	30830	30681	15260	15626	21426	21645	5086	5674
Senaki	2583	2136	1090	656	1219	1078	20	34	250	360		2	4	6	23005	24855	13495	11130	16233	17631	2896	3094
Khobi	2443	2776	850	1082	1029	1051	10	14	550	623			4	6	24900	26666	17150	18627	15735	16670	1250	1195
Guria																						
Chokhata-uri	1413	1133	515	333	684	540	41	63	173	194				3	15110	15927	7460	7772	9920	4689	5080	5948

Racha-lechkhumi qvemo svaneti																						
Total	3151	3112	1448	1296	1403	1493	32	45	257	267	7	5	4	6	41528	38095	22185	21237	24847	19991	4571	3299
Ambrolauri	876	776	414	382	381	295	8	9	72	88	1	1		1	10445	9978	6603	6454	4647	2228	914	583
Lentekhi	730	718	371	318	293	340	5	6	60	52	1			2	11980	9673	5245	5268	8398	5691	746	343
Oni	558	521	281	177	241	313	2	3	33	26	1	1		1	6473	5594	3447	2888	4672	3849	261	213
Tsageri	987	1097	382	419	488	545	17	27	92	101	4	3	4	2	12630	12850	6890	6627	7130	8223	2650	2160
Mtsekheta -Mtianeti																						
Tianeti	666	851	166	353	411	387	30	48	58	61	1	1		1	8553	8882	6354	7257	5589	5753	3264	5135
kvemo Kartli																						
Gardabani	4653	5074	1754	1908	152	221	656	749	2075	2173	16	14		9	46940	48607	25936	27955	2214	5063	58890	72168
Kakheti																						
Total	17290	17904	5916	5530	6479	6249	2587	3300	2206	2712	99	77	3	36	130645	135766	79861	81685	84677	74618	291369	286062
Akhmeta	2985	2991	973	924	1080	1017	652	700	269	343	11	4		3	22700	22604	12850	12127	12500	13580	59000	63399
Gurjaani	1201	1147	521	352	362	380	183	239	123	156	12	12		8	8113	8377	6338	6196	5182	5784	18278	23541
Dedoplis-tskaro	1961	2077	675	694	854	846	296	339	153	187	10	10		1	18540	15232	8700	6444	12300	8024	33200	26132
Telavi	2407	2328	672	523	1081	1036	252	368	387	384	15	11		6	13742	14991	9222	8939	13793	11628	31022	33386
Lagodekhi	2305	2437	880	809	870	910	212	266	324	435	16	10	3	7	22238	24787	14701	15372	11165	12075	23190	23402
Sagarejo	2710	2901	999	849	697	597	558	845	442	595	14	10		5	23933	29491	12667	16510	6847	6893	69783	78067
Signagi	1156	1590	528	851	235	250	243	266	137	210	13	12		1	9800	8392	6700	4062	3480	3530	30000	16539
Kvareli	2565	2433	668	528	1300	1213	218	277	371	402	8	8		5	11579	11892	8683	8035	19410	13104	26896	21596

ANNEX 7. TRANSPORT, POWER AND HEAT INFRASTRUCTURE

Figure 1. TRACECA Corridor of Georgia

Figure 2. Whole TRACECA Corridor

Figure 3. North-South Corridor

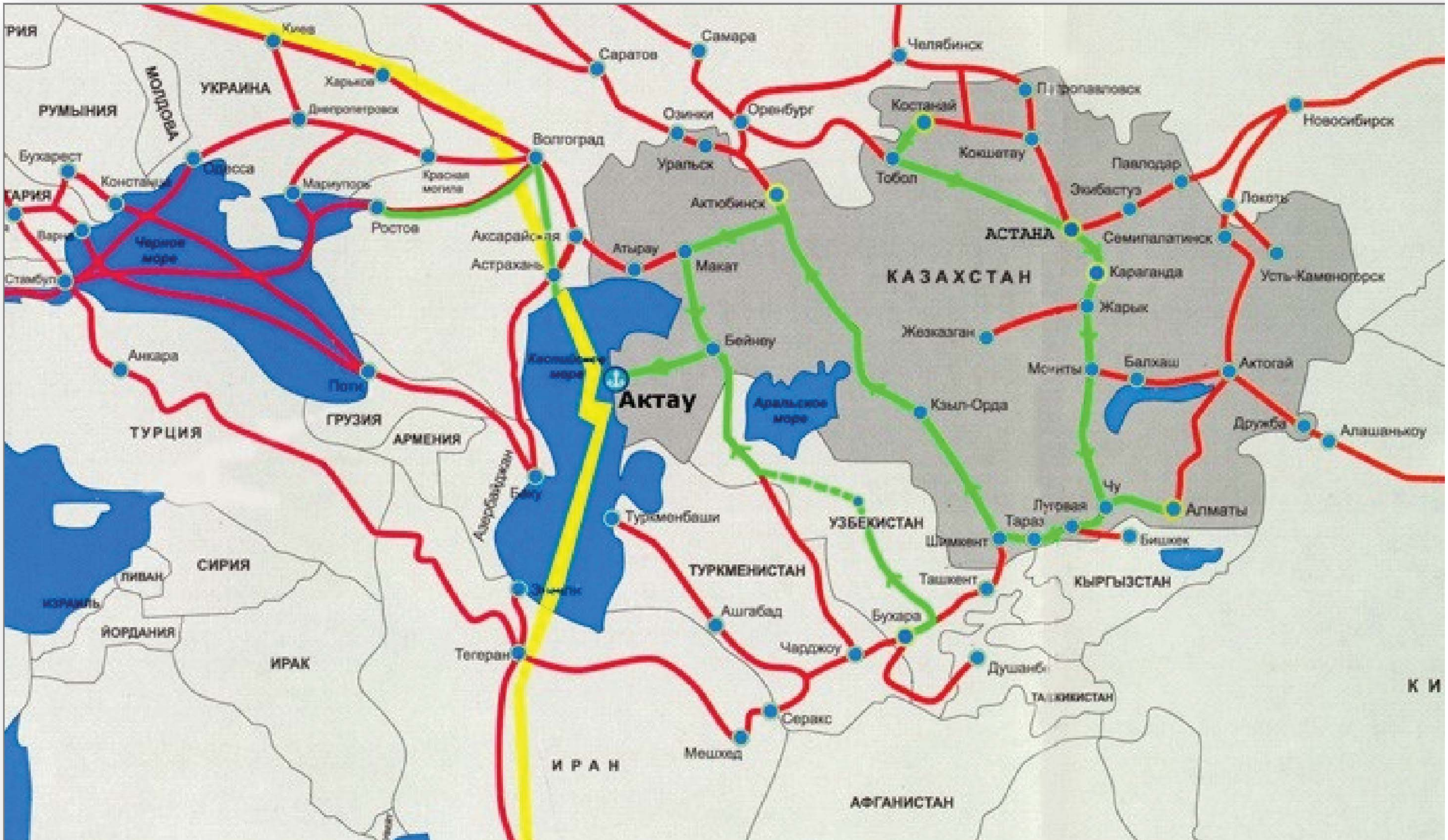


Figure 4. Poti Port Throughput

Figure 5. Dynamics of Container Handling (2000-2010) in Poti Port

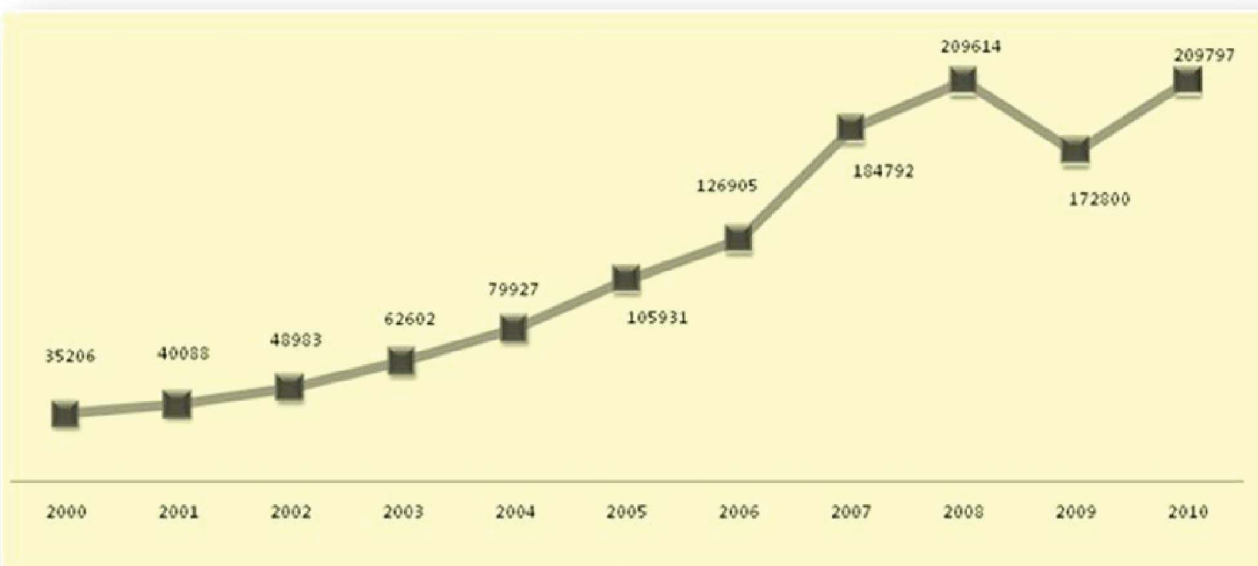


Figure 6. Power System of Georgia

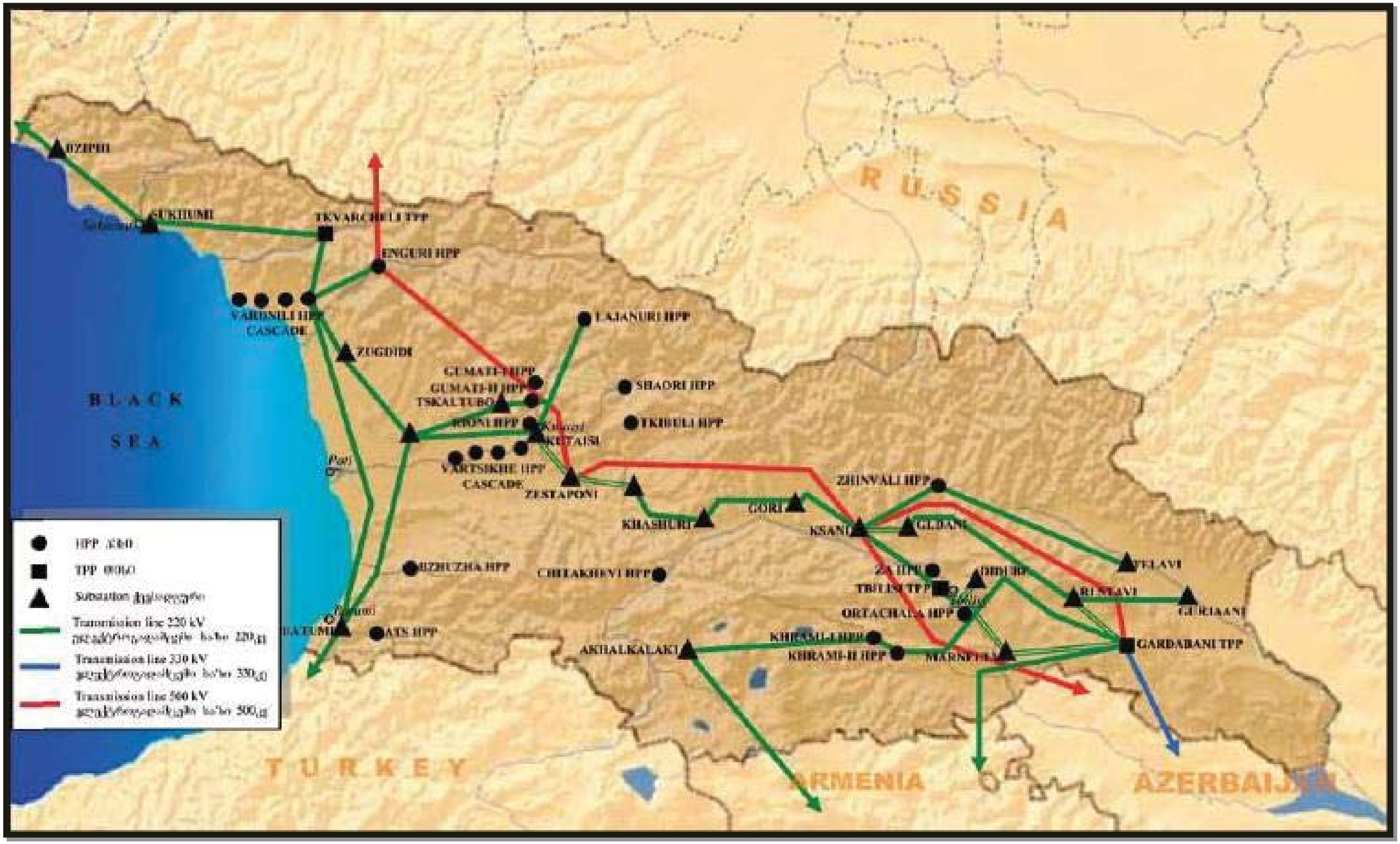


Figure 7. Shceme of the 500/400 High Voltage Transmission Lnes

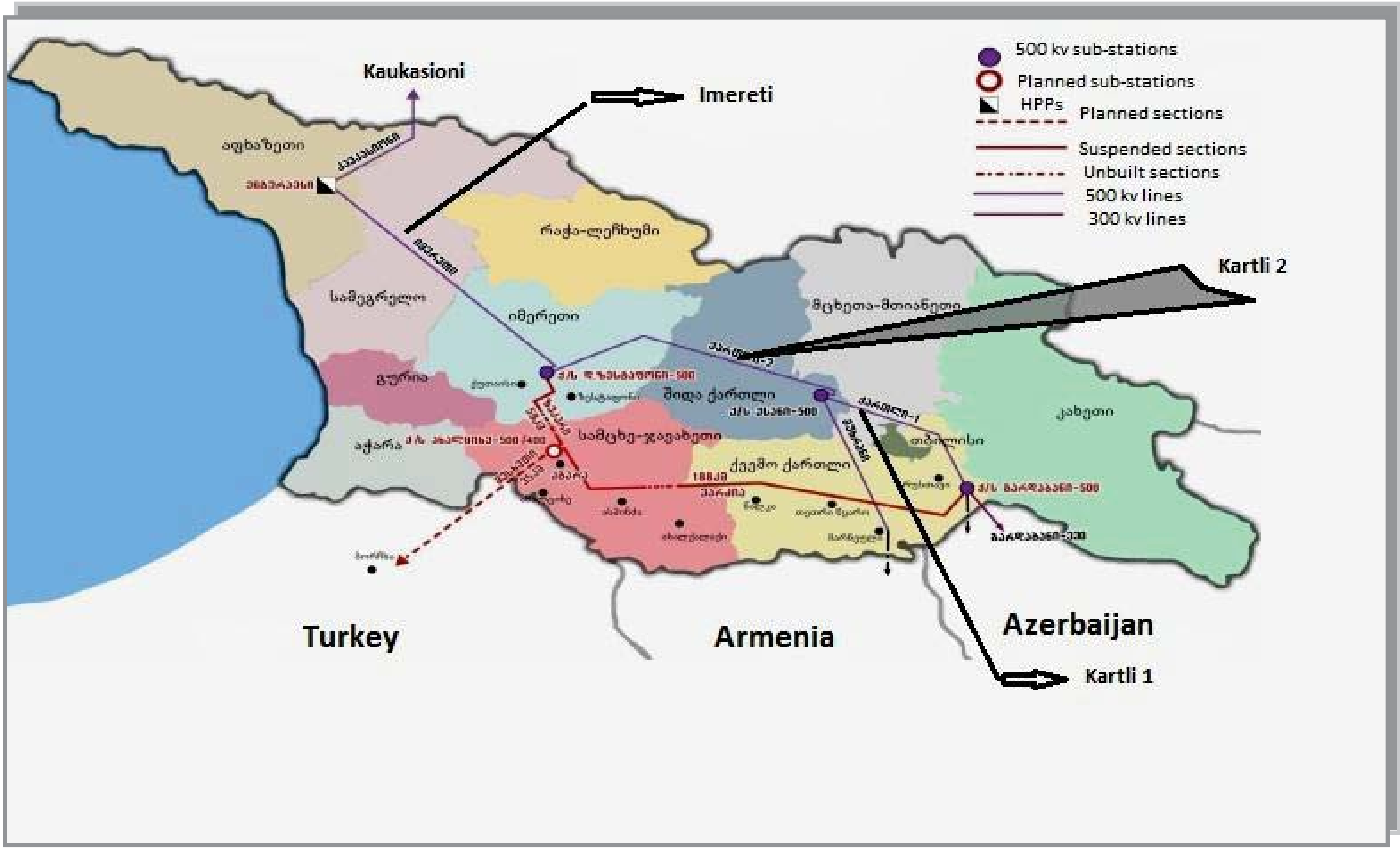


Figure 8. All 4 Alternative Routes of the Black Sea 500kv Transmission Line

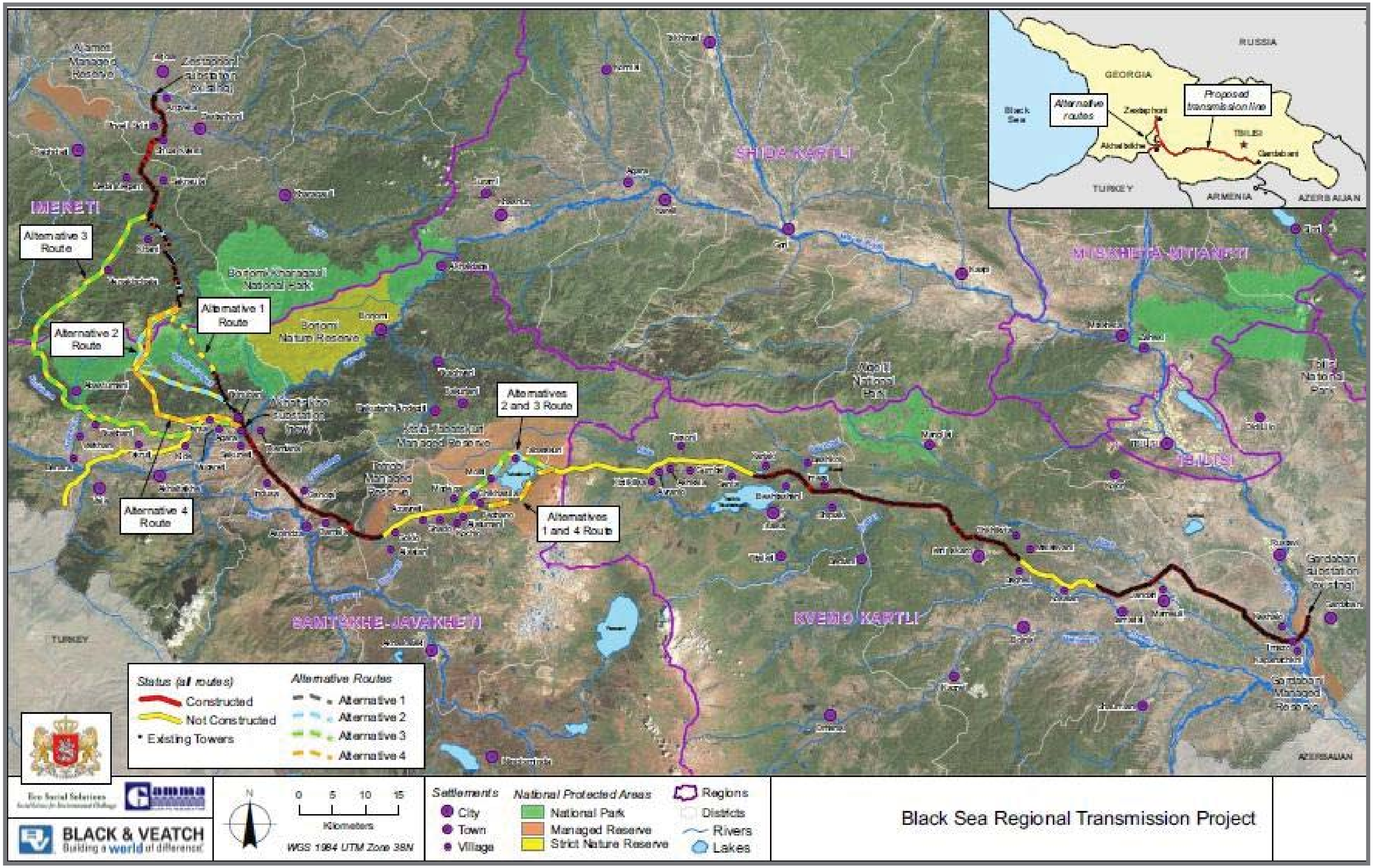


Figure 9. Major Gas Pipelines of Georgia

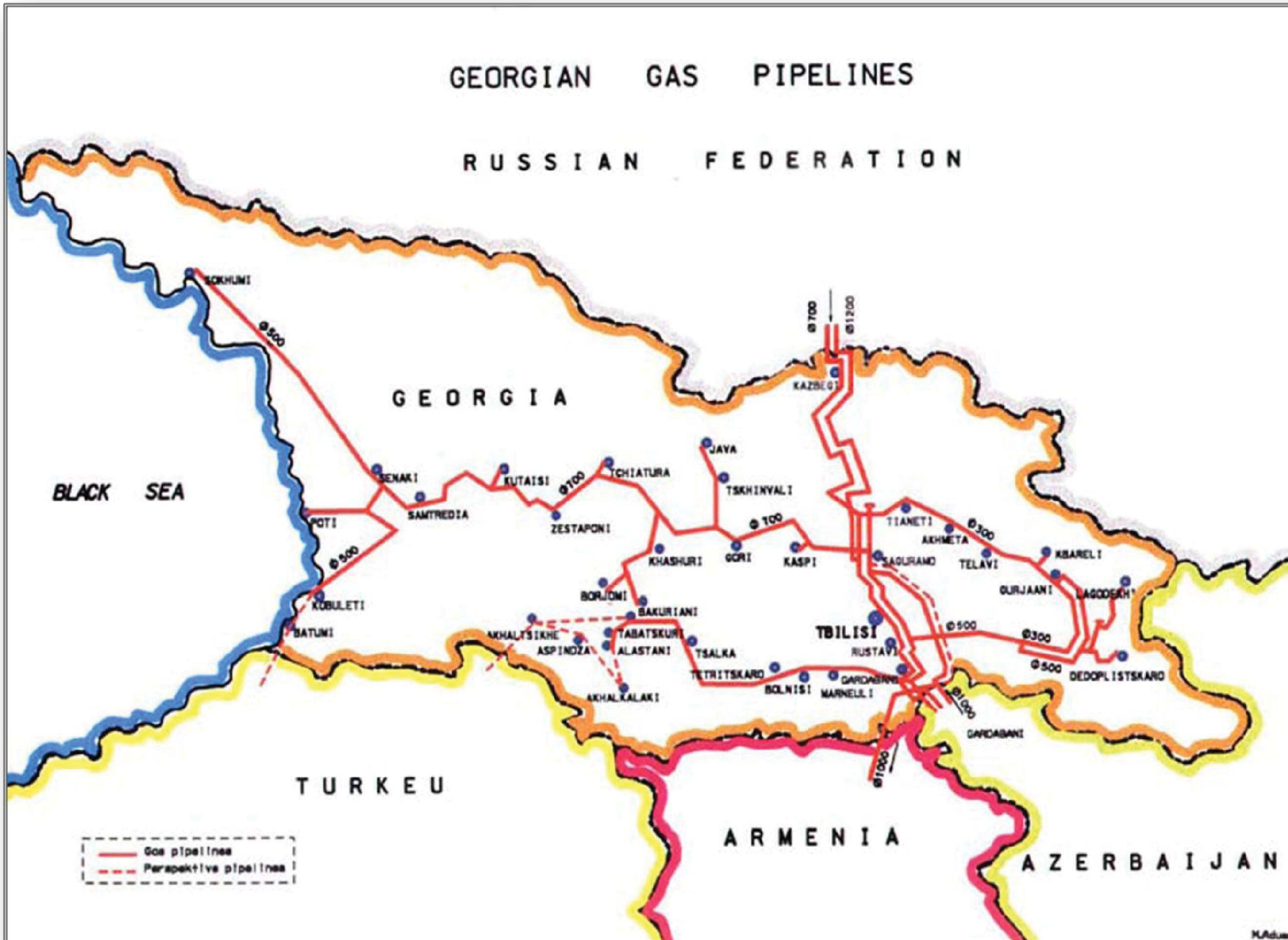
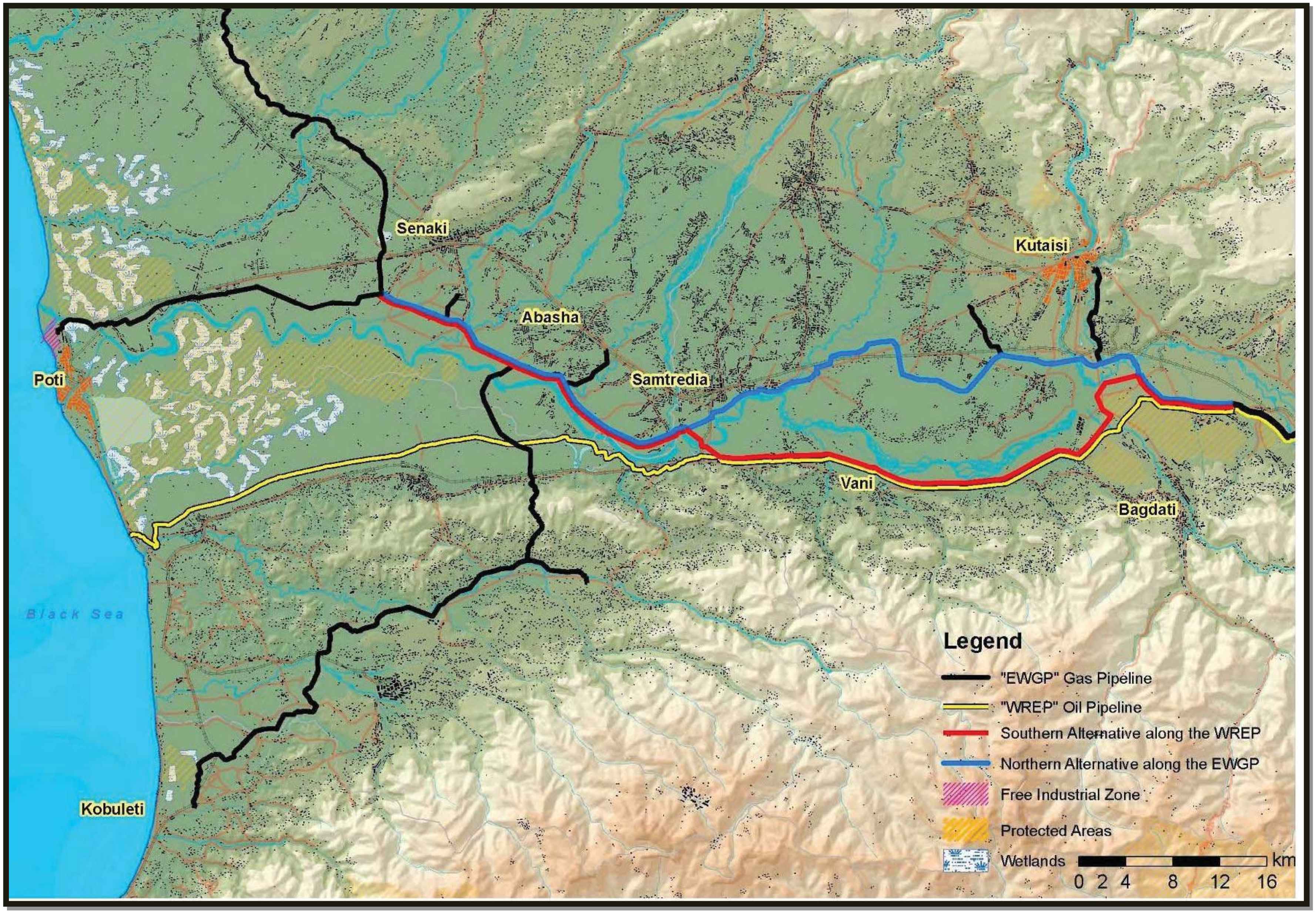


Figure 10. Kutaisi-Senaki Section of the East-West Gas Main Pipeline



ANNEX 8. IRRIGATION SYSTEMS

Figure 1. Irrigation Canals in the Alazani River Basin

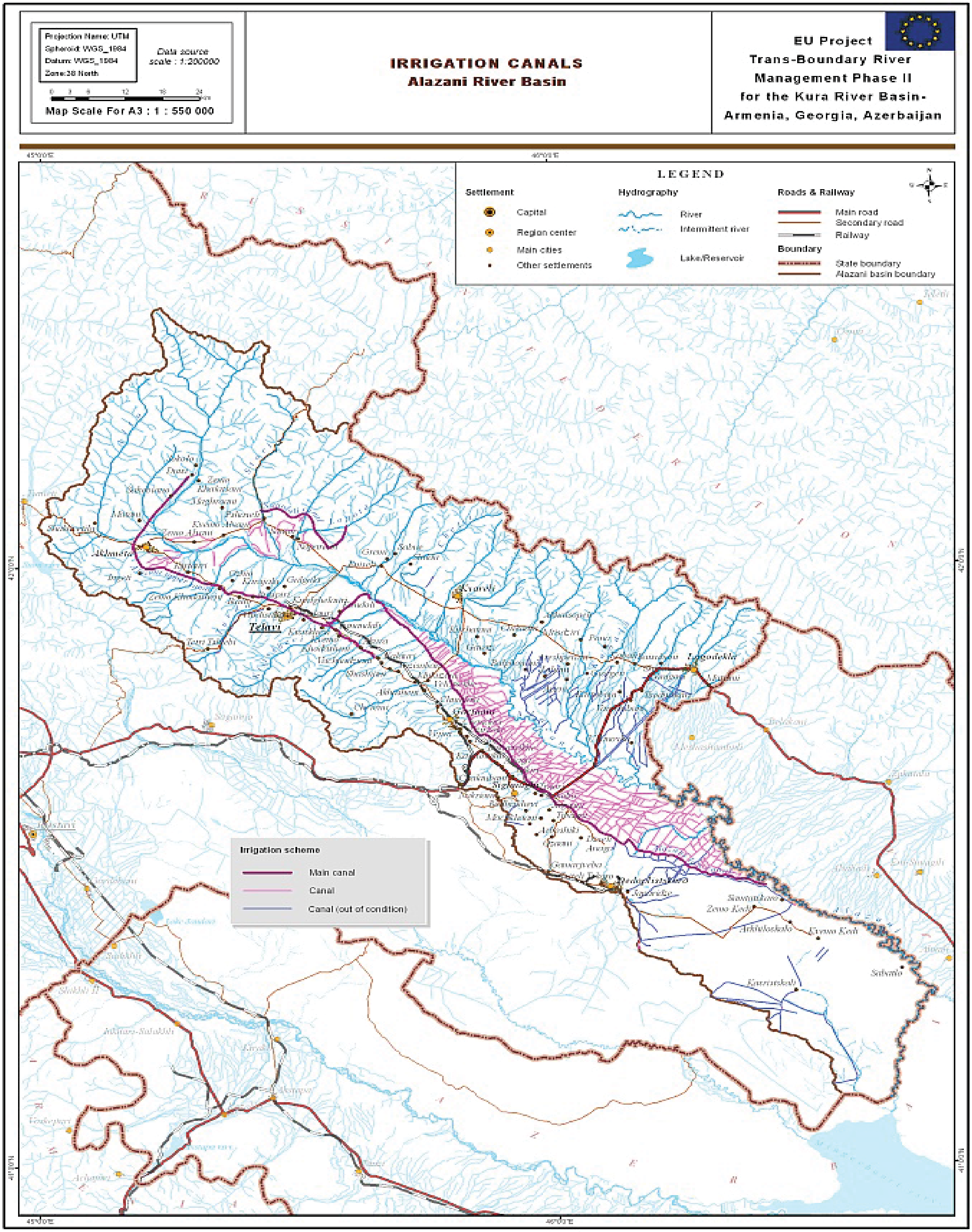


Figure 2. Naurdali and Upper Alazani Irrigation Canal

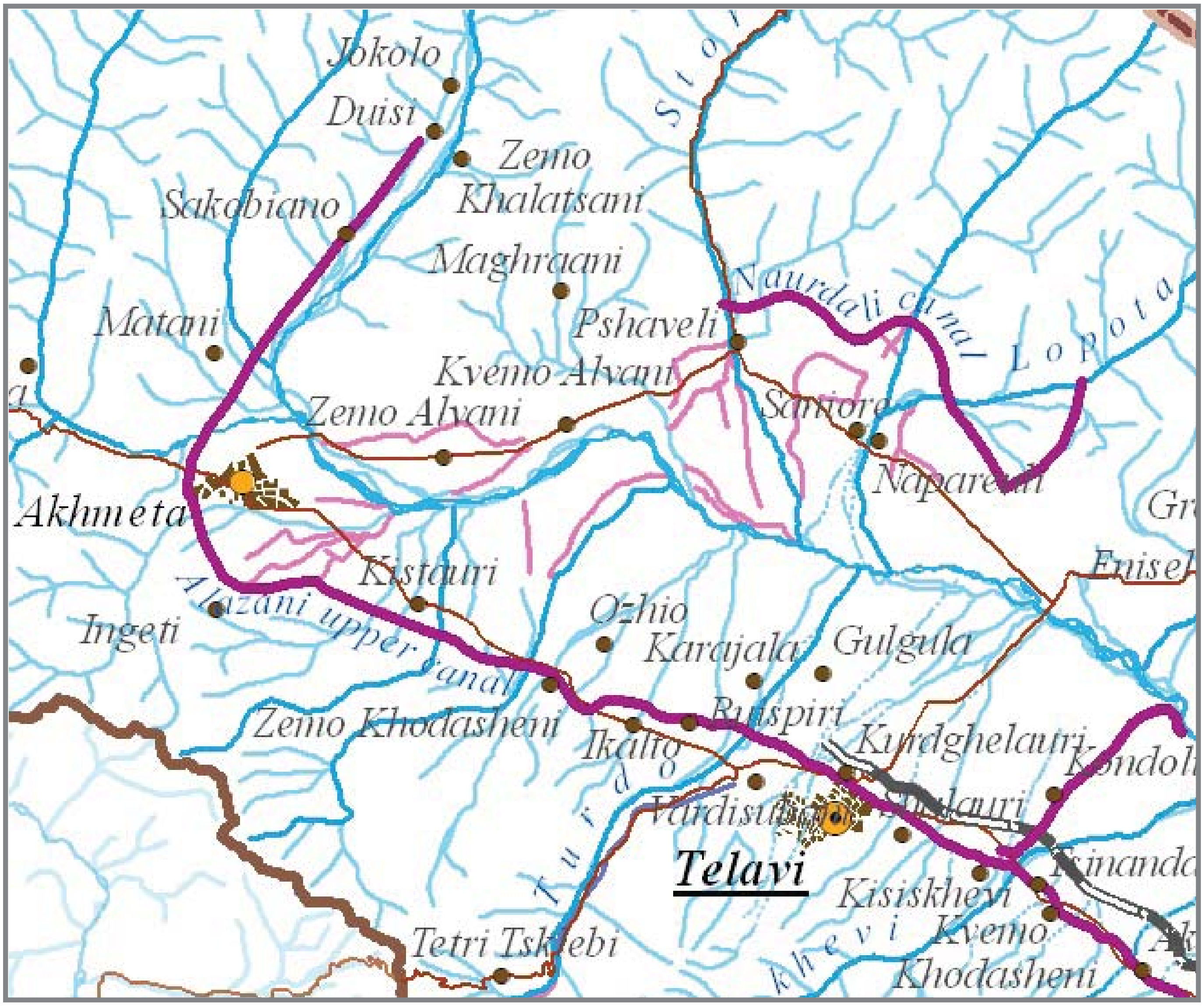
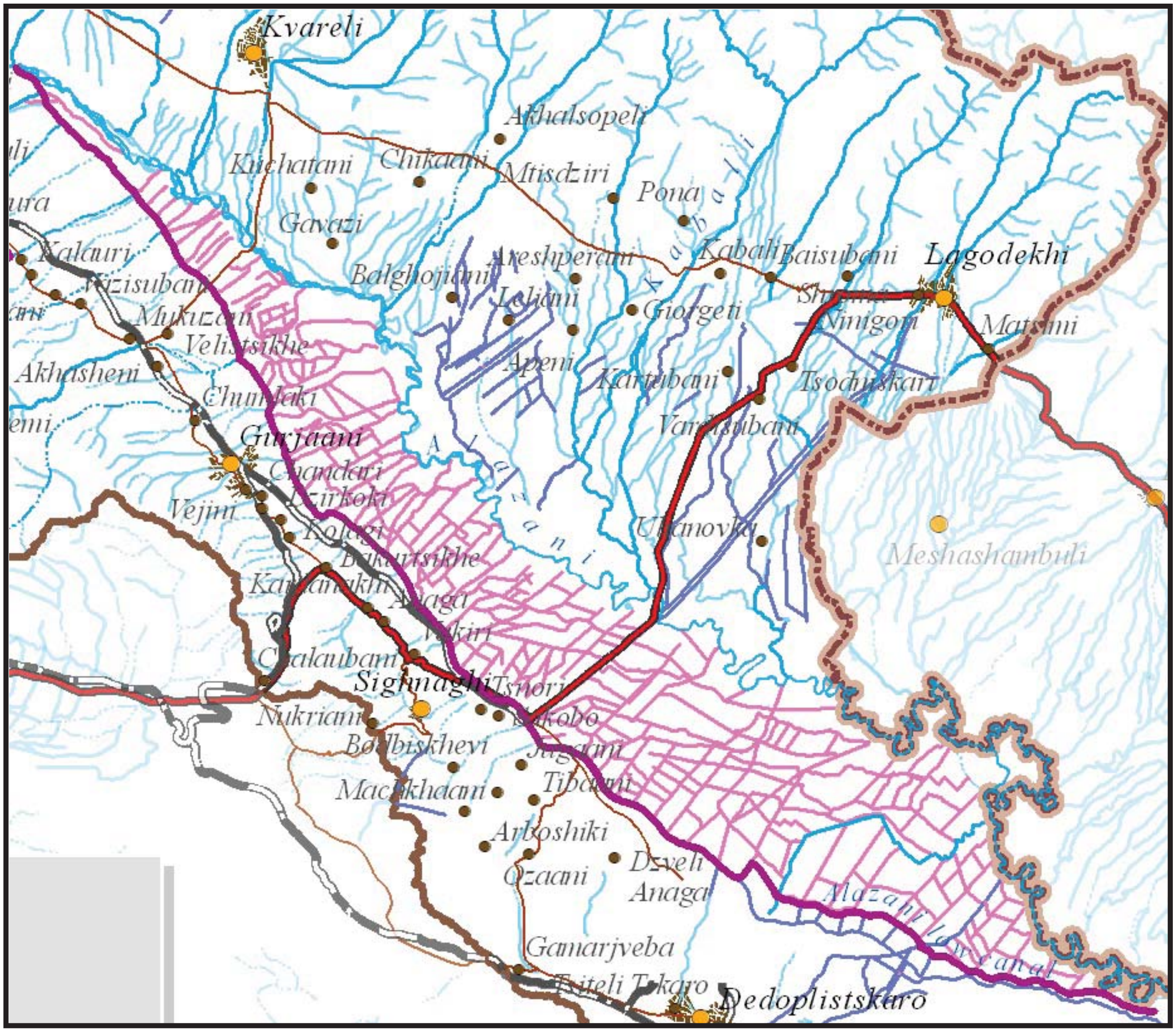


Figure 3. Lower Alazani Irrigation



ANNEX 9. HPPS, DAMS AND RESERVOIRS

Figure 1. Existing and Prospective medium to large HPPs

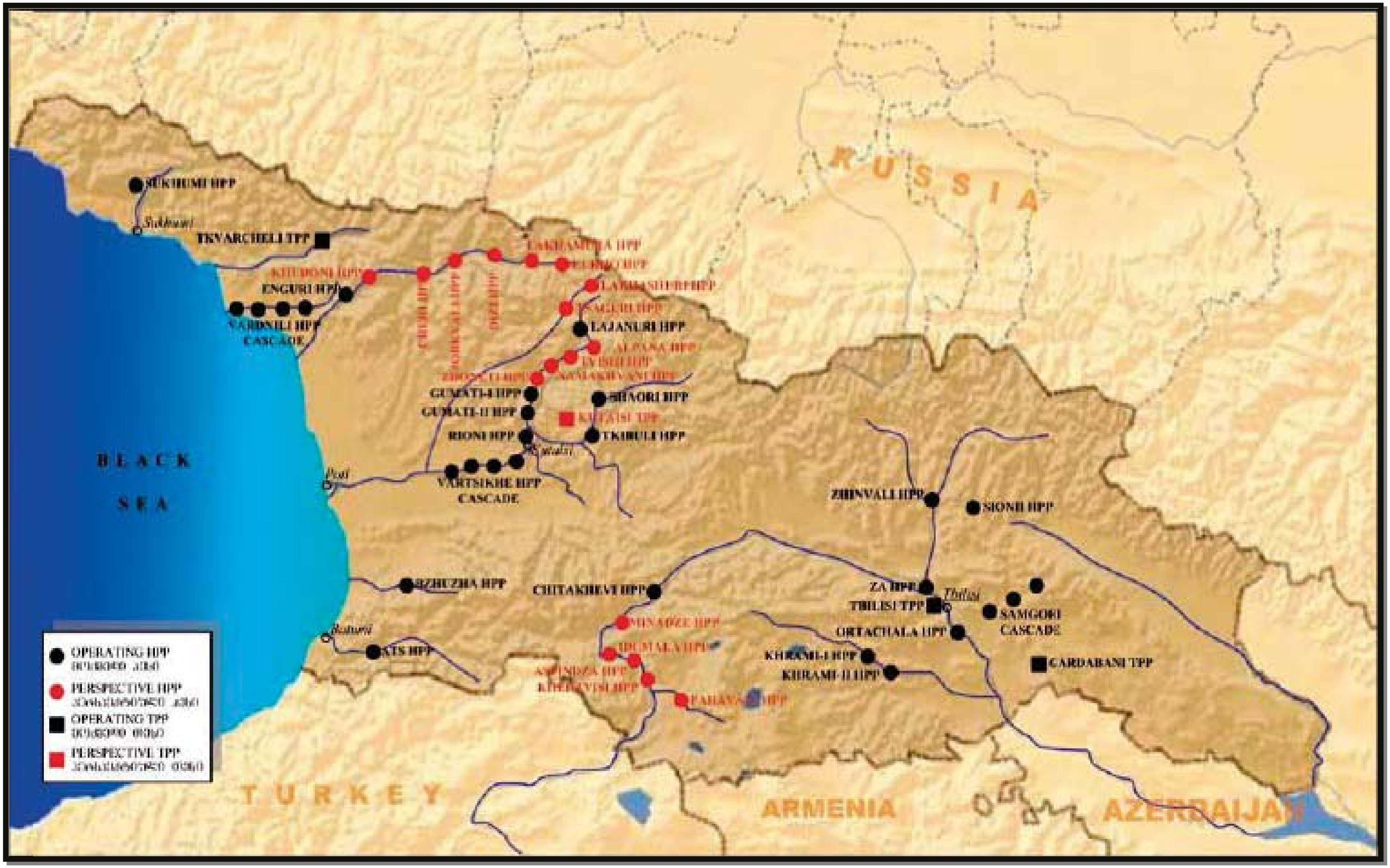


Figure 2. Existing and P Medium to Large-size Hydropower Plants and Transmission Lines

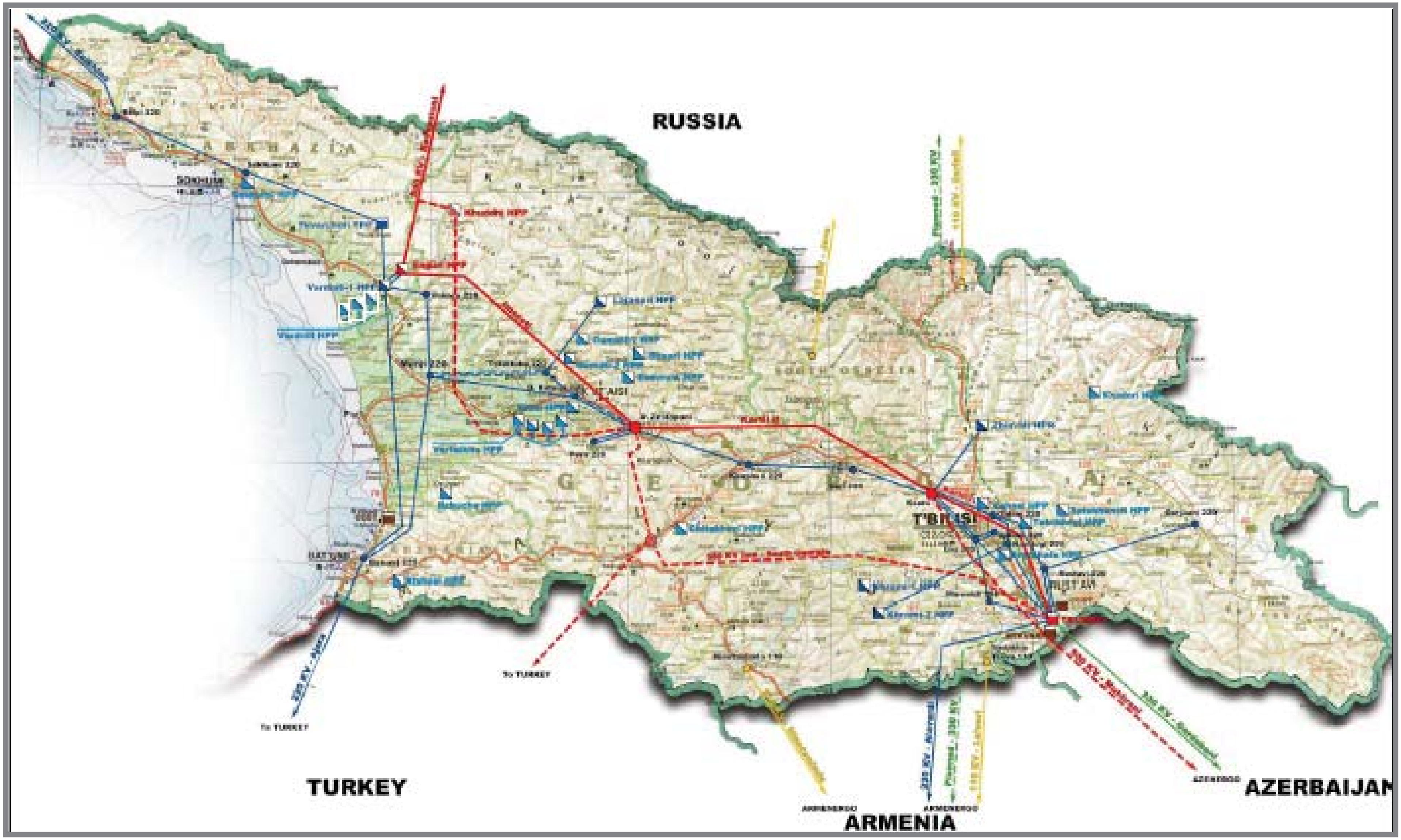
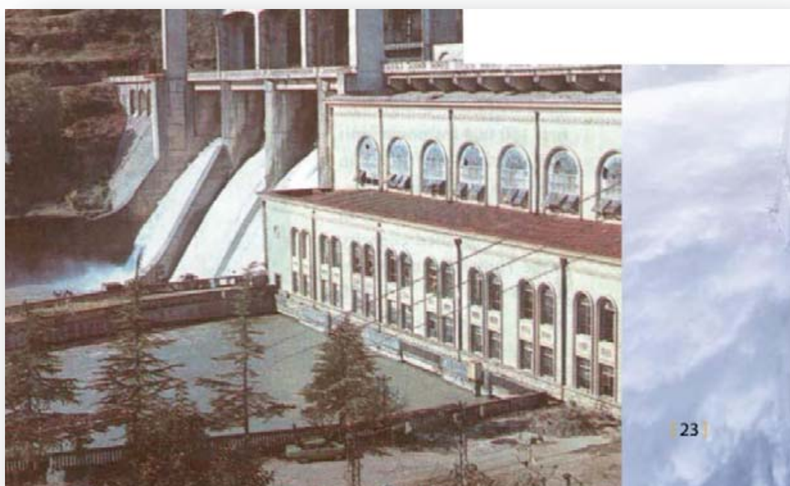


Table 1. Existing Medium to Large HPPs in Alazani-Iori and Rioni River Basins

Name of HPP	Commissioning date	location	capacity	power generation	Type
Lajanuri	1960	rivers Ladjanura and Tskhenistskali	112.5	438	seasonal regulation
Dzevrula	1956	V. Akhalsopheli	80 (4X20)	117	annual regulation
Satskhenisi	1952	V. Saakadze	14	50	irrigation canal
Khadori	2004	Akhmeta district, r. Alazani and Samkhuristskali	24	142	run-off-the river
Gumati cascade		V. Zhoneti to Kutaisi			
Gumati 1	1958		44	249	daily regulation
Gumati 2			22.8	127	
Rioni	1933	Near Kutaisi	48	325	diversion
Shaori	1955	Tkibuli	38.4 (4X9.6)	114	annual regulation
Vartsikhe cascade		from Vartskikhe to Gubistskali	184	1050	seasonal
Vartsikhe 1	1976		46(2X23)		diversion
Vartsikhe 2	1978		46(2X23)		diversion
Vartskikhe 3	1980		46(2X23)		diversion
Vartsikhe 4	1987		46(2X23)		diversion

Figure 3. Main Characteristics of Gumati HPP



GUMATI HPP-I

PARAMETERS:
Capacity MW: 44
Power output GWh: 249
Reservoir storage mln m^3: 13/39
Rated water discharge m^3/s: 214
Discharge through waterways m^3/s: 2965
Rated head m: 25
TYPE OF REGULATION:
Seasonal
TURBINE: Type-Kaplan
Quantity x Capacity MW4X11.5
MANUFACTURER: Tampella (Finland)
GENERATOR: Type-Vertical, synchronous
Quantity x Capacity MW: 5X260
MANUFACTURER: Siemens-Schukert (Austria)
YEAR OF START UP: 1958

DAM PARAMETERS:

Height m: 52
Thickness:
at the crest m: 10
at the contact with foundation m: 41
Crest length m
of the overflow part m: 59

of the right part m: 73
of the left part m: 66
GEOLOGICAL CONDITIONS: Rock-fissured diabases

Gumati HPP II

Capacity MW: 23
Power output GWh: 127
Rated water discharge m^3/s: 214
Discharge through waterways m^3/s: 425
Rated head m: 13
TYPE OF REGULATION: Seasonal
TURBINE: Type - Kaplan
Quantity x Capacity MW: 3X7.948
MANUFACTURER: VOITH (Austria)
GENERATOR: Type-Vertical, synchronous
Quantity x Capacity MW: 3X7.6
MANUFACTURER: Siemens-Schukert (Austria)
YEAR OF START UP: 1956

Figure 4. Main Characteristics of Shaori HPP

PARAMETERS:
Capacity MW: 38
Power output GWh: 138
Reservoir storage mln m^3: 87/90
Rated water discharge m/s: 10
Discharge through waterways m/s: 150
Rated head m: 478
TYPE OF REGULATION: Seasonal

TURBINE: Type-Pelton
Quantity x Capacity MW: 4X10
MANUFACTURER: ANSALDO-San Georgia (Italy)
GENERATOR: Type GS-1910
Quantity x Capacity MW 4X9.6
MANUFACTURER: ASEA (Sweden)
YEAR OF START UP: 1955

Rockfill Dam Parameters:

Height m	14.8
Thickness:	
at the crest m	8.8
at the contact with the foundation m	76.4
Crest length m	1210

GEOLOGICAL CONDITIONS:
Clay loams and marls

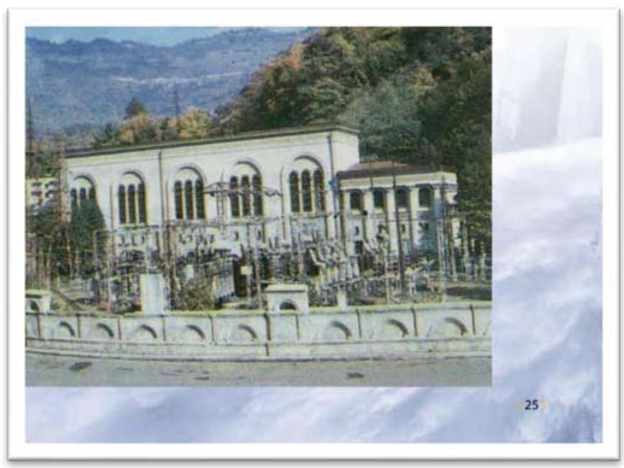


Figure 5. Main Characteristics of Tkibuli (Dzevrula) HPP

PARAMETERS:
Capacity MW: 80
Power output GWh: 140
Reservoir storage mln m^3: 66/82
Rated water discharge m^3/s: 34
Discharge through waterways m^3/s: 75
Rated head m: 293
TYPE OF REGULATION: Seasonal

TURBINE: Type-Francis
Quantity x Capacity MW: 4X21
MANUFACTURER: VOITH (Austria)
GENERATOR: Type-Vertical
Quantity x Capacity MW: 4X20
MANUFACTURER: Siemens-Schukert(Austria)
YEAR OF START UP: 1956

Earth Dam Parameters:

Height m: 36
Thickness:
at the crest m: 6
at the contact with the foundation m: 191.1
GEOLOGICAL CONDITIONS: Rock, argillite and gravelled earth in river bed

HPP Layout

1. Earth dam
2. Reservoir
3. Water intake
4. Diversion pressure tunnel
5. Reinforce concrete water conduit
6. Discharge tunnel
7. Waste release spillway
8. Surge shaft
9. Metal turbine penstock
10. Power house

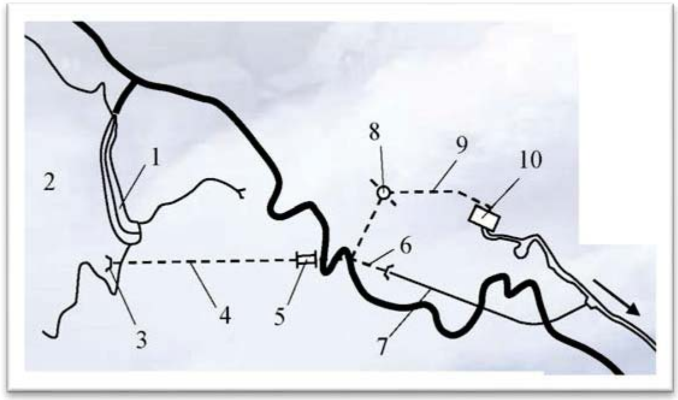


Figure 6. Main Characteristics of Lajanuri HPP

Capacity MW: 113
Power output GWh: 438
Reservoir storage mln m^3: 18/25
Rated water discharge m7s: 100
Discharge through waterways m^3/s: 420
Rated head m: 128
TYPE OF REGULATION: Seasonal

TURBINE: Type-Francis
Quantity x Capacity MW: 3X38.6
MANUFACTURER: VOITH (Austria)
GENERATOR: Type-Vertical
Quantity x Capacity MW: 3X37.5
MANUFACTURER: Siemens - Schukert (Austria)
YEAR OF START UP: 1960

Arch Dam Parameters:
Height m: 69
Saddle m: 20
Thickness:
at the crest m: 3.7
at the contact with saddle m: 8
at the contact with foundation m: 13
Arch crest length m: 127
GEOLOGICAL CONDITIONS: Laminated, in places fissured limestones

Diversion Flow Tunnel Parameter:
Length m: 5524
Net diameter m: 5
Maximal discharge capacity m7s: 60
GEOLOGICAL CONDITIONS Fissured limestones

Pressure diversion Tunnel Parameters:
Length m: 2549
Net diameter m: 6
Maximum discharge capacity m7s: 10
GEOLOGICAL CONDITIONS: First interval - fissured thin – layered limestones, thereafter coarser limestones, from place to placed fissured

Underground Powerhouse Parameters:
Width m: 18
Length m: 557
Height m: 56
Maximum depth of occurrence m: 140
GEOLOGICAL CONDITIONS: Coarse-layered fissured limestones

Figure 7. Main Characteristics of Vartsikhe HPP Cascade

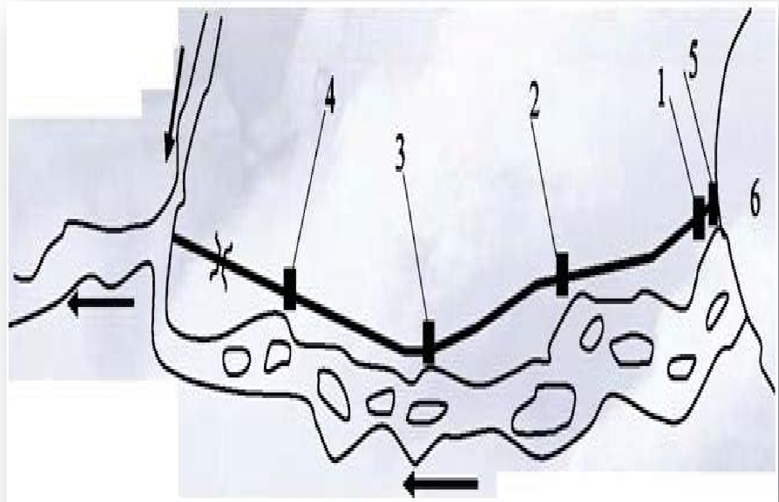
Parameters of HPP MMIIJV

Capacity MW: 4x4 184
Power output GWh: 4x262.5 1050
Reservoir storage mln m^3 2/14.6
Rated water discharge m^3/s: 350

Discharge through waterways m^3/s: 2950
Rated head m: 15
TYPE OF REGULATION: Seasonal

TURBINE: Type-Kaplan
Quantity x Capacity MW: 8X23.8
MANUFACTURER: VOITH (Austria)
GENERATOR: Type-Vertical, Synchronous
Quantity x Capacity MW: 8X23
MANUFACTURER: Siemens-Schukert (Austria)
Trail race canal – Length m: 27134**,** including Lining sections m: 6050
Width at bottom m: 25
Width at top m: 60/65
Depth m: 6
Hillsides: 1:2/1:2.5
GEOLOGICAL CONDITIONS: Delluvial loams in places with rare
rare small boulders
Water discharge m/s: 350

Layout of Vartsikhe HPP Cascade



1. Vartsikhe 1HHP
2. Vartsikhe 2 HHP
3. Vartsikhe 3 HHP
4. Vartsikhe 4 HHP
5. Head structures
6. Reservoirs

Figure 8. Locational Map of Vartsikhe HPP Cascade

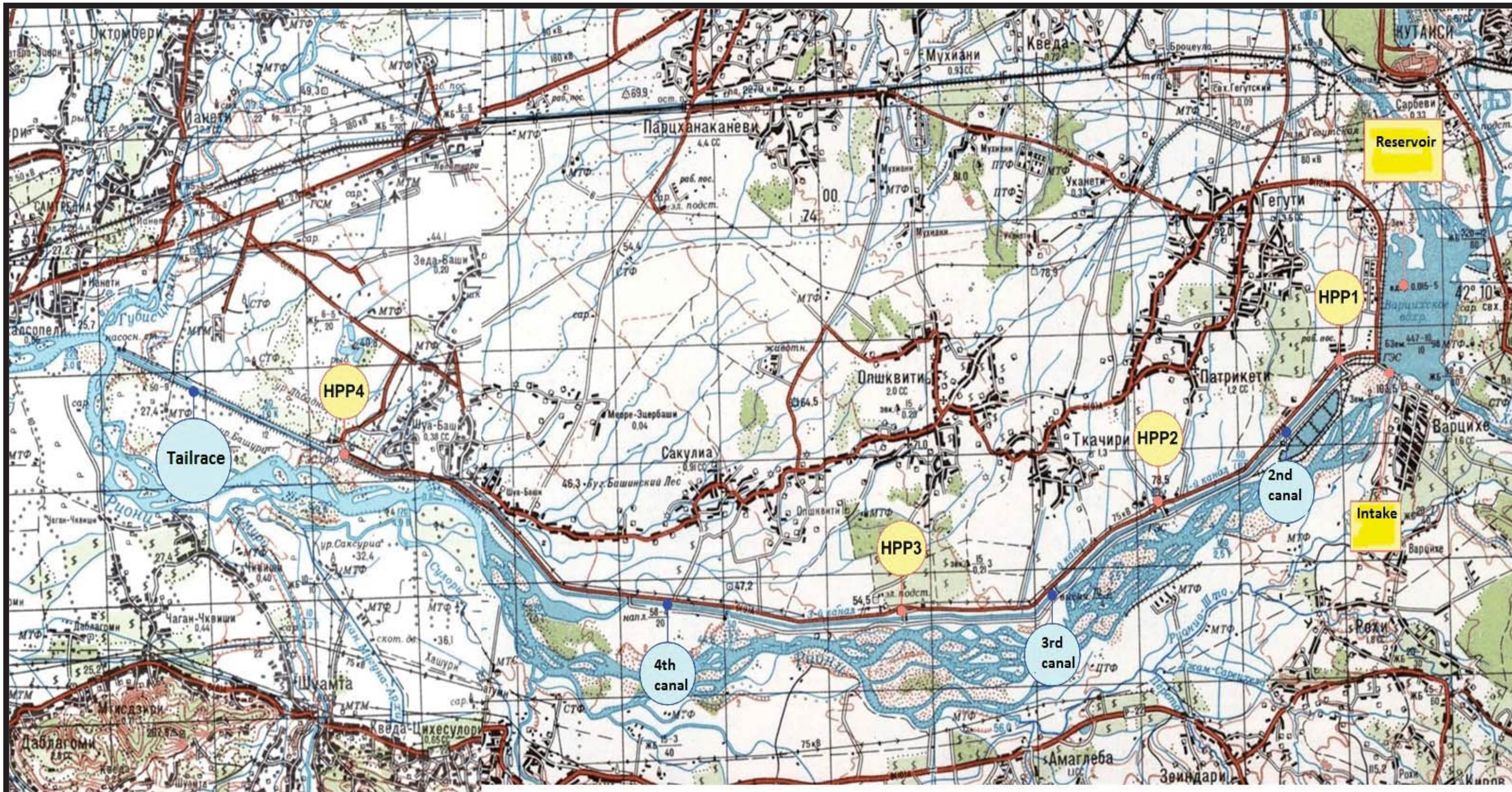


Figure 8. Lowest Step (Lowest Reach) of Vartsikhe HPP

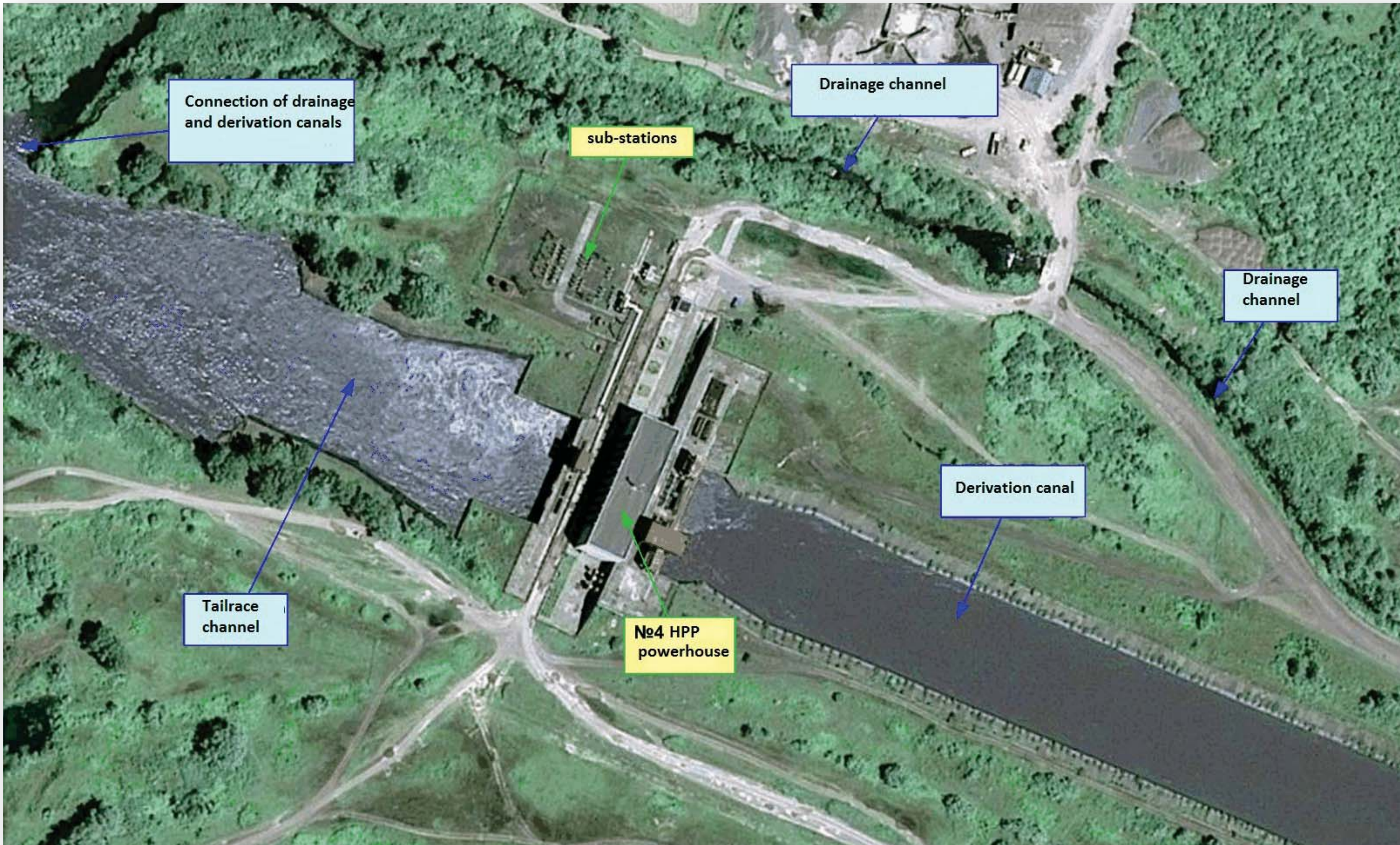


Table 2. Existing (Qualified) Small HPPs in Alazani-Iori and Rioni River Basins

No	Qualified enterprise	License Type/Activity	Long title of power plant	Location	Installed capacity (MW)
1	"Abhes-Eleqtro" LTD	small HPP	Abhesi	Martvili dist.	2
2	"Ritseulahesi" LTD	small HPP	Ritseulahesi	Ambrolauri dist.	6.1
3	"Feri" LTD	small HPP	Intsobahesi	Kvareli dist.	1.65
4	"Kindzmarauli Corporation" JSC	small HPP	Tcalahesi	Kvareli dist.	1.5
5	"Goresha" LTD	small HPP	Goreshahesi	Kharagauli dist.	0.15
6	"Georgian International Energy Corporation	small HPP	Alazanhesi	Gurjaani dist.	4.8
7	"Energo-pro Georgia" JSC	small HPP	Sionhesi	Tianeti dist.	9.14
8		small hpp	Martkopihesi	Gardabani dist.	3.86
9	"Kabalhesi-2006" LTD	small HPP	Kabalhesi	Lagodekhi dist.	1.5
10	"Sulorhesi" LTD	small HPP	Sulorhesi	Vani dist.	0.8
11	"Energia-I" LTD	small HPP	Boldodahesi	Telavi dist.	2.5
12	"Orba 2008" LTD	small HPP	Zvaretihesi	Ambrolauri dist.	0.26
13	Ltd "Eastern Energy Corporation"	small HPP	Mini HPP "Khadori I "	Akhmeta	0.65

Figure 8. Scheme of the Sioni Reservoir and Samgori Irrigation Sysetem

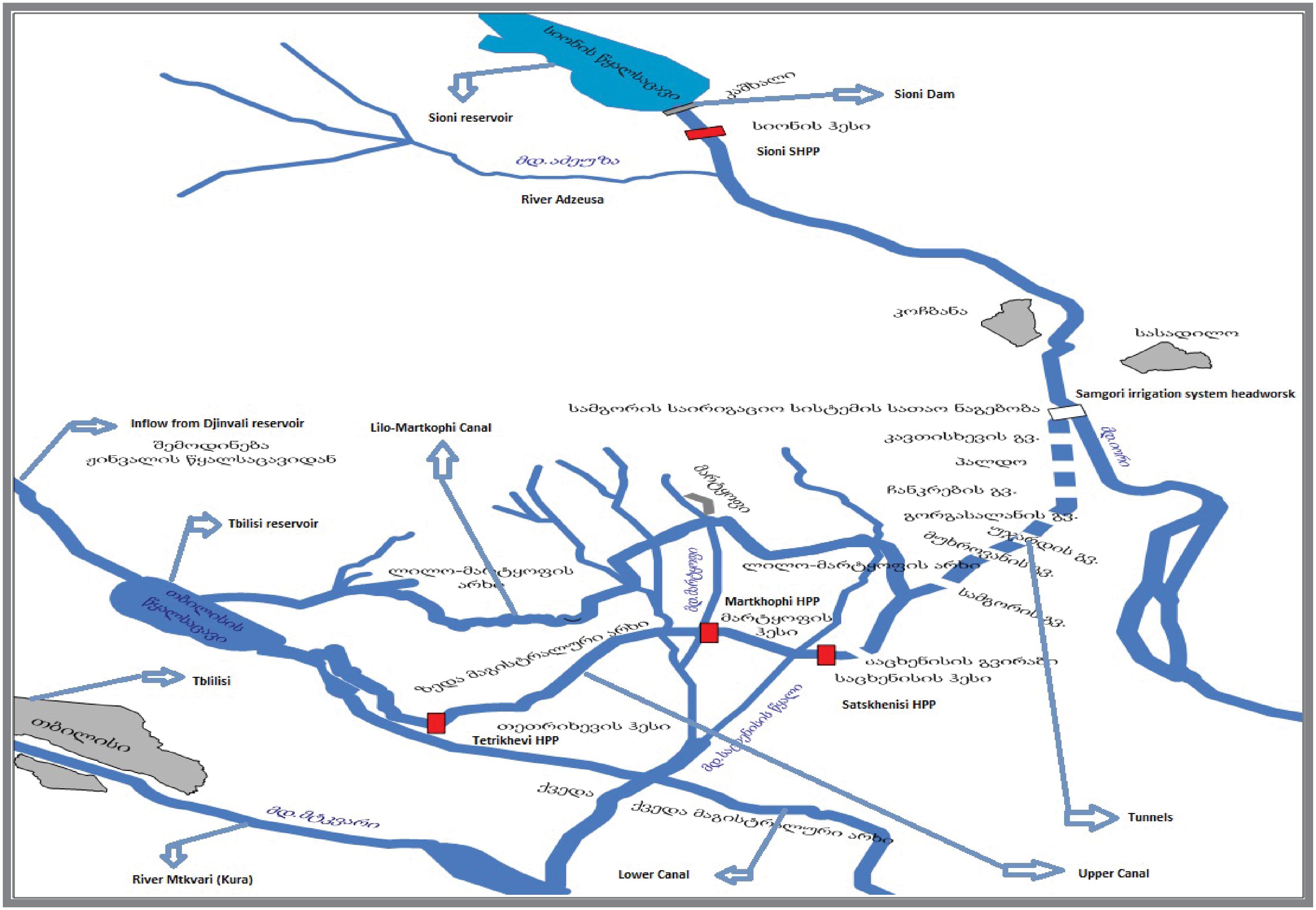


Figure 6. Potential HPP Sites in Georgi

Table 3. List of Potential HPPs in Alazani-Iori and Rioni River Basins

#	Name of HPP	River	Region	Installed capacity	Average Annual Output	Efficiency	Rated water discharge	Site cost	Revenue per USD spent
1	Alpana (Sairme)	Rioni	Racha-Lechkhumi - Kvemo Svaneti (NW)	70.60	356.82	57.70	128.80	105.90	0.17
2	Avani	Avanis khevi	Kakheti (E)	4.60	18.60	46.20	1.50	7.80	0.13
6	Boriti	Dumala	Imereti (W)	6.40	33.80	60.20	2.50	10.90	0.18
7	Chelti 1	Chelti	Kakheti (E)	4.80	25.00	59.60	2.40	8.20	0.17
8	Chelti 2	Chelti	Kakheti (E)	4.80	25.09	59.70	2.40	8.20	0.17
9	Cheshura	Cheshura	Racha-Lechkhumi - Kvemo Svaneti (NW)	7.50	32.40	49.30	3.60	11.30	0.15
10	Tskhimra	Tekhuri	Samegrelo - Zemo Svaneti (NW)	29.00	159.60	62.80	18.90	52.50	0.18
12	Duruji	Duruji	Kakheti (E)	1.74	10.70	70.10	0.60	2.96	0.21
13	Erjia	Tekhuri	Samegrelo - Zemo Svaneti (NW)	24.40	136.60	63.90	14.00	41.50	0.19
15	Stori	Stori	Kakheti (E)	11.80	56.80	54.90	3.00	20.00	0.15
16	Stori 3	Stori	Kakheti (E)	13.70	60.60	50.50	13.40	24.70	0.13
18	Iori	Iori	Mtskheta-Mtianeti (NE)	9.70	54.00	63.60	6.00	19.40	0.15
19	Jejora	Jejora	Racha-Lechkhumi - Kvemo Svaneti (NW)	15.80	86.60	62.60	17.30	28.40	0.17
20	Jonouli	Jonouli	Racha-Lechkhumi - Kvemo Svaneti (NW)	13.00	66.50	58.40	6.00	22.80	0.16
21	Lebarde 1	Lebarde	Samegrelo - Zemo Svaneti (NW)	4.60	19.80	49.60	2.50	9.10	0.12
22	Lebarde 2	Tekhuri	Samegrelo - Zemo Svaneti (NW)	4.20	17.50	47.90	2.00	8.30	0.11
23	Lekarde	Magana	Samegrelo - Zemo Svaneti (NW)	20.00	107.00	61.10	10.00	36.00	0.16
24	Lesulukhe	Tsachkuru	Samegrelo - Zemo Svaneti (NW)	5.70	24.90	49.80	6.00	11.40	0.12
25	Lechekha	Tekhuri	Samegrelo - Zemo Svaneti (NW)	18.80	118.70	72.10	4.50	33.80	0.20
26	Magana	Magana	Samegrelo Zemo Svaneti (NW)	20.60	106.38	58.95	7.80	37.10	0.15
27	Marelisi	Bjholiskhevi	Imereti (W)	4.60	19.70	49.00	4.20	7.80	0.15
28	Medani	Chanistsqali	Samegrelo - Zemo Svaneti (NW)	4.40	23.85	61.90	5.95	8.80	0.15
38	Nobulevi	Tekhuri	Samegrelo - Zemo Svaneti (NW)	18.50	107.40	66.20	22.40	33.30	0.19
44	Samquristsqali 1	Samkuristsqali	Kakheti (E)	4.88	25.70	60.10	5.10	8.54	0.16
45	Samquristsqali 2	Samkuristsqali	Kakheti (E)	22.60	117.40	59.30	5.60	39.90	0.17
46	Somitso	Jejora	Racha-Lechkhumi - Kvemo Svaneti (NW)	24.30	144.30	67.80	20.00	43.70	0.18
47	Stori 1	Stori	Kakheti (E)	14.00	69.40	56.60	4.60	25.20	0.15
48	Stori 2	Stori	Kakheti (E)	11.40	50.50	50.60	11.40	20.50	0.13
51	Tekhuri 1	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20
52	Tekhuri 2	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20
53	Tekhuri 3	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20
54	Tekhuri 4	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20

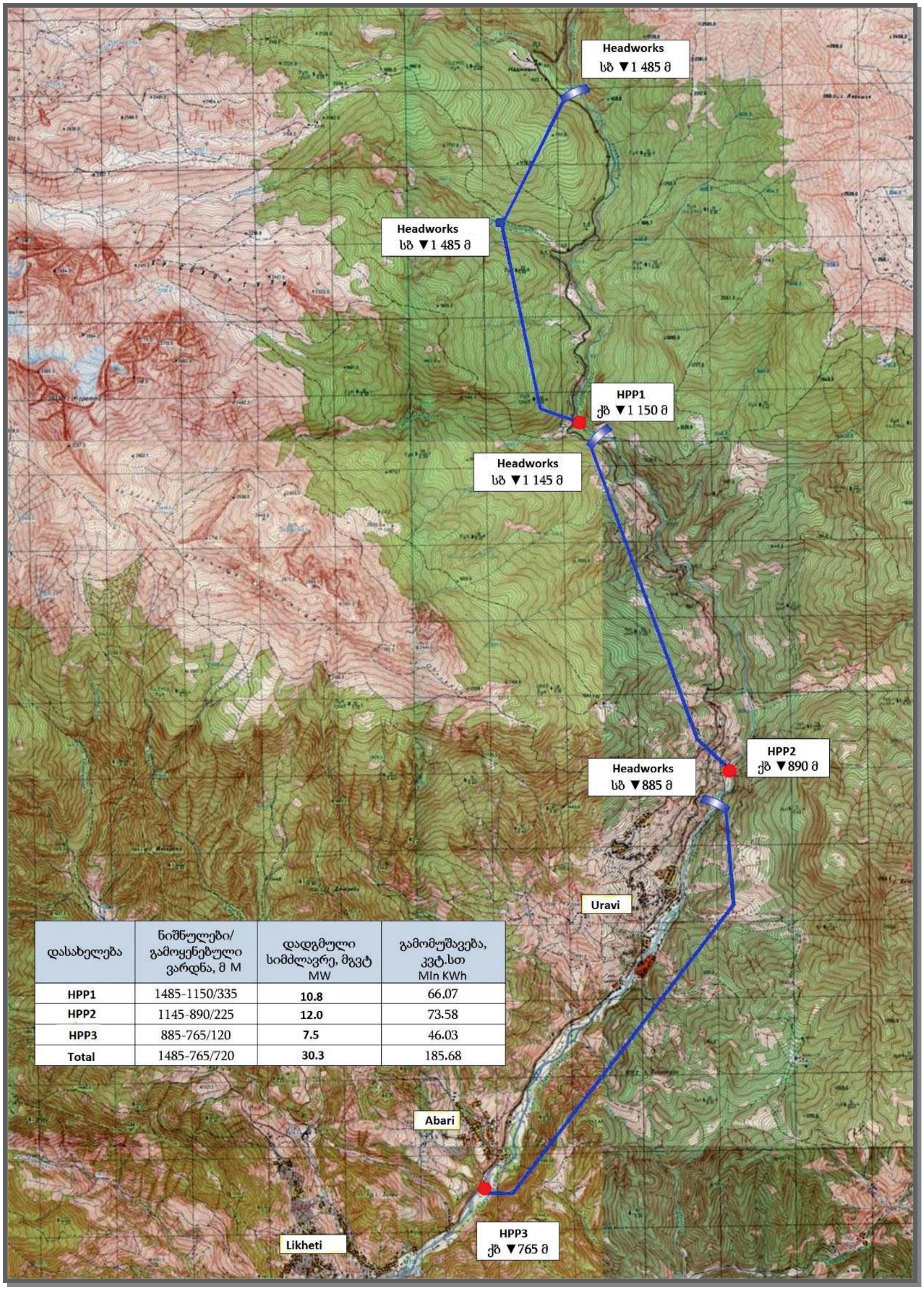
55	Tekhuri 5	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20
56	Tekhuri 6	Tekhuri	Samegrelo - Zemo Svaneti (NW)	3.20	19.00	61.90	40.00	5.30	0.20
57	Uraveli	Uraveli	Javakheti (S)	5.00	19.20	43.90	1.70	8.50	0.12
58	Tsablari 1	Tsablaristsqali	Imereti (W)	7.70	43.20	64.00	2.70	11.60	0.21
59	Tsablari 2	Tsablaristsqali	Imereti (W)	12.00	65.70	62.50	5.00	20.40	0.18
60	Chala	Qvirila	Imereti (W)	9.10	45.60	56.90	15.00	18.30	0.14
61	Khan-Tsablari 3	Khan-Tsablaris Tsqali	Imereti (W)	8.30	58.00	70.40	14.00	15.00	0.23
62	Khani 7	Khanistsqali	Imereti (W)	6.40	48.12	85.80	18.00	10.56	0.27
63	Kheledula 1	Kheledula	Racha-Lechkhumi - Kvemo Svaneti (NW)	18.80	94.30	57.30	6.00	33.80	0.15
64	Kheledula 2	Kheledula	Racha-Lechkhumi - Kvemo Svaneti (NW)	21.60	102.80	54.40	18.40	38.90	0.14
65	Kheledula 3	Kheledula	Racha-Lechkhumi - Kvemo Svaneti (NW)	44.30	229.40	59.10	24.00	79.70	0.15
70	Khunevi	Dzirula	Imereti (W)	11.30	61.60	62.30	6.20	19.80	0.18
71	Qvirila 3	Qvirilistsqali	Guria (W)	5.20	20.50	45.00	2.20	8.80	0.13
72	Zestaponi 1	Qvirila	Imereti (W)	10.00	41.18	47.10	100.00	21.20	0.12
73	Zestaponi 2	Qvirila	Imereti (W)	11.90	48.70	46.70	100.00	25.40	0.11
74	Zestaponi 3	Qvirila	Imereti (W)	15.90	59.20	42.50	149.30	39.80	0.08
75	Zestaponi 4	Qvirila	Imereti (W)	15.90	59.20	42.50	149.30	39.80	0.08

Table 4. Signed MoUs on HPPs in Rioni River Basin

Name	Company	Country	Installed Capacity (MW)	Annual Generation (GW/h)	Estimated Investment (USD)	MoU signing date	Start of Construction	Completion of Construction
Namakhvani Cascade (Tvishi HPP)	KEPCO-Nurol-SK International	South Korea-Turkey	100	403.5	250,000,000	2009 December 8	2011 2nd half	2017 2nd Half
Namakhvani Cascade (Namakhvani HPP)	KEPCO-Nurol-SK International	South Korea-Turkey	250	928	500,000,000	2009 December 8	2011 2nd half	2017 2nd Half
Namakhvani Cascade (Zhoneti HPP)	KEPCO-Nurol-SK International	South Korea-Turkey	100	346	250,000,000	2009 December 8	2011 2nd half	2017 2nd Half
Lukhuni HPP 1	Rusmetali LLC	Georgia	10.8	66.07	18,178,218	2009 July 07	2015 May 01	2019 December 01
Lukhuni HPP 2	Rusmetali LLC	Georgia	12	73.58	20,198,020	2009 July 07	2010 August 01	2014 December 01
Lukhuni HPP 3	Rusmetali LLC	Georgia	7.5	46.03	12,623,762	2009 July 07	2020 May 01	2024 December 01
Kvirila HPP	Zoti Hydro	Chezh Republic -Georgia	5.2	22	11,611,650	2009 May 28	2010 December 01	2015 December 01
Zoti HPP	Zoti Hydro	Chezh Republic -Georgia	36	144	80,388,350	2009 May 28	2010 December 01	2015 December 01
Tekhuri Cascade (Nobulevi HPP)	Kolin Construction, Tourism, Industry and	Turkey	25.7	100	33,000,000	2010 November 10	2011 September	2013 August 10

	trading Co. Inc.							
Tekhuri Cascade (Tskhimra HPP)	Kolin Construction, Tourism, Industry and trading Co. Inc.	Turkey	32	150	45,000,000	2010 November 10	2011 September	2014 May 10
Tekhuri Cascade (Erjia HPP)	Kolin Construction, Tourism, Industry and trading Co. Inc.	Turkey	27	130	37,000,000	2010 November 10	2011 September	2014 May 10
Tekhuri Cascade(Lechexa HPP)	Kolin Construction, Tourism, Industry and trading Co. Inc.	Turkey	21	110	35,000,000	2010 November 10	2011 September	2014 February 10
Khunevi HPP	Unal Insaat Ticaret A.S.	Turkey	11	62	19,780,000	2010 December 27	2012 March 21	2015 November 21
Alpana HPP	Energo-Pro Georgia	Chezh Republic -Georgia	70.6	356.82	140,000,000	2011 February 15	2011 November 1	2014 November 1
Sadmeli HPP	Energo-Pro Georgia	Chezh Republic -Georgia	97	465	165,000,000	2011 February 15	2013 September 1	2019 January 1

Figure 7. On-going Lukhuni HPP Cascade Scheme



დასახელება	ნიშნულები/ გამოყენებული ვარდნა, მ M	დადგმული სიმძლავრე, მგვტ MW	გამომუშავება, კვტ.სთ Mln KWh
HPP1	1485-1150/335	**10.8**	66.07
HPP2	1145-890/225	**12.0**	73.58
HPP3	885-765/120	**7.5**	46.03
Total	1485-765/720	**30.3**	185.68

Figure 8. Location of Planned Namakhvani HPP Cascade

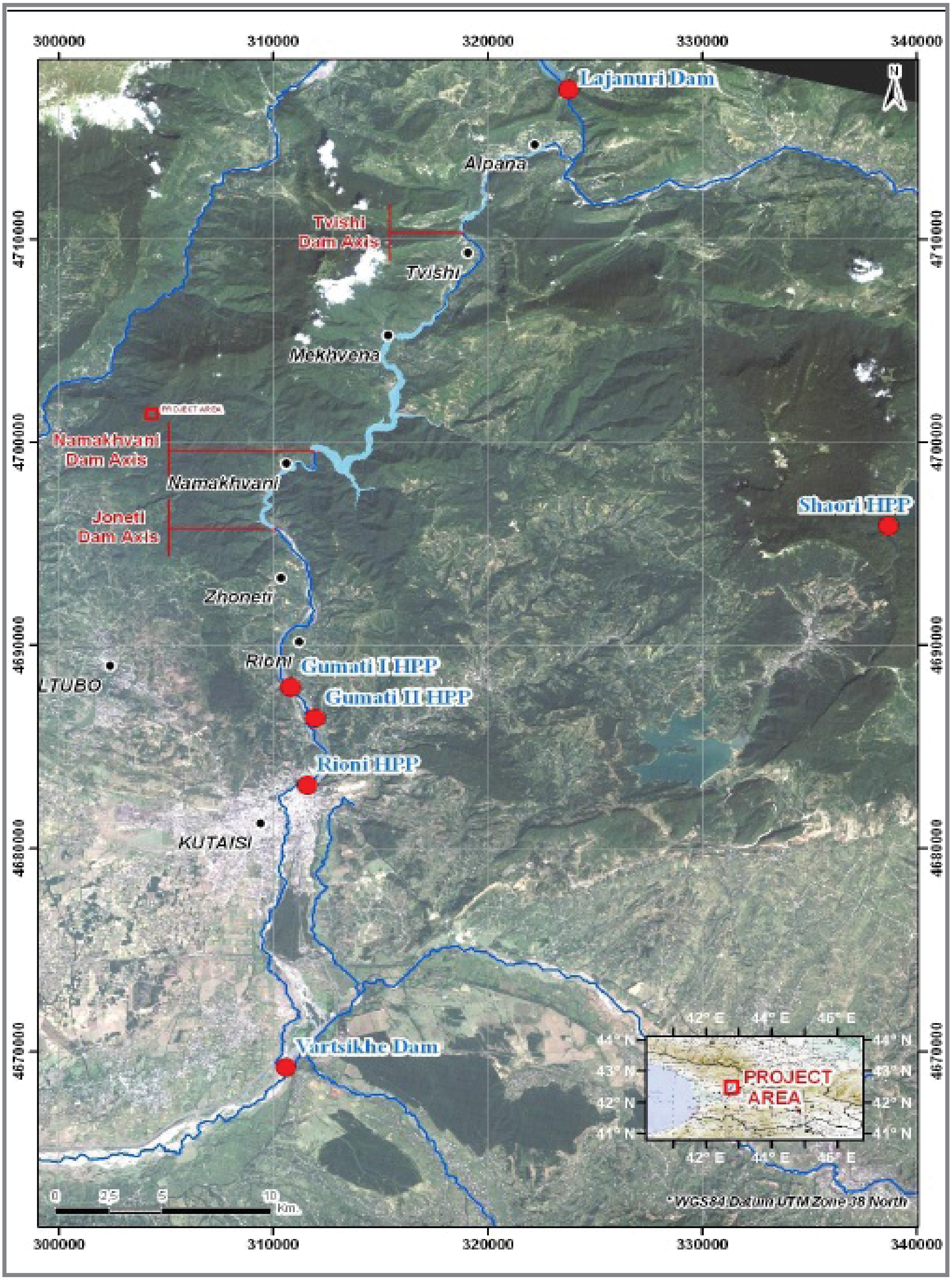
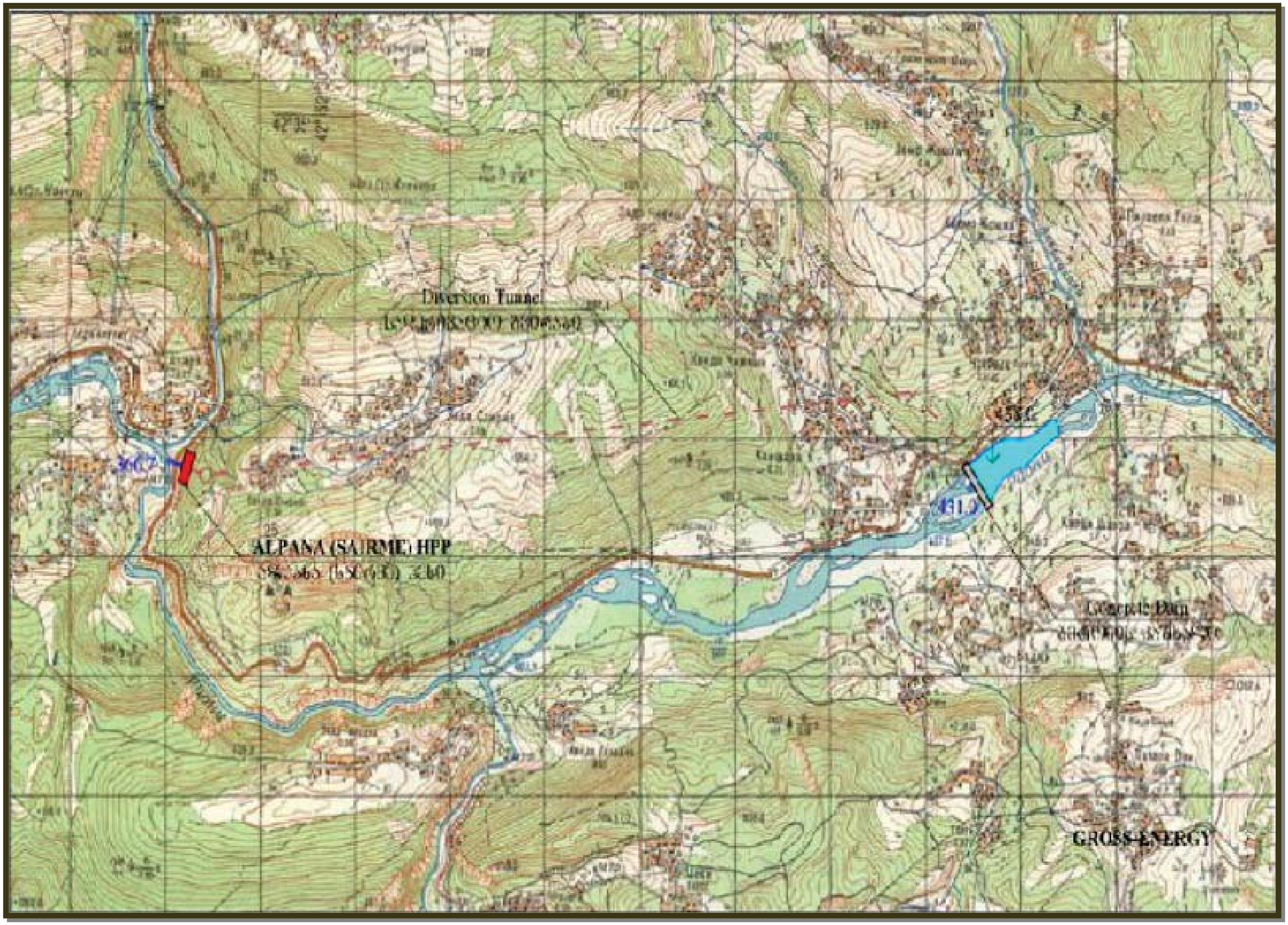


Figure 9. Locational Map of Planned Alpana HPP



Frigure 10. Alpana HPP Layout

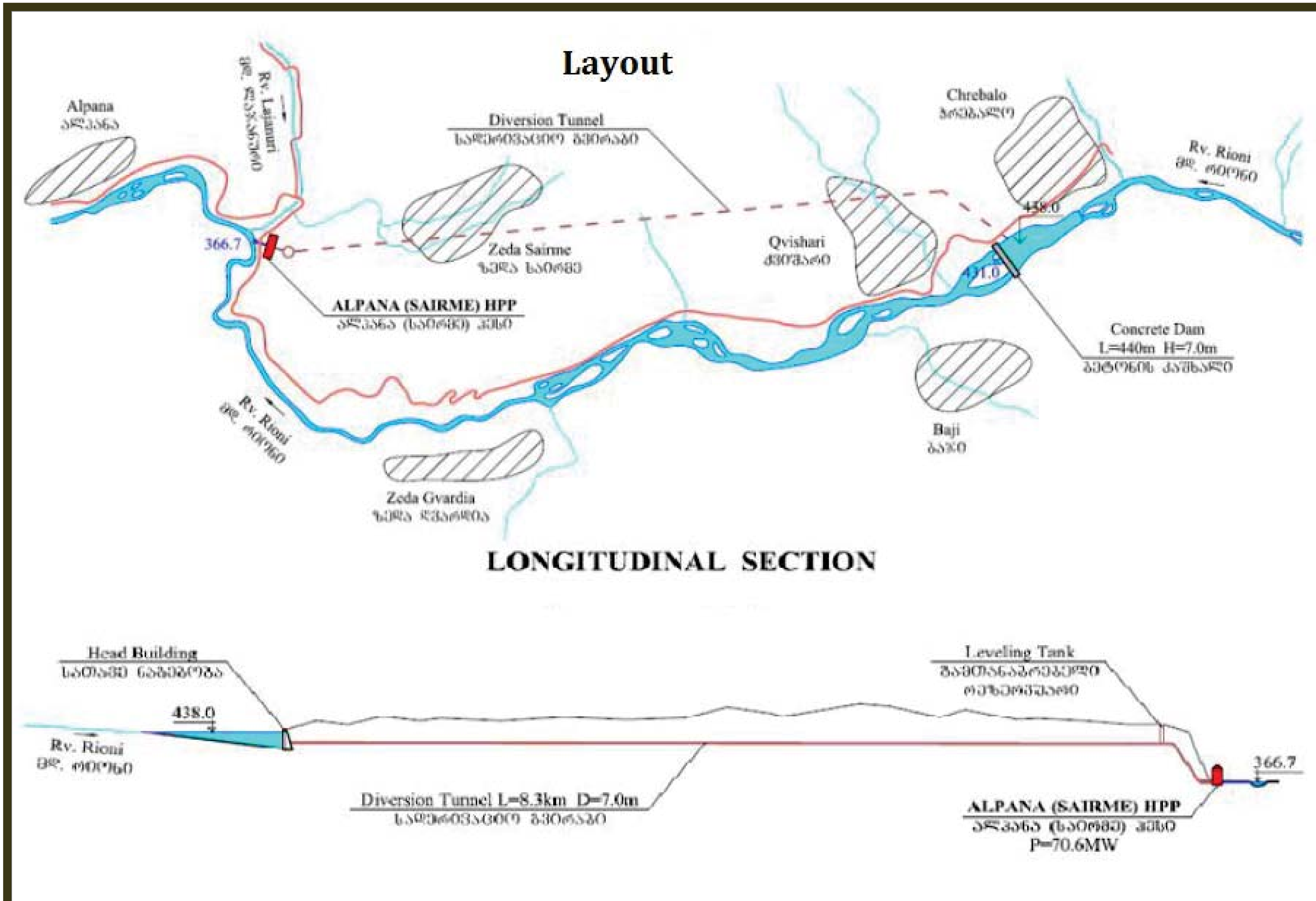


Table 5. Alazani River Basin Water Reservoirs

N	Reservoir Name	River basin	Available storage Millio m^3	Active storage Million m^3	Water-surface area in case of Max. operational level ha	Purpose
1	Mtis Dziri	Mamutlidere	3.07	2.95	82	I
2	Zilicha	Alazani	4.5	4		I
3	Kudigori	Durudji	3.6	3	300	I
4	Chali	Chagurgula	1.5	1	35	I, HP
5	Akhalsopeli	Avniskhevi	1.4	1		I
6	Kustskaro	Kustskharo	0.5	0.4		I
7	Cheremi	Patara Beti, Chermiskhevi	1.2	1.06	21	I

Table 6. Alazani River Basin Dams

№	Name	Type	Height, m	Speed of discharge cub m/sec.	Construction date
1	Mtisdziri	Earth	11	worked by water	1983
2	Kudigori	Earth	20	worked by water	1971
3	Chali	Earth	4	worked by water	1966
4	Cheremi	Rock embankment	30.5	81.5	1981

Table 7. Iori River Basin Water Reservoirs

N	Name of reservoir	River basin	Available storage Millio m^3	Active sotage Million m^3	Water-surface area in case of Max. operational level, ha	Purpose
1	Sioni	Iori	325	315	1040.0	I, HPP
2	Tbilisi	Iori	308	155	1180.0	I, D
3	Dalis mta	Iori	180	140		I
4	Kushiskhevi	Iori	5	4	65.0	I
5	Kranchiskhevi	Iori	1.92	1.25		I
6	Telatskali	Iori	1.6	1.3	14.0	I
7	Mtsaretskali	Iori	1.5	1.3		I
8	Devistskali	Iori	3.7	3.2		I
9	Vake	Iori	1.29	1.05		I
10	Tavtskaro	Iori	3.36	3.00		I

Table 8. Iori River Basin Dams

№	The name of reservoir	Type	Height, m	Speed of discharge cub m/sec.	Construction date
1	Sioni	Earth	84,8	600	1964
2	Tbilisi			worked by water	1954
	dam №1	Concrete	9		
	dam №2	Concrete	15		
	dam №3	Earth	10		

	dam №4	Earth	12		
3	Dalis mta	Earth	34	-	1988
4	Kushiskhevi	Earth	18	worked by water	1977
5	Kranchiskhevi	Earth	14,5	worked by water	1984
6	Telatskali	Earth	37	worked by water	1978

Table 9. Rioni River Basin Reservoirs

#	The name of reservoir	River basin	Available storage Millio m3	Active sotage Million m3	Water-surface area in case of Max. operational level, ha	Purpose
1	Gumati	Rioni	39.0	13.0	240	HPP
2	Vartsikhe	Rioni, Kvirila, tskhenitskali	14.6	2.4	510	HPP
3	Shaori	Shaori	71.0	68.0	1320	HPP
4.	Lajanuri	Tskhenistskali, Lajanuri	24.0	16.0	160	HPP
5.	Tkibuli	Tkibula	84.0	62.0	1150	HPP
6	Kukhi	Kukhistskali	1.9	1.85	30	Irrigation

ANNEX 10. MUNICIPAL SERVICE INFRASTRUCTURE

Table 1. Drinking Water related Statistics for Selected Cities of Alazani and Rioni River Basin (2005)

City/town	Total population in the baseline year	Abstracted from			Reported share of population served by system	Water consumption by households	Water supply regularity
		Underground sources	Surface sources				
	people	%	%		%	l/c/d	hour/day
Large cities (above 140,000 people)							
Kutaisi	189,960	100%	0%		99.50%	116	6
Resort towns of the Black sea coastal zone							
Tskhaltubo	13,600	100%	0%		100%	180	20
Poti	70000	100%	0%		65%	101	10
Other settlements							
Samtredia	30,000	100%	0%		61.30%	260	24
Chiatura	22,500	100%	0%		80.00%	57	10
Zestaphoni	25,000	100%	0%		36.00%	119	8
Senaki	28,000	100%	0%		47.50%	150	14
Gurdiaani	12,000	100%	0%		81.00%	125	4
Terdjola	5,500	100%	0%		100%	447	22

Table 2. Sewarage Systems Related Statisticts for Selected Cities of Alazani and Rioni River Basins (2005)

	City/town	Reported share of population connected to the centralized sewerage system%	wastewater collected th.m^3/year	Domestic sewage th.m^3/year	Wastewater from industries and other consumers th.m^3/year	volume of treated wastewater%
1	Large cities (above 140,000)					
	Kutaisi	74.10%	12,200	11,900	300	0%
2	Resort towns of the Black sea coastal zone					
	Tskhaltubo	48.40%	880	580	300	0%
	Poti	8.70%	3,150	2,170	980	0%
3	Other settlements					
	Samtredia	8.30%	324.0	146	178	0%
	Chiatura	55.60%	1,050.0	346	704	0%
	Zestaphoni	36.00%	440	280	160	0%
	Gurjaani	80.00%	650.0	490	160	0%
	Terdjola	16.40%	200	80	120	0%

Table 6. Kakheti Region Sewerage Systems

City	Presence of Sewerage systems (yes/no)	Coverage area(%)	Wastewater treatment	Current status of Treatment
Telavi	Yes	70	Alazani	No
Gurjaan	Yes	50	Alazani	No
Kvareli	Yes	40	Alazani	No
Lagodekhi	Yes	80	R. Shromiskhevi	No
Signagi	Yes	20	Anagiskhevi/Alazani	No
Tsnori	No	0	Alazani	No
Dedoplistskaro	No	40	Artsiviskhevi	No

Table 7. Kakheti Region Rural Water Supply Systems

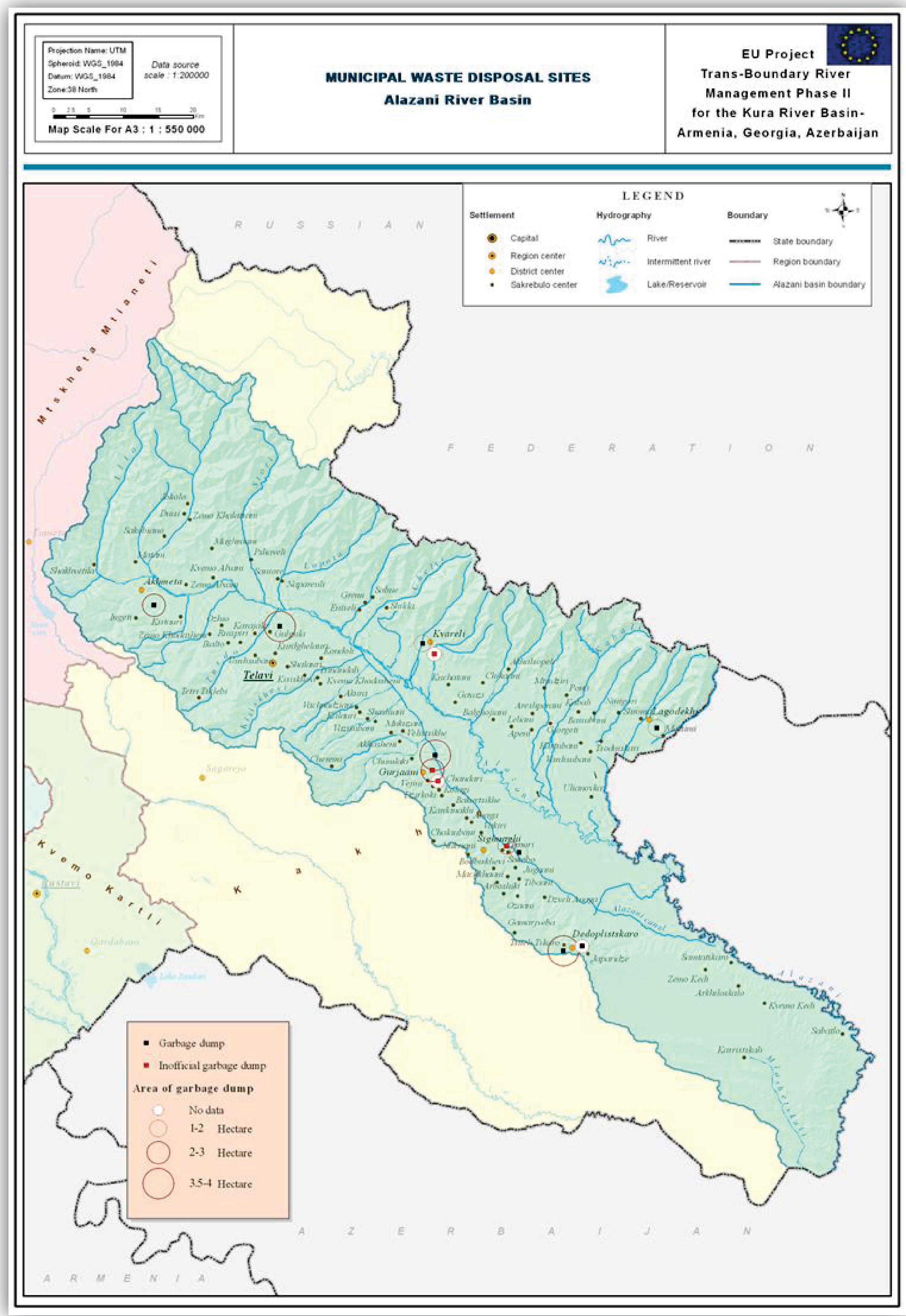
Management of water supply	Quantity of water pipeline systems	Power 100 cub.m per year	Losses (%)	Network length, km	Sources of water supply			Water volume 1000 cub m per year		Population served
					Springs	ground water	Surface water	Population	Industry	
2	3	4	5	6	7	8	9	10	11	12
Akhmeta	3	3683	17	149.0	1683	2000	-	1463	1581	24000
Gurdjaani	10	1538	18	239.5	1100	1438	-	883	378	22150
Dedoplistskaro	1	1891	18	193.0	-	1891	-	767	783	14500
Telavi	3	22075	8	100.4	-	22075	-	3920	3973	38400
Lagodekhi	3	18922	3	127.6	-	18922	-	1437	1141	16400
Signakhi	1	37843	9	245.0	-	37843	-	2803	2680	32000
Kvareli	14	4142	18	380.4	400	3742	-	1048	1947	17400

Table 8. Main Parameters of Water Supply and Sewerage Systems in Alazani, Iori and Rioni River Basins

		Water Supply Systems				Sewerage system					
City	Main pipe from intake to network (km)	Internal Network (km)	Number of wells , open	Number of underground wells	Length of the network with underground wells (km)	Main pipe from intake to network (km)	Internal network (km)	Number of wells, open	Number of underground wells	Length of the network with underground wells (km)	Status of water supply systems
1	2	3	4	5	6	7	8	9	10	11	12
Samegrelo-Zemo Svaneti											
Martvili	15.6	17.4	35	0	0	0	0	0	0	0	Old
Abasha	16	46	45	10	0.4	5					Old
Senaki	21	54.4	28	40	2.2	0	0	0	0	0	Old
Poti	90	145	78	0	0	0	46	460	0	0	Old
Khobi	7.5	39.2	10	20	25	0	0	0	0	0	Old
Imereti, Racha-Lechkhumi and Kvemo Svaneti											
Kutaisi	112	320	98	26		38	202	9890	99	4.95	Partially rehabilitated
Khoni	4.5	60.1	52	2	____	6.4	16.1	190	4	___	Old
Terjola	4.91	43.4	10	10	20	4.5	2.8	45	110	1.8	Old
Kharagauli	Legvnis Tskaro 14	21	132	_	_	No data					New
	Islaris Tskaro 0.8	0.8	_	_	_						
Tkibuli	30	77	4	18			37		300 m		Old
Bagdati	18	8.52	51	20	3.1	Absence of sewer					Partially rehabilitated
Zestaphoni	15	45	40	10	2.5	9	48	110	200	3.3	Old
Chiatura	18	51	5	2	0.3	2	46	1184	120	3	Old
Samtredia	13.5	42.7	12	19	12	5	22	12	48	7.5	Old
Tskaltubo	14.2	52	72	12	0.2	10	24	0.4	60	0.3	Old
Ientekhi	5.57	4.76	20	0	0	0	5.783	202	0	0	New
Ambrolauri	15.5	21	17	3	0.8	_	_	_	_	_	Partially rehabilitated
Tsageri	16	11	45	0	0	Construction activities for sewerage system are on-going					New
Oni	1) from Kvedni pipeline to internal network 9.25 km 2) from Djidjoeti pipe to internal network 2.4 km	18.6	24	2	0.2	1.523	14.477	350	50	2	New

Kakheti											
Telavi	22.8	63.4	480	20	3.2	42	1.25	120	6		Partially rehabilitated
Kvareli	19.3	34.8	28	0	0	4	0.53	0	0		Old
Akhmeta	24.3	23.2	18	7	1.5	25	0	0	0		Old
Gurjaani	33.9	37.74	24	3	0.5	11	0.42	15	1		Partially rehabilitated
Signagi	9	11.5	7	0	0	5.5	0.058	0	0		Old
Dedoplistskaro	4.6	37	89	0	0	6	0.105	11	0.6		New
Lagodekhi	24	52	51	0	0	20	0.367	23	1.4		Old
Sagarejo	6.35	28.9	26	0	0	18	0.196	10	0.5		Old

Figure 1. Municipal Waste Disposal Sites in Alazani River Basin



ANNEX 11. GOVERNANCE RELATED INFORMATION

Table 1. 2009 State Expenditures for Kakheti Region

Sector	GEL	%
Potable water	15861000	13.97
Sanitation	40000	0.04
Schools and kindergartens	26653000	23.47
Roads	65230000	57.45
Buildings and appartments	0	0.00
Rural assistance	2566000	2.26
Others	3195000	2.81
TOTAL	113,545,000	100.00

Table 2. 2009 State Expenditures for Mtskheta-Mtianeti Region

Sector	GEL	%
Potable water	6,424,000	10.7
Sanitation	2,415,000	4.0
Schools and kindergartens	6,729,000	11.2

Roads	33,685,000	56.1
Buildings and apartments	235,000	0.4
Rural assistance	1,238,000	2.1
Others	9,357,000	15.6
TOTAL	60,083,000	100.00

Table 3. 2009 State Expenditures of Kvemo Kartli Region

Sector	GEL	%
Potable water	11,705,000	10.8
Sanitation	1,465,000	1.4
Schools and kindergartens	8,767,000	8.1
Roads	66,563,000	61.7
Buildings and appartments	2,713,000	2.5
Rural assistance	2,016,000	1.9
Irrigation systems	7,646,000	7.1

Others	7,046,000	6.5
TOTAL	107,921,000	100.00

Table 4. 2009 State Expenditure for Racha Lechkhumi and Kvemo Svaneti Region

Sector	GEL	%
Potable water	3547000	11
Sanitation	1862000	6
Schools and kindergartens	1616000	5
Roads	18790000	60
Buildings and appartments	310000	1
Rural assistance	737000	2
Others	4330000	14
TOTAL	31,192,000	100

Table 5. 2009 State Expenditures for Imereti Region

Sector	GEL	%
Potable water	25,729,000	23.3
Sanitation	442,000	0.4
Schools and kindergartens	13,792,000	12.5

Roads	31,766,000	28.7
Buildings and appartments	11,753,000	10.6
Rural assistance	2,164,000	2.0
Irrigation systems	2,668,000	2.4
Others	22,292,000	20.2
TOTAL	110,606,000	100.00

Table 6. 2009 State Expenditures for Samegrelo-Zemo Svaneti Region

Sector	GEL	%
Potable water	14,249,000	14
Sanitation	4,278,000	4
Schools and kindergartens	17,050,000	17
Roads	45,691,000	45
Buildings and apartments	2,843,000	3
Rural assistance	2,415,000	2

Irrigation systems	0	0
Others	14,846,000	15
TOTAL	101,372,000	100.00

Table 7. 2009 State Expenditures for Guria Region

Sector	GEL	%
Potable water	3,703,000	12.6
Sanitation	61,000	0.2
Schools and kindergartens	5,091,000	17.3
Roads	15,883,000	54.1
Buildings and apartments	542,000	1.8
Rural assistance	1,122,000	3.8
Irrigation systems	0	0
Others	2,949,000	0.0
TOTAL	29,351,000	100.00

Table 8. Contact Information on Kakheti Regional Administration

Governor's administration		
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Mr. Alexander Kakhidze	Deputy Governor	Mobile: +995 91 18 82 82; Office: 8 250 7 29 01
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Ms. Natia Kaciashvili		Mobile: +995 99 65 85 85; Office: 8 250 7 03 00
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Table 9. Contact Information on Mtskheta-Mtianeti Administration

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Mr. Nunu Mghebrishvili	Deputy Governor	(+995 32) 24-45-51

Mr. Givi Maisuradze	Deputy Governor	(+995 32) 24-45-51 ; (+995 32) 51-23-40.
Office of Administration		
Ms. Luba (Lulu) Kipiani		(+995 32) 24-45-51; (+995 32); 24-45-52
Office of Relations with Local Government and State Agencies		
Ms. Natalia Maisuradze	Head of the Office	(+995 32) 24-45-53; (+995 32) 24-45-52
Office of State Supervision/Public Monitoring		
Ms. Marina Zurabishvili	Head of office	(+995 32) 24-45-51; (+995 32) 24-45-52
Office of Regional Development		
Ms. Nino Makharashvili	Head of the Office	(+995 32) 24-45-51; (+995 32) 24-45-52
Office of Financies		
Mr. Eldar Gulbatashvili	Head of the Office	(+995 32) 24-45-53; (+995 32) 24-45-52
Regional Structure of Special office of the State Governor Administration (Dusheti, Tianeti, Kazbegi, Mtskheta municipalities)		
Mr. Gia Abuashvili	Director	(+995 32) 24-45-53; (+995 32) 24-45-52

Table 10. Contact Information on Kvemo Kartli Regional Administration

Governor's administration		
Mr. David Kirkitadze	Governor	
Mr. Mamuka Chikovani	First Deputy Governor	
Mr. Husein Iusubov	Deputy Governor	

Table 11. Contact Information of Racha-Lechkhumi and Kvemo Svaneti Regional Administration

Governor's administration		
Mr. David Gagoshidze	Governor	
Mr. Aleksandre Kvatadze	First Deputy Governor	
Mr. Rostom Tskhvediani	Deputy Governor	

Table 12 Contact Information of Imereti Regional Administration

Governor's administration		
Mr. Lasha Makatsaria	Governor	

Mr. Grigol Shushania	First Deputy Governor	
Mr. Grigol Mataradze	Deputy Governor	
Mr. Nikoloz Kachkachishvili	Deputy Governor	
Administration Service		
Ms. Zeinab Khachidze		895 900 511; 877 959 081; 8231 4 61 78, e-mail: imereti2010@gmail.com
Service for Relations with Local Government and State Agencies		
Mr. Giorgi Abesalashvili	Head of the Office	8 231 4 82 01
Service for State Supervision		
Mr. Gocha Gabunia	Head of office	8(231)45385; 895 103090 e-mail: gocha_gabunia@yahoo.com
Service for Regional Development		
Mr. Amiran Endeladze	Head of the Office	
Service of Financial and Operational Management		
Mr. Zaza Kikvadze	Head of the Office	895 900 614
Service for Emergency Situations Management		
Mr. Gocha Jikia	Head	

13. Contact Information of Samegrelo-Zemo Svaneti Regional Administration

Governor's administration		
Mr. Zaza Gorozia	Governor	(+995)21550505; FAX:(+995)21550505 E-mail: szs@szs.gov.ge
Mr. Erekle Japaridze	First Deputy Governor	899 171 706 / 877 955 955 Office: 8(215) 50797 Reception: 8(215) 51736 Fax:: 8(215) 50505 Email: erekle65@gmail.com
Mr. Vakhtang Tskadaia	Deputy Governor	899 344 555 / 877 952 424 Office: 8(215) 50797 Reception: 8(215)50243 Fax: 8(215)50505 Email: vtskhadaia@gmail.com
Mr. Givi Maisuradze	Deputy Governor	(+995 32) 24-45-51 ; (+995 32) 51-23-40.
Office of Administration		
Mr. Akaki Salaridze		8(215) 51738 / 877 295 522 / 899 155526 FAX: 8(215) 50505 E-mail: akakisaralidze@yahoo.com
Office of Relations with Local Government and State Agencies		
Vacant		
Office of State Supervision		

Mr. Shota Izoria	Head of office	8(215) 51703 / 877 955 905 / 899 938994 FAX: 8(215) 50505 E-mail: shotaizoria@yahoo.com
Office of Regional Development		
Mr. Gela Svirava	Head of the Office	8(215) 53515 / 877 295 592899 / 899 153652 FAX: 8(215) 50505 gsvirava@gmail.com
Office of Finances		
Mr. Malkhaz Tsikutania	Head of the Office	8(215) 50505 / 877 739 55 / 893 211120 FAX: 8(215) 50505 tsikutania@gmail.com
Service for Emergency Situation Management		
Mr. Teimuraz Ivardava	Head of the Office	8(215) 50184 / 877 955 940 / 895 48 48 01 FAX: 8(215) 50505 tivardava@gmail.com

14. Contact Information on Guria Regional Administration

Governor's administration		
Mr. Valerian Chitaishviliu	Governor	
Mr. Tamaz Makharqdze	First Deputy Governor	
Ms. Lela Tavarkiladze	Deputy Governor	
Mr. Lasha Shapatidze	Deputy Governor	
Office of Administration		
Mr. Isak Lomtatidze		
Office of Relations with Local Government and State Agencies		
Ms. Maia Baramidze	Head of the Office	
Office of State Supervision		
Mr. Archil Khazaishvili	Head of office	
Office of Regional Development		
Mr. Giorgi Gegechkori	Head of the Office	
Office of Finance and Operations Management		
Ms. Mzia Chkhatarashvili	Head of the Office	
Service for Emergency Situation Management		
Vacant		

Table 15. Kakheti Municipalities Contact Information

Name	Position	Contact
Telavi Municipality		
Mr. Khucaidze Nugzar	Sakrebulo Chairman	Mobile: 899 51 13 13; Office: 8 (250) 7 38 00
Mr. Davitashvili Vasil	Municipality Gamgebeli	Mobile: 895 57 57 84/ 877 58 35 83

		Office: 8 (250) 7 60 09
Akhmeta Municipality		
Mr. Mailashvili Alexander	Sakrebulo Chairman	Mobile: 898 55 58 00/ 877 95 50 70 Office: 8 (249) 2 22 99
Mr. Khangoshvili Japar	Deputy Chairman	Office: 8 (249) 2 16 43; mobile: 877953074
Mr. Maisuradze Koba	Gamgebeli	Mobile: 899 91 50 33/895 33 32 27/ 877 92 44 88; Office: 8 (249) 2 16 09
Mr. Naskidashvili Vajha	First Deputy Gamgebeli	Mobile: 877 43 22 3; Office: 8 (249) 2 15 45
Gurjaani Municipality		
Mr. Iaganashvili Zaqaria	Sakrebulo chiarman	Mobile: 891 21 44 21/ 877 21 44 55; Office: 8 (253) 2 03 05
Mr. Utiashvili Shota	Gamgebeli	Mobile: 877 95 54 15/877 95 54
Kvareli Municipality		
Mr. Zandarashvili Beso	Sakrebulo Chairman	Mobile: 895 90 74 74 / 877 79 90 07 Office: 8 (252) 2 19 19
Mr. Lomidze Zaza	Deputy Sakrebulo Chairman	Mobile: 895 90 54 54; Office: 8 (252) 2 12 11
Mr. Gamsakhurdia Levan	Gamgebeli	Mobile: 877 47 47 80 / 895 20 33 99 Office: 8 (252) 2 12 12
Mr. Tsincadze Gia	First Deputy Gamgebeli	Mobile: 899 33 37 72; Office: 8 (252) 2 07 05
Dedoplistskaro Municipality		
Mr. Baghashvili Levan	Sakrebulo Chairman	Mobile: 899 19 85 58 / 877 75 31 31 Office: 8 (256) 2 50 34
Mr. Shanshiashvili Nikoloz	Gamgebeli	Mobile: 877 95 57 95
Lagodekhi Municipality		
Mr. Gozalishvili Gia	Sakrebulo Chairman	Mobile: 895 78 02 02 / 877 57 41 41 Office: 8 (254) 2 14 14
Mr. Bakashvili Davit	Deputy Sakrebulo Chiarman	Mobile: 899 32 04 70 Office: 8 (254) 2 39 54
Mr. Loladze Dimitri	Gamgebeli	Mobile: 895 49 94 44 / 877 54 24 42 Office: 8 (254) 2 30 20
Sagarejo Municipality		
Mr. Chiaureli Ilia	Sakrebulo Chairman	Mobile: 895 56 02 02 / 877 92 22 44 Office: 8 (251) 4 39 91
Mr. Pirkulashvili Gia	Deputy Sakrebulo Chairman	Mobile: 893 72 68 67; Office: 8 (251) 4 30 43

Mr. Chalatashvili Gia	Gamgebeli	Mobile: 899 98 20 00 / 895 40 99 44 / 877 90 77 00; Office: 8 (251) 4 33 35
Mr. Kuchuashvili Emzar	First Deputy Gamgebelo	Mobile: 895 19 55 99 / 899 57 32 21 Office: 8 (251) 4 33 32
Signagi Municipality		
Mr. Zedelashvili Zaza	Sakrebulo Chairman	Mobile: 895 90 28 28 / 877 95 53 73 Office: 8 (255) 3 11 11
Mr. Kochlamazashvili Nodar	Gamgebeli	Mobile: 899 10 08 96 / 877 54 35 35 Office: 8 (255) 3 12 12

Table 16. Contacts of Tianeti Municipality:

Name	Position	Contact
Telavi Municipality		
Mr. Givi Tsiklauri	Sakrebulo Chairman	
Mr. Nugzar Kurshavishvili	Depu Sakrebulo Gagebeli	
Mr. George Abulashvili	Municipality Gamgebeli	8 95 22 11 83
Mr. Tamaz Iarajuli	Deputy Gamgebeli	

Table 17. Contacts of Racha-Lechkumi Municipalities

Name	Position	Contact
Ambrolauri Municipality		
Mr. Kakhaber Parjanadze	Sakrebulo Chairman	
Mr. Avtandil Vakhtangadze	Deputy Sakrebulo Gagebeli	
Mr. Levan Jmunkhadze	Municipality Gamgebeli	
Mr. Aleko Kurtsikidze	Deputy Gamgebeli	
	Architecture and Supervion service	
Mr. Erekle Dokhnadze	Head	
Culture, Sports, Youth Affairs, Health and Social Protection		
Mr. Gaioz Gabisiani	Head	
Municipal Services and Infrastructure Service		
Mr. Giorgi Gagoshidze	Head	
	Administration Service	
Mr. Robinzon Chelidze	Head	
Mr. Revaz Kobakhidze	Head	
Military Recruitement Service		
Mr. Besik Chelidze	Head	
Financial-Budgeting Service		
Mr. Bejan Kobakhidze	Head	
Fire Fighting and Rescue Service		
Mr. Kakhaber Vakhtangadze	Head	

Figure 1. Municipalities and Territorial Units of the Alazani River Basin

Figure 2. Municipalities and Territorial Units of the Iori River Basin

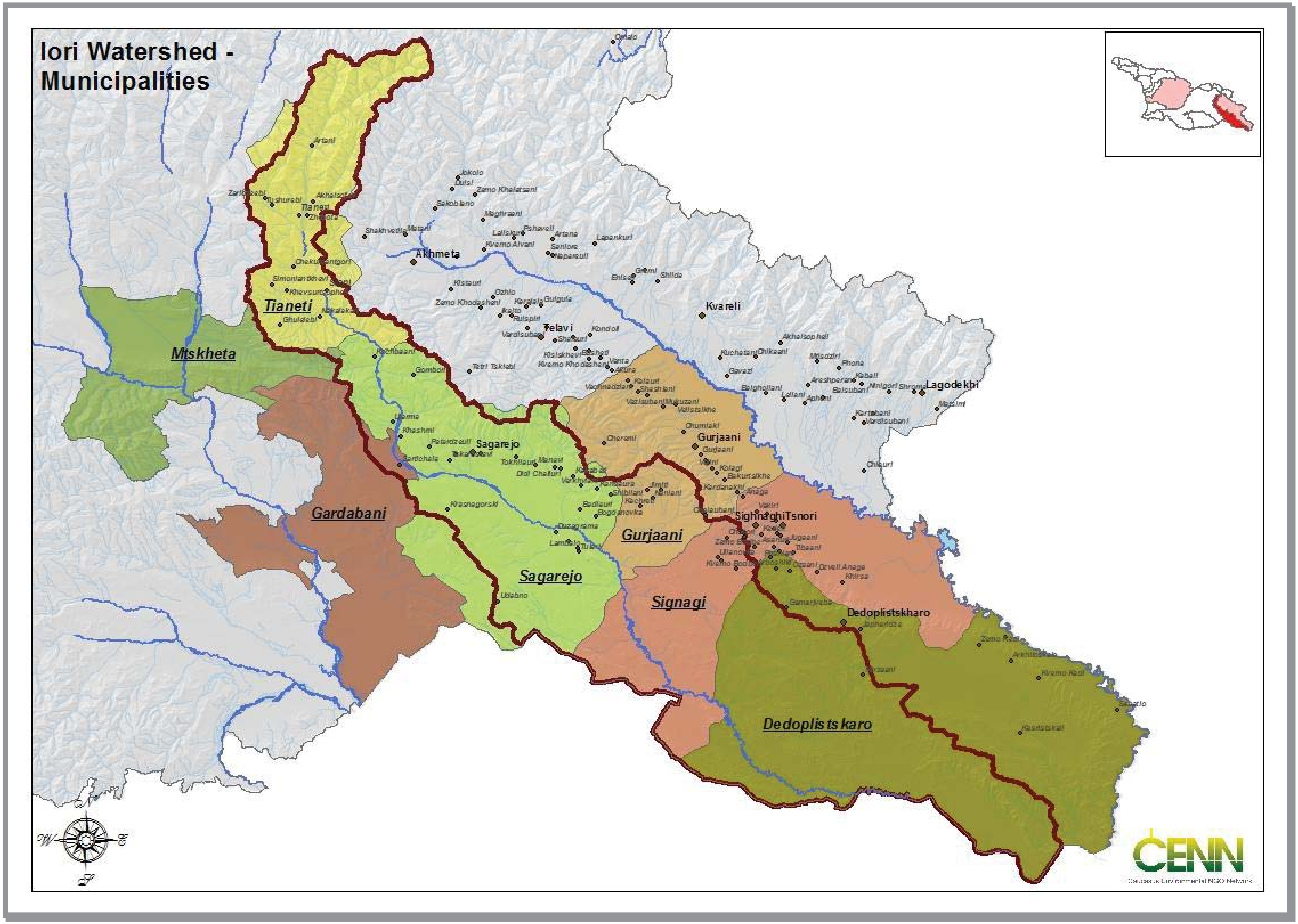
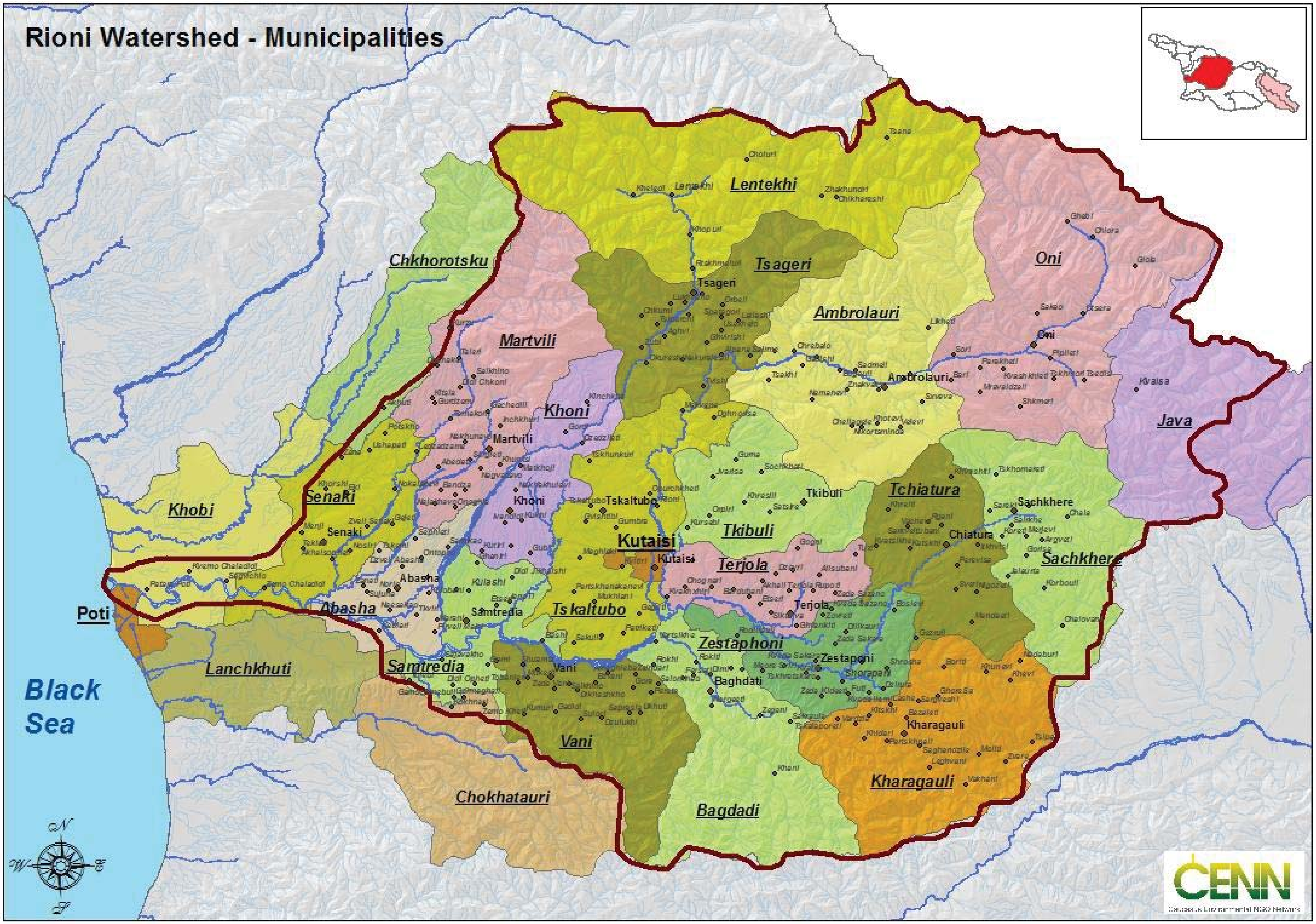


Figure 3. Municipalities and Territorial Units of the Rioni River Basin



ANNEX 12. ANTRHOPOGENIC PRESSURES ON NATURAL RESOURCES

Table 1. 2009 Water Abstractions in the Alazani River Basin, by Rivers (mln. m3/year)

Rivers of Alazani watershed	Abstraction		Consumption					
	in total	from which ground water	Total	purposes				
				drinking	industrial	irrigation	HPP	fishery
1	2	3	4	5	6	7	8	9
Alazani Basin	724.81	12.36	657.27	9.94	0.76	5.87	629.4	11.3
Alazani	588.31	10.42	521.11	8.48	0.35	5.65	496.61	10.02
Lopota	4.22		4.22				4.07	0.13
Samkuritskali	107.67		107.67				107.67	
Ilto	0.22	0.01	0.15	0.00*	0.01	0.15		
Stori	0.07		0.07			0.07		
Didkhevi	0.05		0.05					0.05
Matantsara	0.04		0.04		0.04			
Vantiskhevi	0.00*				0.00*			
Bursa	21.4	0.29	21.34	0.01	0.28		21.05	
Apheni	1.13		1.10					1.10
Kabali	0.06		0.06		0.06			
Lagoddekhistskali	1.62	1.62	1.45	1.45				
Turdo	0.02		0.02		0.02			

0.00* - abstraction is low < 1,000 m3/year

Table 2. 2009 Water Abstractions in the Alazani River Basin, by Municipalities (mln. m3/year)

District	Abstraction		Consumption						
	in total	from which from which ground water	Total	from which used water by transferring	purposes				
					drinking	industrial	irrigation	HPP	fishery
1	2	3	4	5	6	7	8	9	10
Kakheti region	724,65	12.35	657.19	389.15	9.94	0.75	5.84	629.2	11.46
Telavi	475.48	1.69	20.15	0.007	0.81	0.35	5.84	4.07	9.14
Kvareli	23.8	2.75	23.23	0.00	1.93	0.24		21.05	0.02
Signagi	3.71	3.71	3.82	0.2	3.57				0.25
Lagodekhi	2.81	1.62	2.60	-	1.45	0.06	0.00*		1.1
Sagarejo	2.73	1.16	1.93	0.00	0.78	0.34	0.77		0.04
Akhmeta	215.58	0.39	215.57	-	0.35	0.01		215.17	0.03
Gurjaani	3.04	1.98	391.57	388.92	1.64	0.10		388.92	0.92
Dedophlitskaro	0.22	0.22	0.20	-	0.20				

Table 3. 2009 Water Abstractions in the Iori River Basin, by Rivers (mln.m3/year)

Rivers of Iori watershed	Abstraction		Consumption						
	in total	from which ground water	in total	from which used water by transferring	purposes				
					drinking	industrial	irrigation	HPP	fishery
1	2	3	4	5	6	7	8	9	10
iori	181.95	2.16	161.88	157.85	1.76	0.47	1.92	157.69	0.04
Sioni reservoir	78.85	-	78.85					78.85	
in total	**260.95**	2.16	240.73	157.85	1.76	0.47	1.91	236.54	0.04

Table 4. 2009 Water Abstractions in the Iori River Basin, by Municipalities (mln. m3/year)

District	Abstraction		Consumption						
	in total	from which from which ground water	in total	from which used water by transfer-ring	purposes				
					drinking	industrial	irrigation	HPP	fishery
1	2	3	4	5	6	7	8	9	10
In total	260.79	2.16	240.73	157.81	1.76	0.47	1.92	236.53	0.04
Kakheti	2.73	1.15	1.88		0.732	0.33	0.77		0.04
Signagi	0.002	0.002			0.002				
Sagarejo	2.72	1.15	1.88		0.73	0.33	0.77		0.04
mtskheta-mtianeti	257.11	0.05	80.32		0.05	0.12	1.14	78.85	
Tianeti	257.11	0.05	80.32		0.05	0.12	1.14	78.85	
Kvemo kartli	0.95								
Gardabani	0.95	0.95	79.78	78.97	0.9	0.003		78.84	
Tbilisi	-		78.84	78.84				78.84	

Table 5. 2009 Water Abstractions in the Rioni River Basin, by Rivers (mln.m3/year)

rivers of Rioni watershed	Abstraction		Consumption					
	in total	from which ground water	in total	purposes				
				drinking	industrial	irrigation	HPP	fishery
1	2	3	4	5	6	7	8	10
Rioni Basin	16274.24	72.48	16259.45	63.16	15.49	0.12	16180.68	
Rioni	8997.34	46.49	8988.37	37.14	0.95	0.11	8950.13	
Abasha	104.76	0.24	104.71	0.15	0.05		104.51	
Kvirila	12.48	7.69	11.3	6.19	5.12			
Tkibuli	0.26		0.22	0.2	0.02			
Cholaburi	0.07		0.07		0.07			
Tskatsitela	0.12		0.12		0.12			
Tsablarastskali	0.02		0.02	0.02				
Khanistskali	0.14	0.02	0.12	0.1	0.02			
Skipi	0.14	0.14	0.13	0.13				
Sulori	0.04	0.04	0.04		0.02			
Tskaltubostskali	5.43	5.43	4.35	4.29	0.05			
Chkhara	0.08	0.07	0.08	0.06	0.01			
Tskhenistskali	5.64	5.53	4.78	4.65	0.13			
Buja	0.79	0.01	0.06	0.5	0.59	0.01		
Tekhuri	5.26	5.26	4.26	4.07	0.18			
Ogaskura	0.00*	0.00	0.00	0.00	0.00			
Ritseula	0.12	0.12	0.11	0.11				
Lukhunistskali	1.38	0.66	1.2	1.19				
TsiviTskali	0.09	0.09	0.09	0.09				
Shareula	0.26	0.026	0.24	0.24				
Lajanura	0.14	0.14	0.12	0.12				
Jruchula	0.00	0.00	0.00	0.00				
Rikotula	0.01	0.01	0.01	0.01				
Chkherimela	0.05	0.05	0.06		0.06			
Dzirula	0.03	0.01	0.03	0.01	0.02			
Reservoir of Gumati	6879.7		6879.7				6879.72	
Rsoervoir of Tkibuli	153.69		153.69				153.69	
Reservoir of Shaori	93.04	0.24	93.03	0.23	0.17		92.63	

Table 6. 2009 Water Abstractions in the Rioni River Basin, by Municipalities (mln. m3/year)

District	Abstraction		Consumption					
	in total	from which ground water	in total	purposes				
				drinking	industrial	irrigation	HPP	fishery
1	3	4	5	6	7	8	9	10
Imereti region	14826.75	60.43	14813.97	52.85	14.89	0.12	14746.21	
t. Kutaisi	1569.2	42.07	1560.84	33.38	0.28		1.527.17	
Zestaoponi	11.84	3.03	10.98	2.53	8.43	0.01		
Khoni	1.2	1.12	0.99	0.98				
Kharagauli	0.46	0.45	0.4	0.3	0.11			
Sachkhere	2.12	0.75	2.1	0.72	1.37			
Samtredia	3.58	3.58	3.18	3.00	0.18			
Vani	0.14	0.08	0.14		0.08			
Bgdati	0.17	0.02	0.15	0.12	0.02			
Chiatura	5.87	3.27	5.22	2.46	2.76			
Tskaltubo	12978.51	5.44	12977.3	4.31	0.2	0.11	12972.7	
Tkibuli	98.09		97.18	4.1	0.45		92.63	
Terjola	155.5	0.62	155.48	0.21	1	0.58	153.69	
Racha-lechkhumi kvmo-svaneti region	1335.09	4.17	1334.51	4.63	0.19		1329.96	
Ambrolauri	3.73	2.91	3.37	3.23	0.13			
Lentekhi	0.32	0.32	0.27	0.27				
Oni	0.32	0.18	0.27	0.27				
Tsageri	1330.71	0.76	1330.59	0.58	0.05		1329.96	
Samegrelo –kvemo Svaneti region	113.95	9.43	112.37	7.3	0.73		104.51	
t. Photi	2.39	2.39	2.02	1.83	0.19			
Khobi	0.27	0.27	0.22	0.2	0.3			
Abasha	0.24	0.24	0.19	0.15	0.04			
Martvili	104.73	0.21	104.73	0.17	0.05		104.51	

Senaki	5.05	5.05	4.05	3.90	0.14			
In total r. Rioni basin	16275.79	74.03	16260.78	64.78	15.81	0.12	16180.68	

Table 7. 2009 Wastewater Discharge in the Alazani River Basin, by Rivers (mln. m3/y)

Discharge by rivers	In total		discharge in surface water bodies				
			in total	Form which			
				Polluted		clean water (not needed treatment)	fully treated
	In total	from which discharged on surface relief		without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
In total Alazani river Basin	646.00	5.19	640.81	11.58		629.21	0.02
Alazani	127.27	3.59	121.69	10.1		111.68	
Lower Alazani channel*	389.50		389.50	0.58		388.92	
Samkuristskali	107.57		107.57			107.57	
Ilto	0.01	0.00	0.01	0.01			
Stori	0.00	0.00					
Turdo	0.05		0.05	0.03			0.02
Didkhevi	0.04		0.04	0.04			
Lopota	0.08		0.08	0.08			
Matsantsara	0.02		0.02	0.02			
Intsoba	0.26	0.26					
Nasamkhraliskhevi	0.00		0.00	0.00			
Kisiskhevi	0.04		0.04	0.04			
Chagurgula	21.05		21.05			21.05	
Bursa	0.05		0.05	0.05			0.00
Phaphariskhevi	0.03		0.03	0.03			
Avaniskhevi	0.26	0.26					
Afeni	1.10		1.10	1.10			
Kabali	0.06		0.06	0.06			
Chartliskhevi	1.08	1.08					
Ulgansu	0.04		0.04	0.04			
Lagodekhistskali	0.07		0.07	0.07			

*HPP LTD "Alazani"-abstracts and discharges water from lower Alazani channel

Table 8. 2009 Wastewater Discharges in the Alazani River Basin, by Municipalities (mln. m3/y)

Discharge by rivers	In total		discharge in surface water bodies				
			in total	Form which			
				Polluted		clean water (not needed treatment)	fully treated
	In total	from which discharged in surface relief		without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
Kakheti region	647.56	5.35	642.19	12.95		629.21	0.02
Telavi	11.02	0.28	10.75	6.66		4.07	0.02
Kvareli	22.89	0.69	22.21	1.15		21.05	0.00
Signagi	3.30	2.61	0.70	0.70			
Lagodekhi	2.34	1.08	1.26	1.26			
Sagarejo	0.96	0.07	0,89	0.89			
Akhmeta	215.52	0.33	215.19	0.01		215.18	
Gurjaani	391.31	0.09	391.21	2.29		388.92	
Dedophlitskaro	0.20	0.20					

Table 9. 2009 Wastewater Discharges in the Iori River Basin, by Rivers (mln. m3/y)

Discharge by rivers	In total		discharge in surface water bodies				
			in total	Form which			
				Polluted		clean water (not needed treatment)	fully treated
	In total	from which discharged on surface relief		without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
In total Iori river Basin	65.74*	0.17	65.57	0.79		64.77	0.004
Iori	65.74	0.17	0.8	0.79		64.77	0.004

*In addition 64.77 mln m3 is discharged by Upper Iori Chanel as transit discharge.

Table 10. 2009 Wastewater Discharges in the Iori River Basin, by Municipalities (mln. m3/y)

Discharge by districts	In total		discharge in surface water bodies				
			in total	Form which			
				Polluted		clean water (not needed treatment)	full treated
	In total	from which discharged in surface relief		without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
Kakhet region	0.86	0.07	0.79	0.79			
Dedoflistskaro							
Signagi							
Sagarejo	0.86	0.07	0.79	0.79			
Mtskheta-Mtianeti Region	64.87	0.10	64.773			64.77	0.003
Tianeti	64.87	0.10	64.773			64.77	0.003
Kvemo Kartli region							
Gardabani							
In total Iori Basin	64.87	0.10	64.773			64.77	0.003

Table 11. 2009 Wastewater Discharges in the Rioni River Basin, by Rivers (mln. m3/y)

Discharge by rivers	In total		discharge in surface water bodies				
			in total	Form which			
				Polluted		clean water (not needed treatment)	full treated
	In total	from which discharged in surface relief		without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
In total Rioni river Basin	16242.95	13.03	16228.91	38.28	0.21	16188.23	2.19
Rioni	15861.43	9.83	15851.35	21.14	0.01	15829.84	0.35
Abasha	104.72		104,72	0.21		104,51	
Koritskali	0.03	0.03					
Cholaburi	0.12		0.12	0.02		0.09	
Tsablaratskali	0.02		0.02	0.02			
Khanistskali	0.10	0.00*	0.10	0.08	0.02		
Kvirila	16.74	0.66	15.38	6.39	0.17	7.53	1.29
Skipi	0.04	0.04					
Sulori	0.03	0.01	0.02	0.01	0.00	0.00	0.00
Tskaltubotskali	3.48	1.38	2.1	2.08		0.02	
Tskhenistskali	3.71	0.31	3.35	3.24			0.11
Tkibuli	153.69		153.69			153.69	
Tekhuri	1.98		1.98	1.98			
Ogaskura	0.01					0.01	
Budja	2.87		2.87	2.87			
Tskaltsitela	0.18		0.18			0.18	
Dzirula	0.02		0.02			0.02	
Chlherimela	0.30		0.30	0.23		0.07	
Rikotula	0.01		0.01		0.01		
Ladjanura	0.09	0.09					
Shareula	0.14	0.14					
Ritseula	0.09	0.09					
Lukhunistskali	0.13	0.13					
Chkhara	0.22	0.13	0.08	0	0.01		0.07
Shaori reservoir	0.18	0.18					
Tkibuli reservoir	92.63		92.63			92.63	

Table 12. 2009 Wastewater Discharges in the Rioni River Basin, by Municipalities (mln. m3/y)

Discharge by districts	In total		discharge in surface water bodies				
			in total	Form which			
	In total	from which discharged in surface relief		Polluted		clean water (not needed treatment)	full treated
				without treatment	not sufficient treatment		
1	2	3	4	5	6	7	8
Imereti region	14 800.93	10.48	14 789.47	33.43	0.20	14753.76	2.08
Kutaisi	1553.96	8.02	1545.93	18.70		1527.18	0.05
Zestaoponi	9.70	0.27	8.73	1.77	0.01	6.89	0.06
Khoni	0.79	0.2	0.59	0.59			
Kharagauli	0.31		0.31	0.23	0.01		0.07
Sachkhere	1.77	1.24	1.77	0.52			
Samtredia	2.80		2.56	2.44		0.05	0.07
Vani	0.12	0.04	0.07	0.01			0.06
Bgdati	0.12		0.12	0.1	0.02		
Chiatura	4.20	0.01	4.20	4.04	0.15		0.01
Tskaltubo	12976.33	1.38	12974.94	2.08		12972.73	0.13
Tkibuli	95.69		95.67	2.87		92.63	0.18
Terjola	155.14	0.56	154.57	0.08	0.01	154.28	0.20
Racha-lechkhumi kvmo-svaneti region	1 333.44	2.55	1 330.89	0.81	0.01	1329.96	0.11
Ambrolauri	2.74	2.29	0.46	0.34	0.01		0.11
Lentekhi	0.05		0.05	0.05			
Oni	0.22		0.22	0.22			
Tsageri	1330.42	0.26	1 330.16	0.20		1 329.96	
Samegrelo –kvemo svaneti region	108.77		108.77	2.19		104.51	
t. Photi	1.89		1.89	1.85			
Khobi	0.18		0.18	0.18			
Abasha	0.14		0.14	0.14			
Martvili	104.58		104.58	0.07		104.51	
Senaki	1.98		1.98	1.98			
In total r. Rioni basin	16243.14	13.03	16229.13	36.43	0.21	16188.23	2.19

Figure 1. Inventory of Former Soviet Storehouses of Obsolete Pesticides/Fertilizers

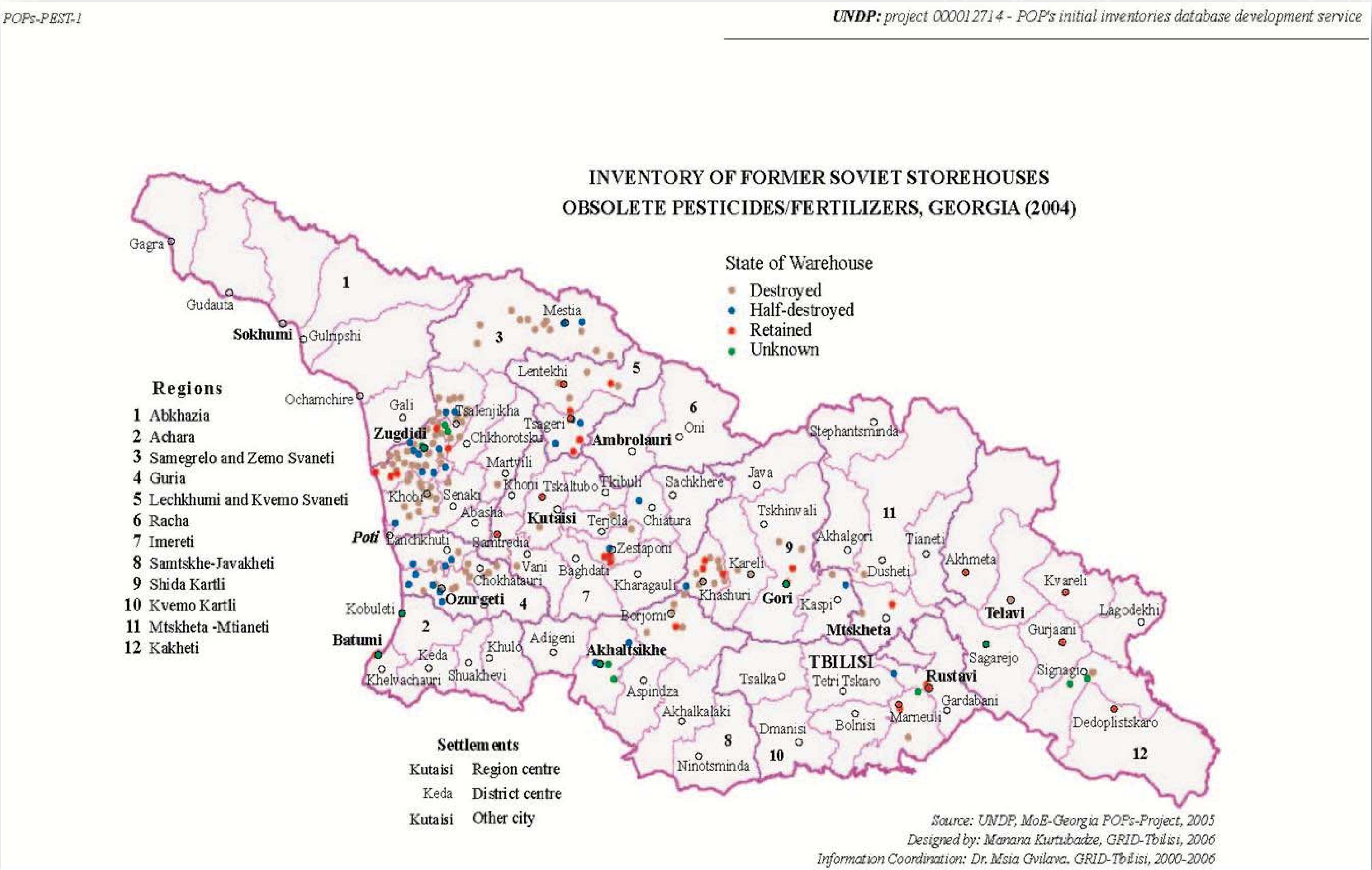
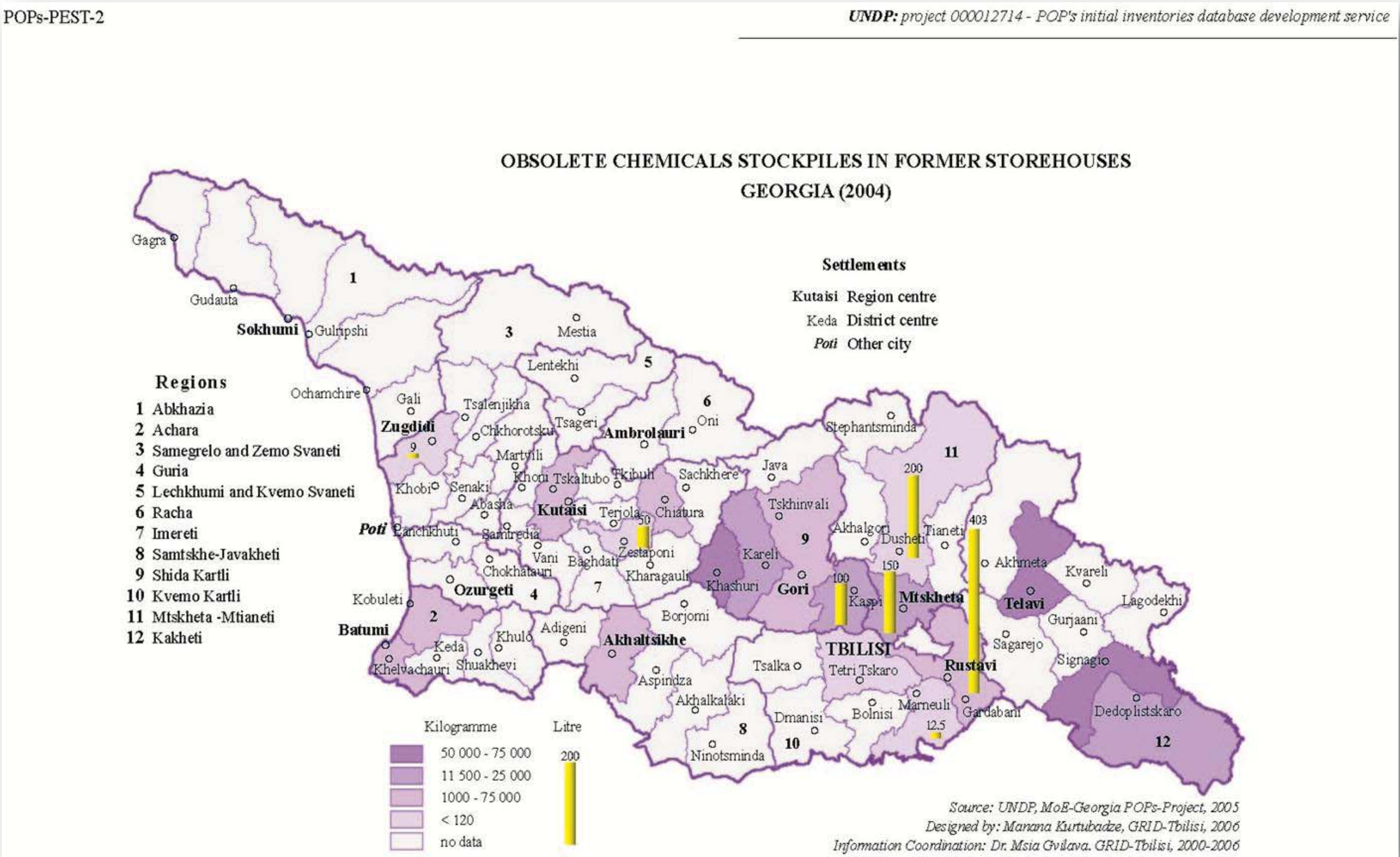


Figure 2. Obsolete Pesticides Stockpiles in Former Storehouses



ANNEX 13. NATURAL PRESSURES

Figure 1. Map of the Flash Flood Risks of Georgia (1991-2000 data)

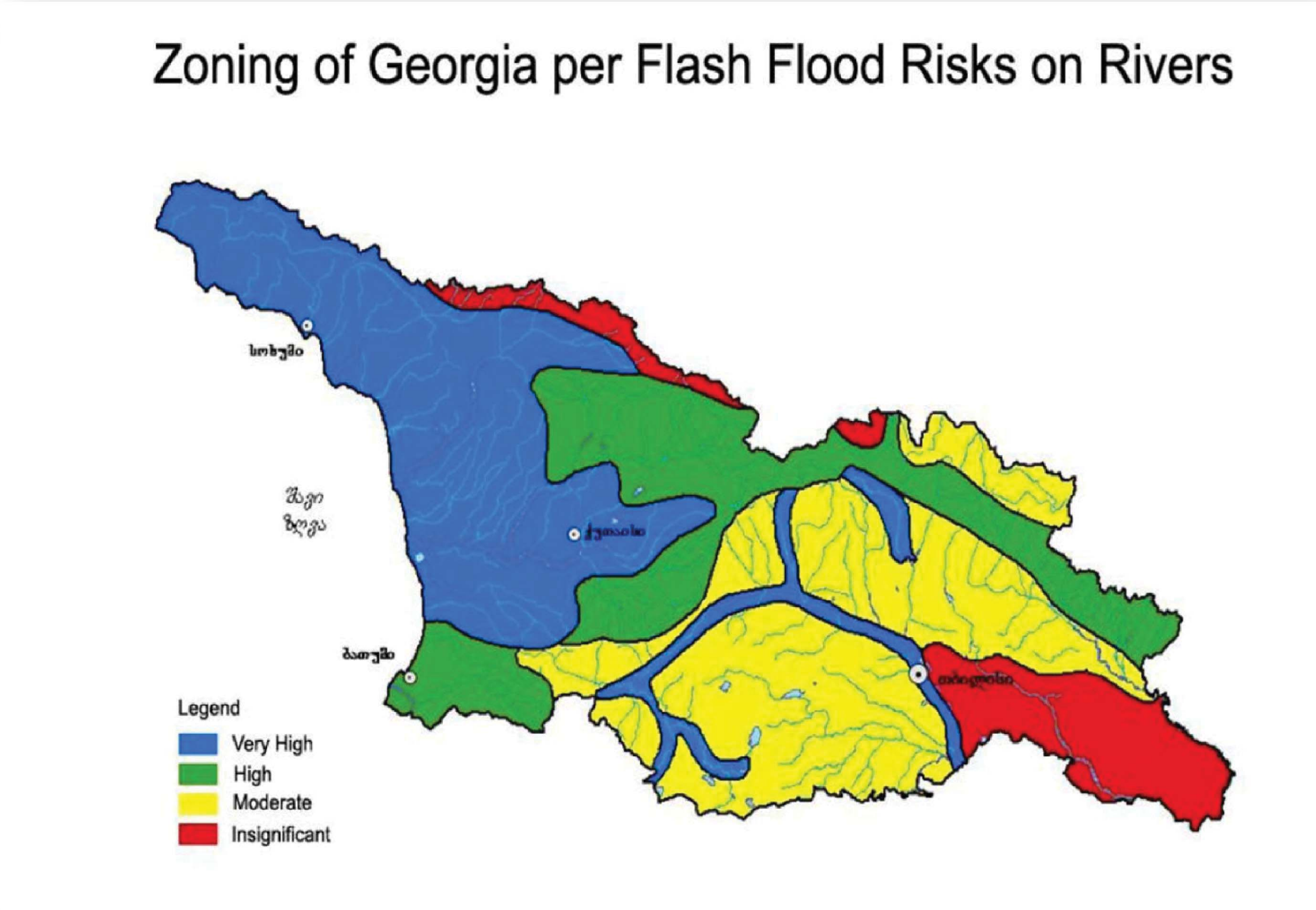


Figure 2. Map of the Catastrophic Flash-Flood Risk Zones

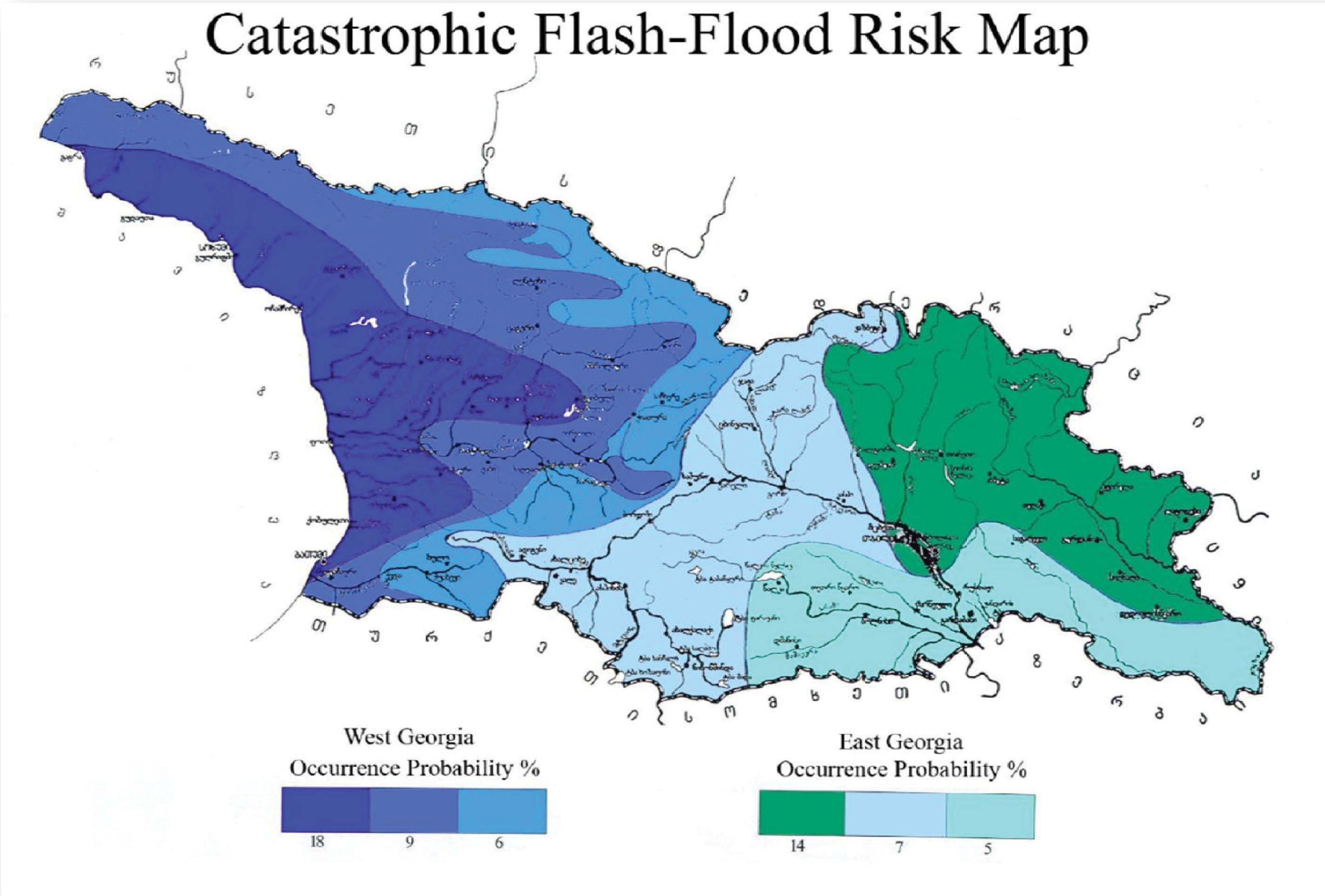


Figure 3. Priority Sub-catchments of flash Flood Hazards in Georgia within River Basins Mtkvari, Alazani, Rioni, Inguri

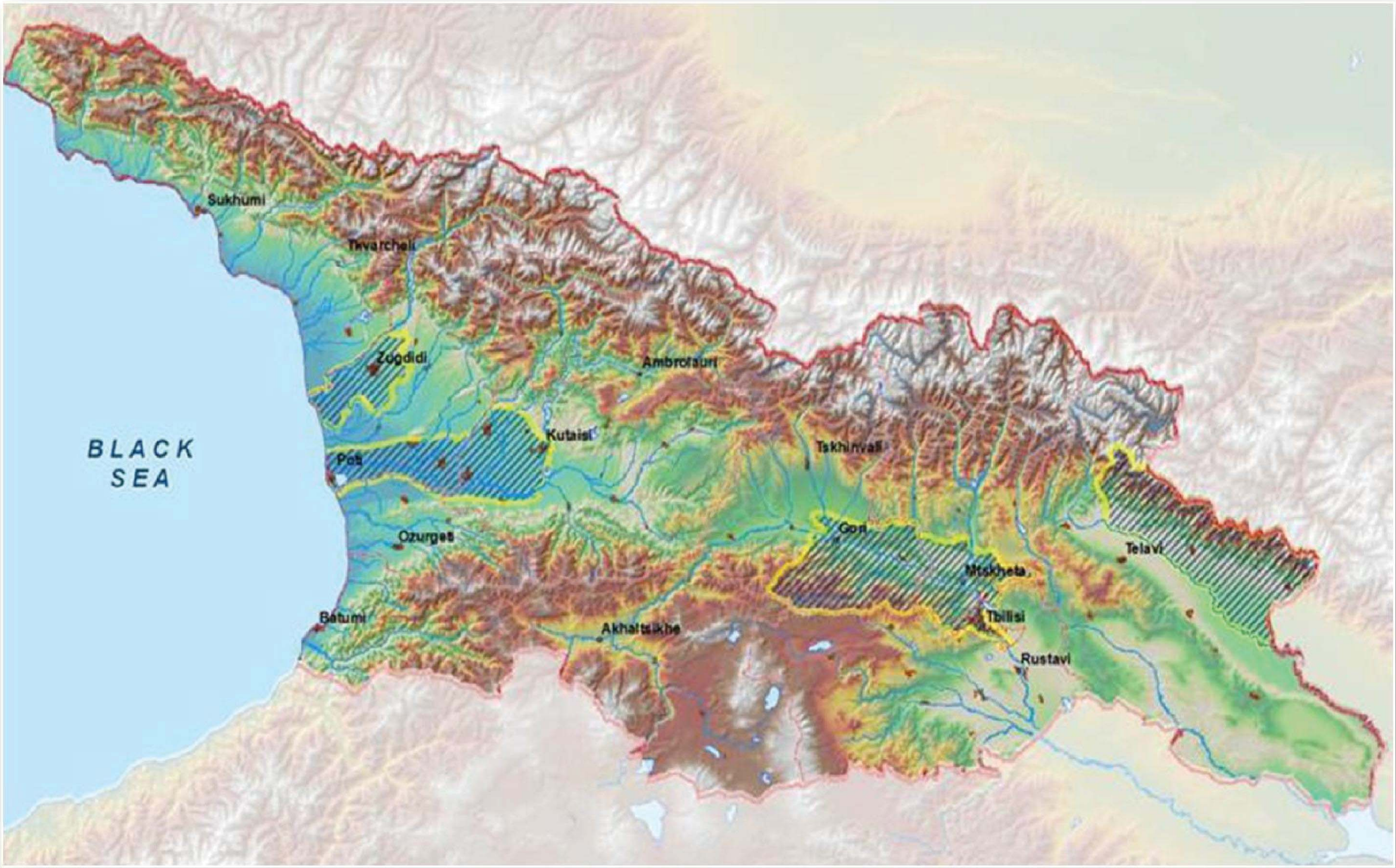


Figure 4. Landslide Prone Areas (Risk Distribution)

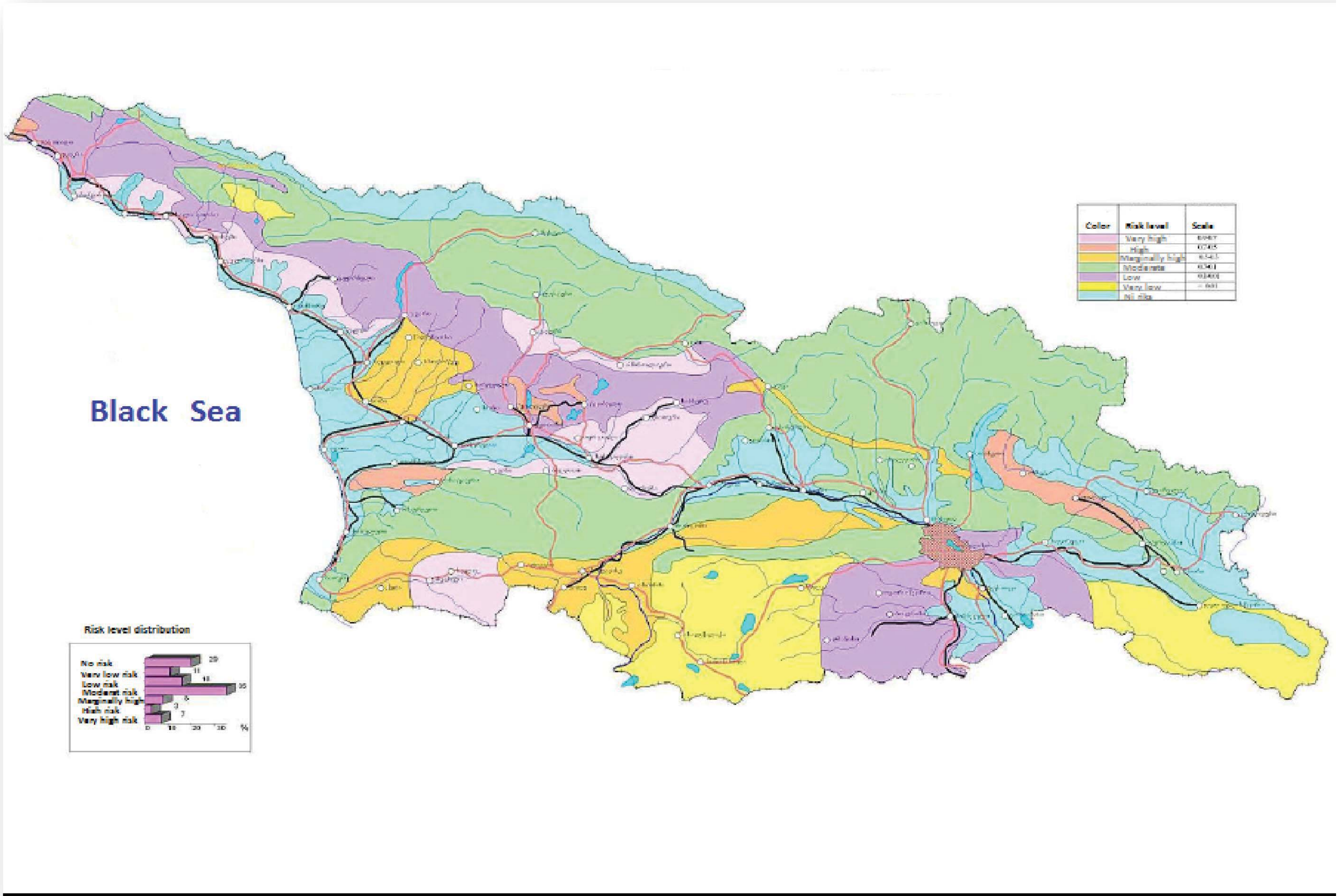


Figure 5. Mudflow Prone Areas in Georgia (Risk Distribution)

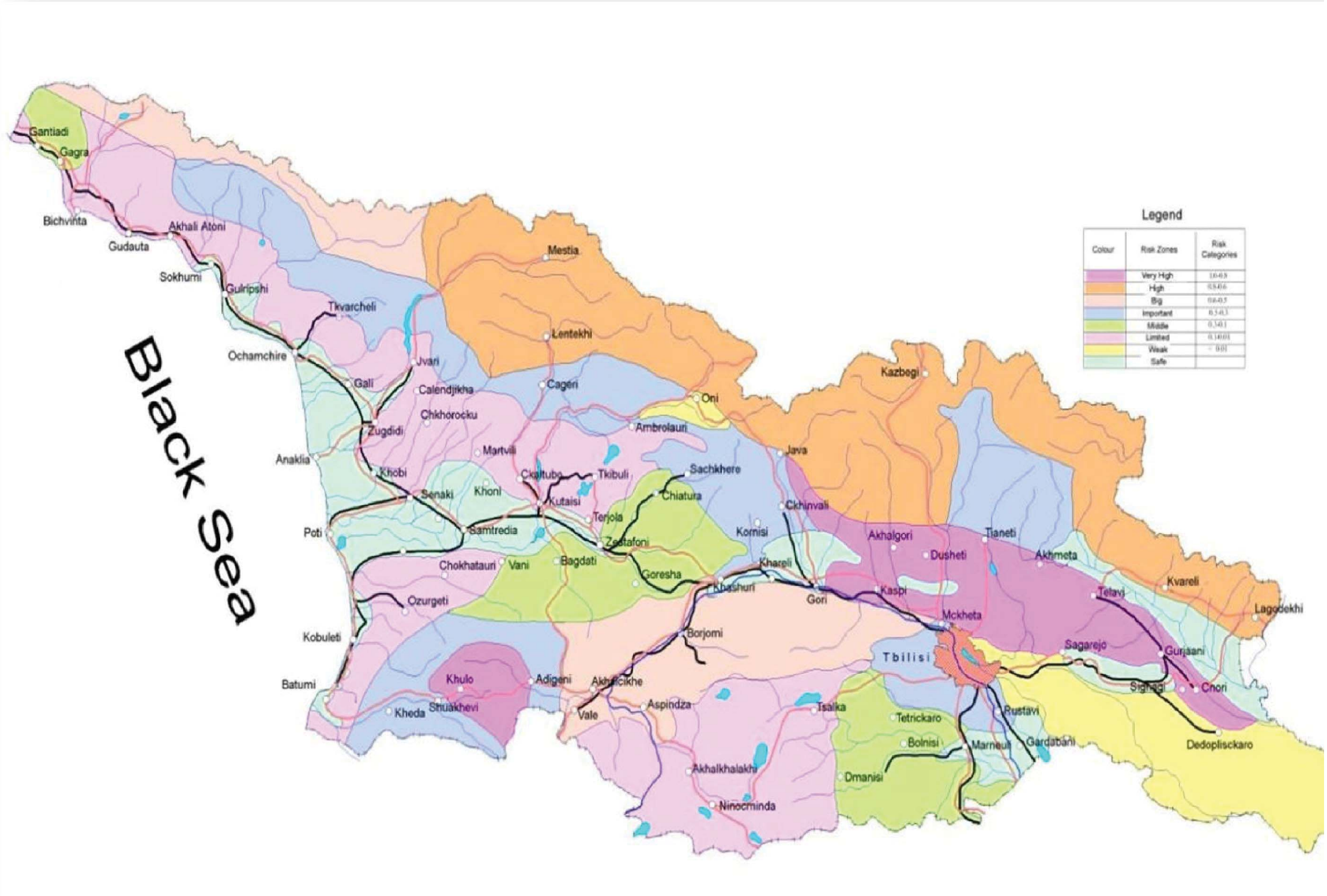


Figure 5. Hydro-Meteorological Network of Georgia

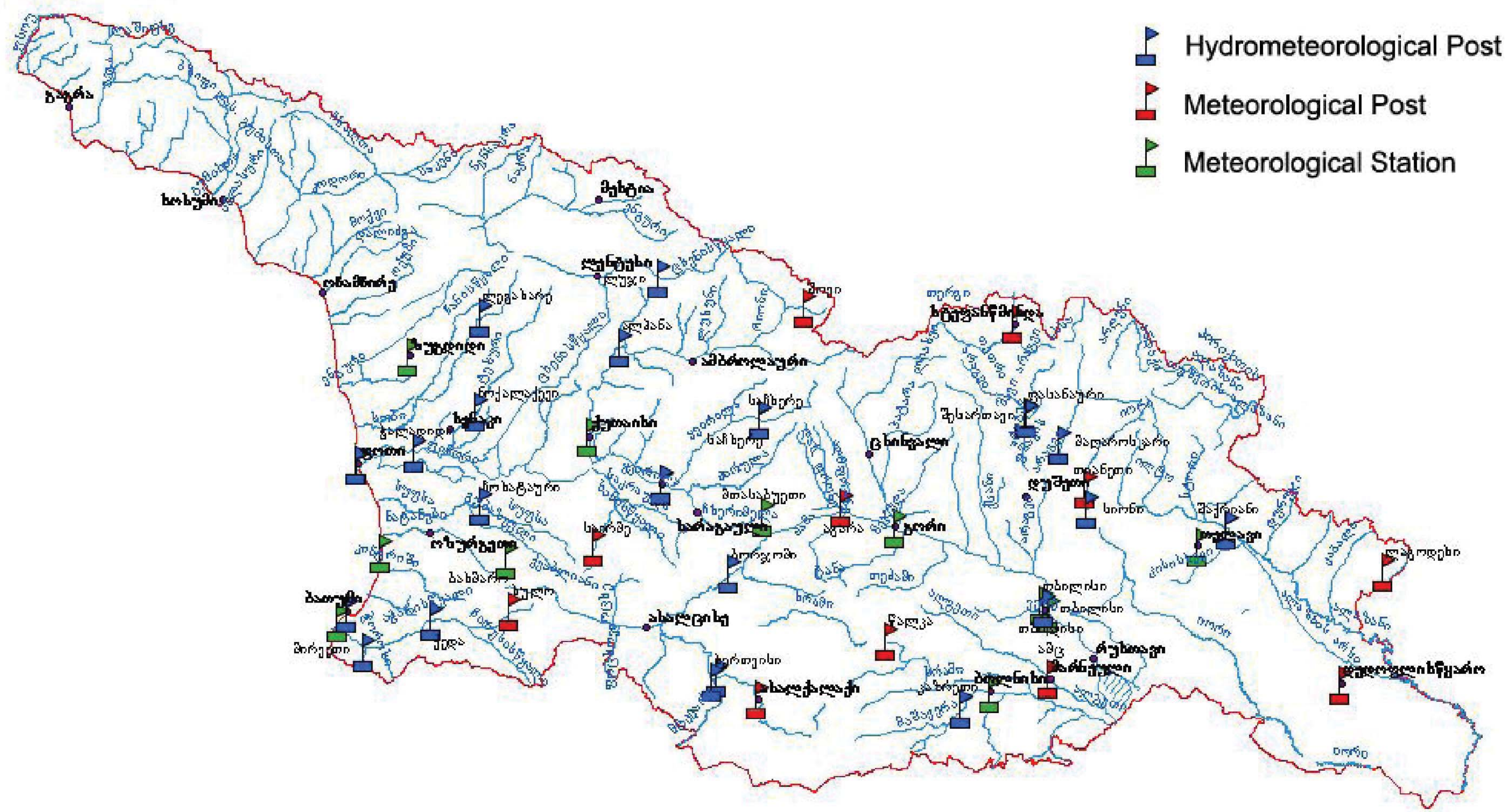


Figure 6. Dynamics of Changes in Hydrometeorological Observation Points in Georgia

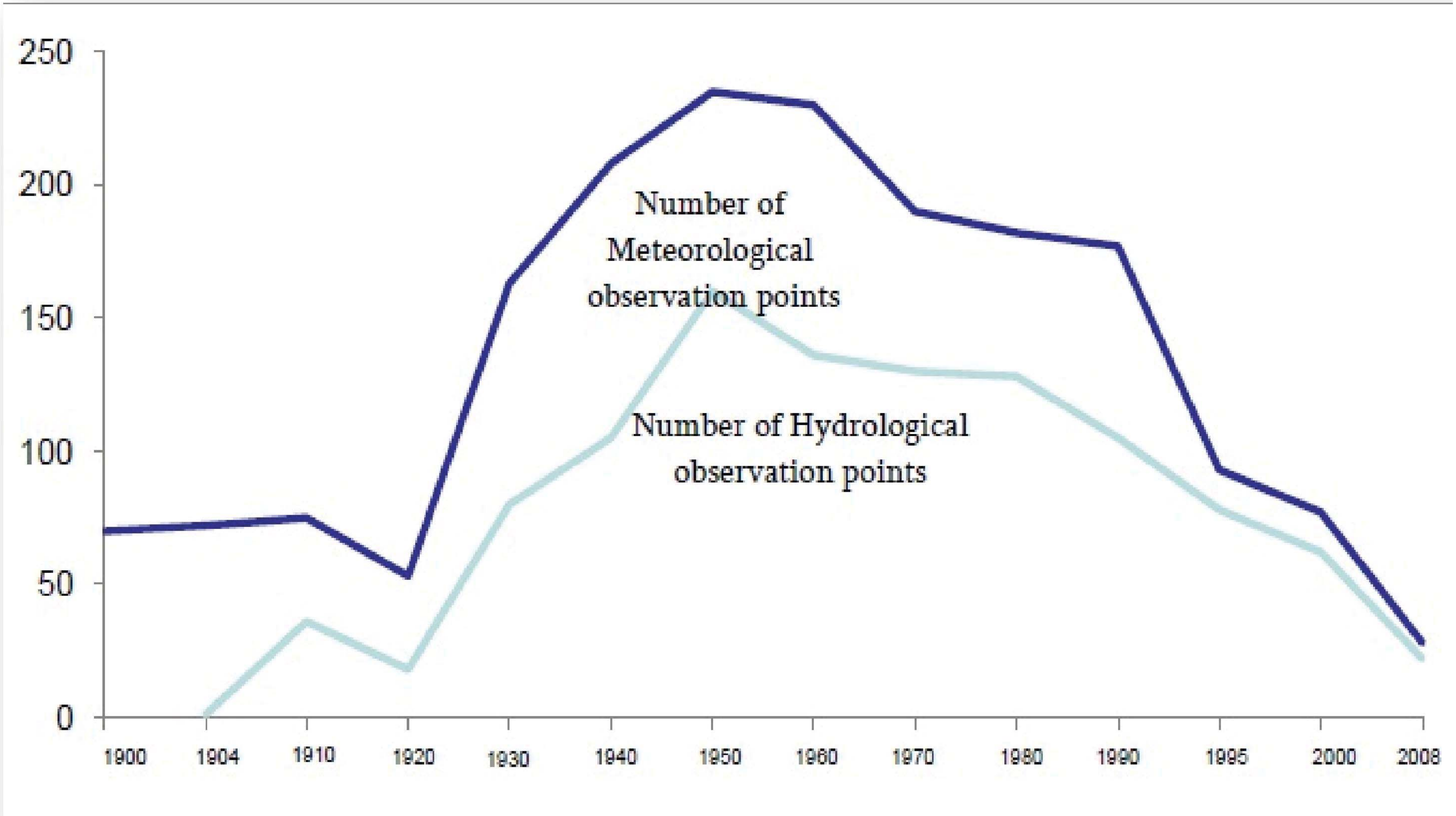


Figure 7. Natural Disasters in Kakheti Region

Figure 8. Natural Disasters in Mtskheta-Mtianeti Region

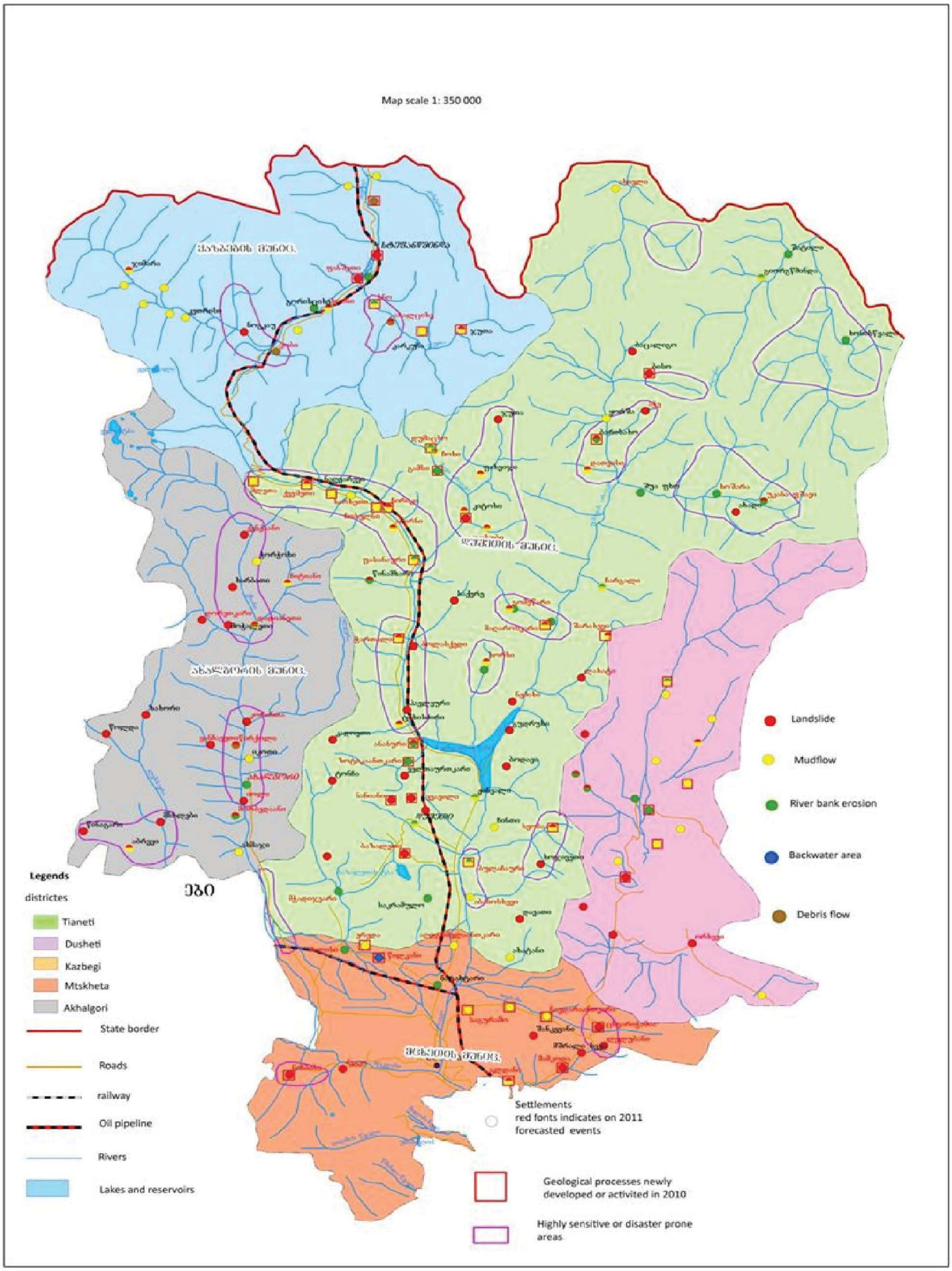


Figure 8. Natural Disasters in Kvemo Kartli Region

Figure 9. Natural Disasters in Racha-Lechkhumi and Kvemo Svaneti Region

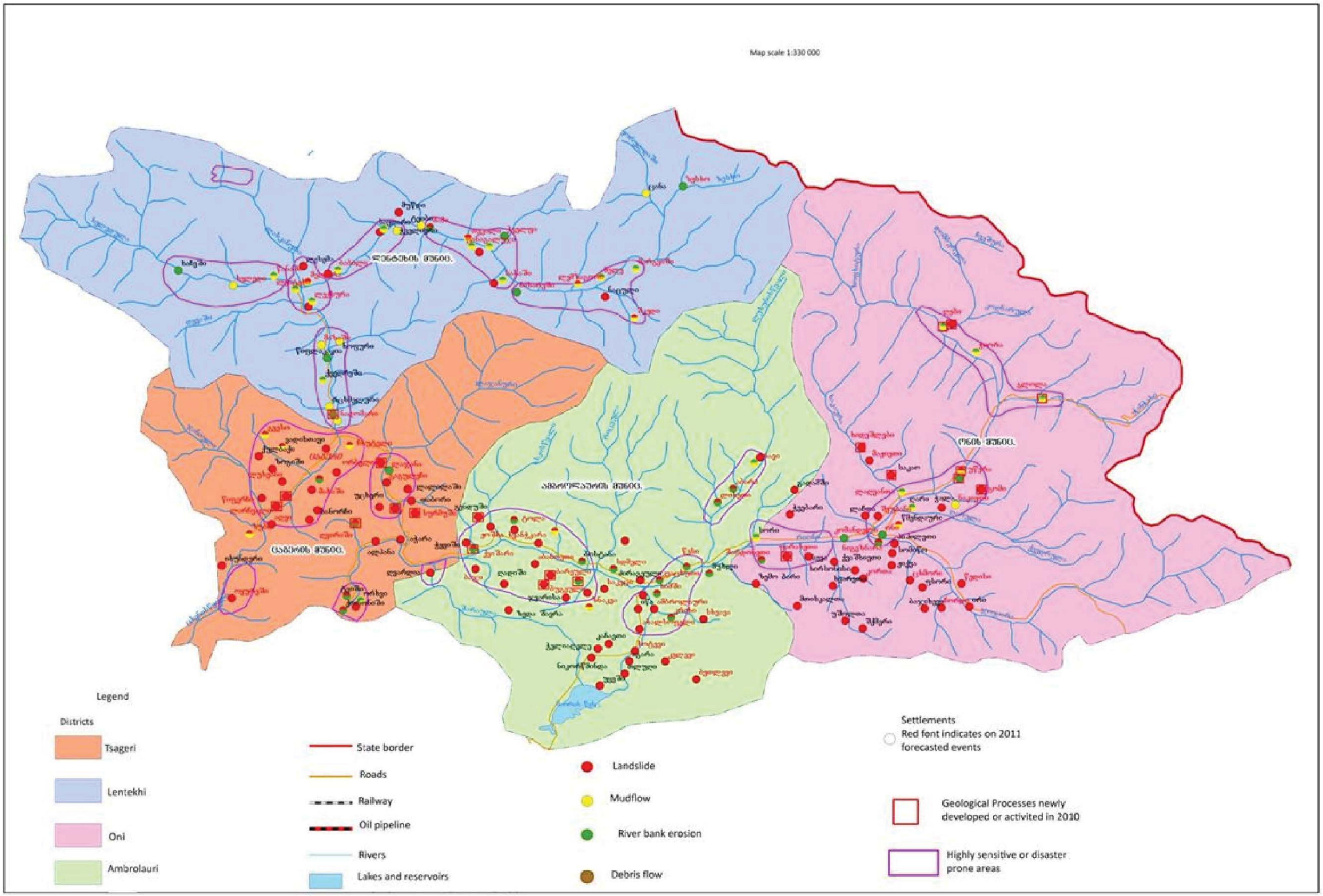


Figure 10. Natural Disasters in Imereti Region

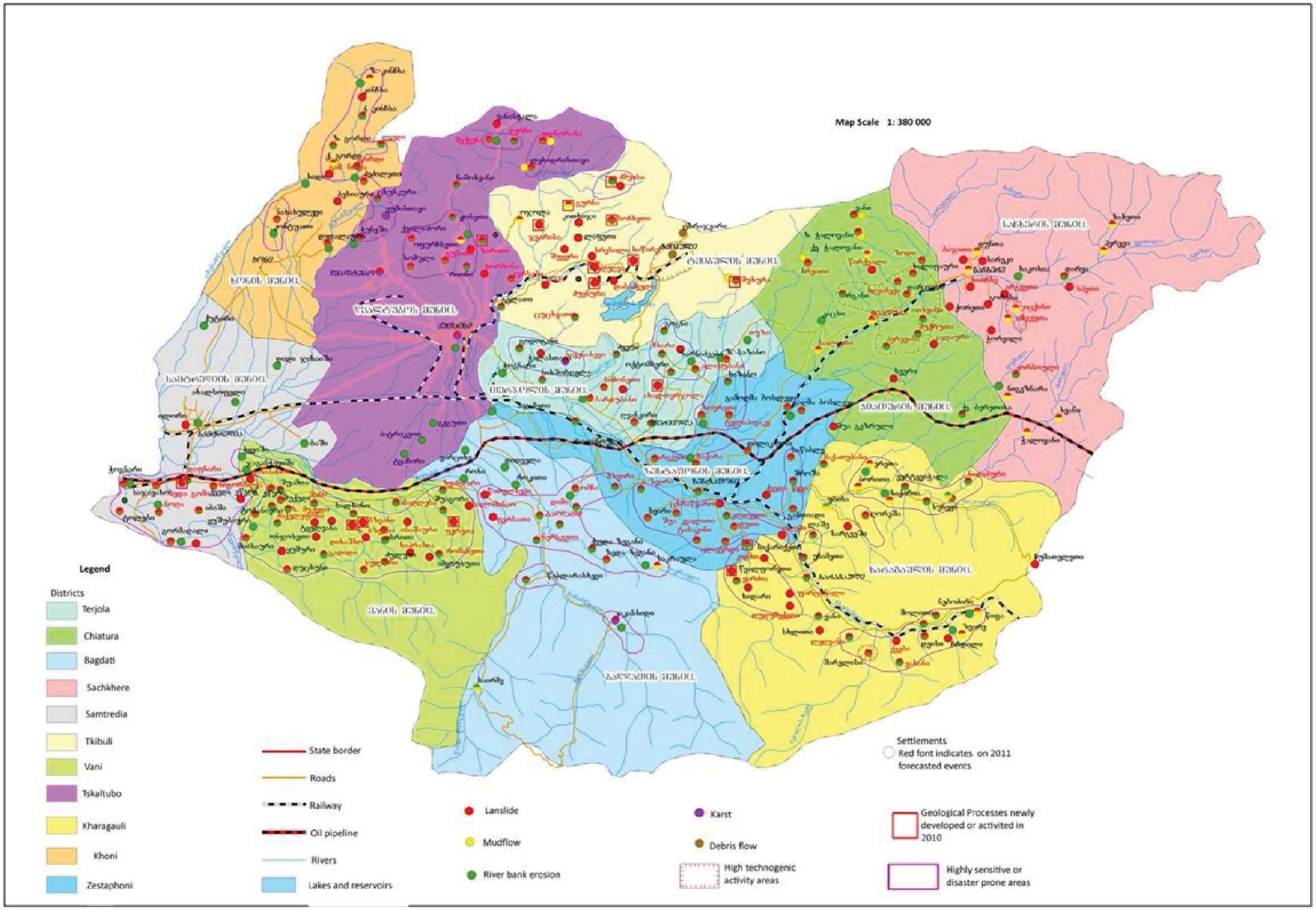


Figure 11. Natural Disasters in Guria Region

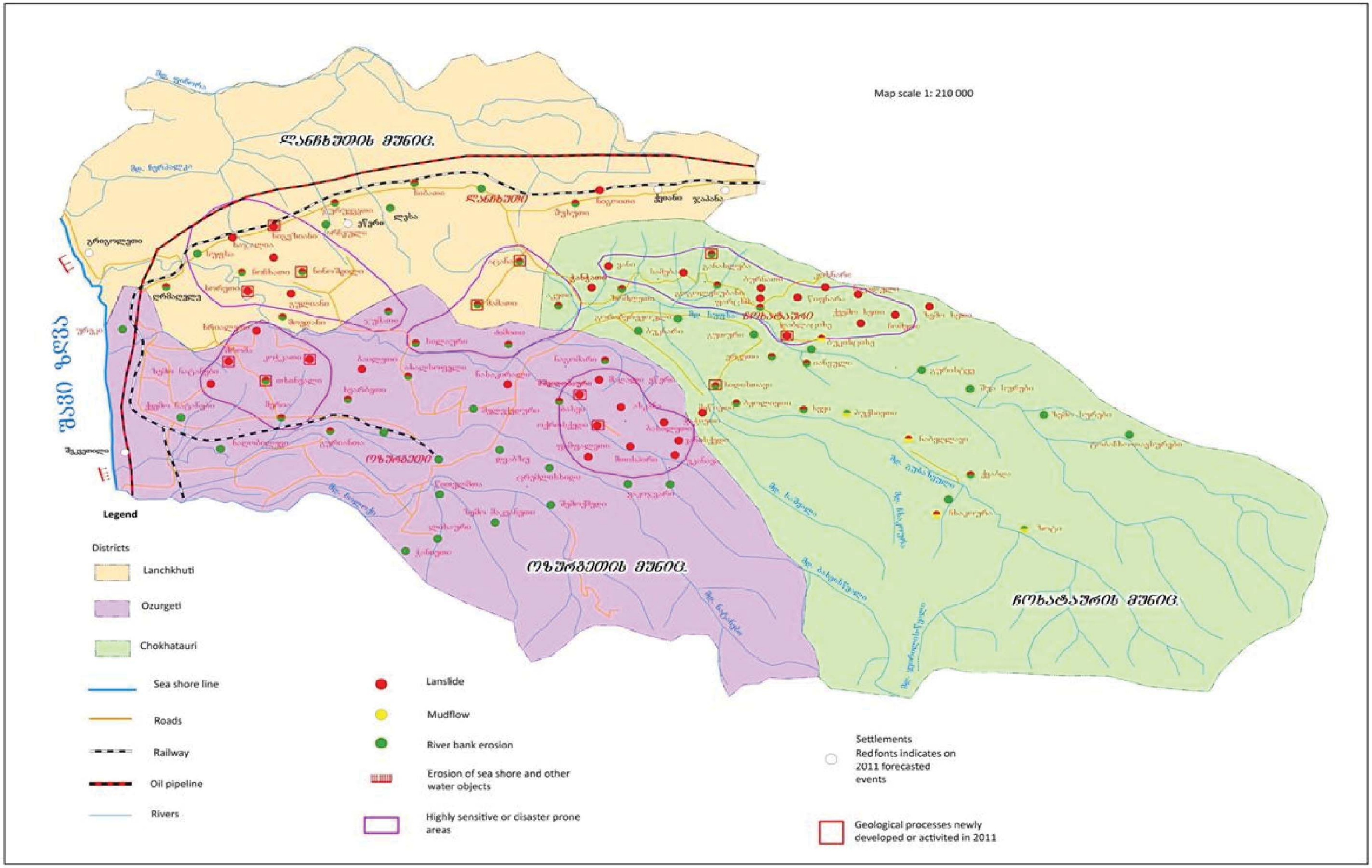
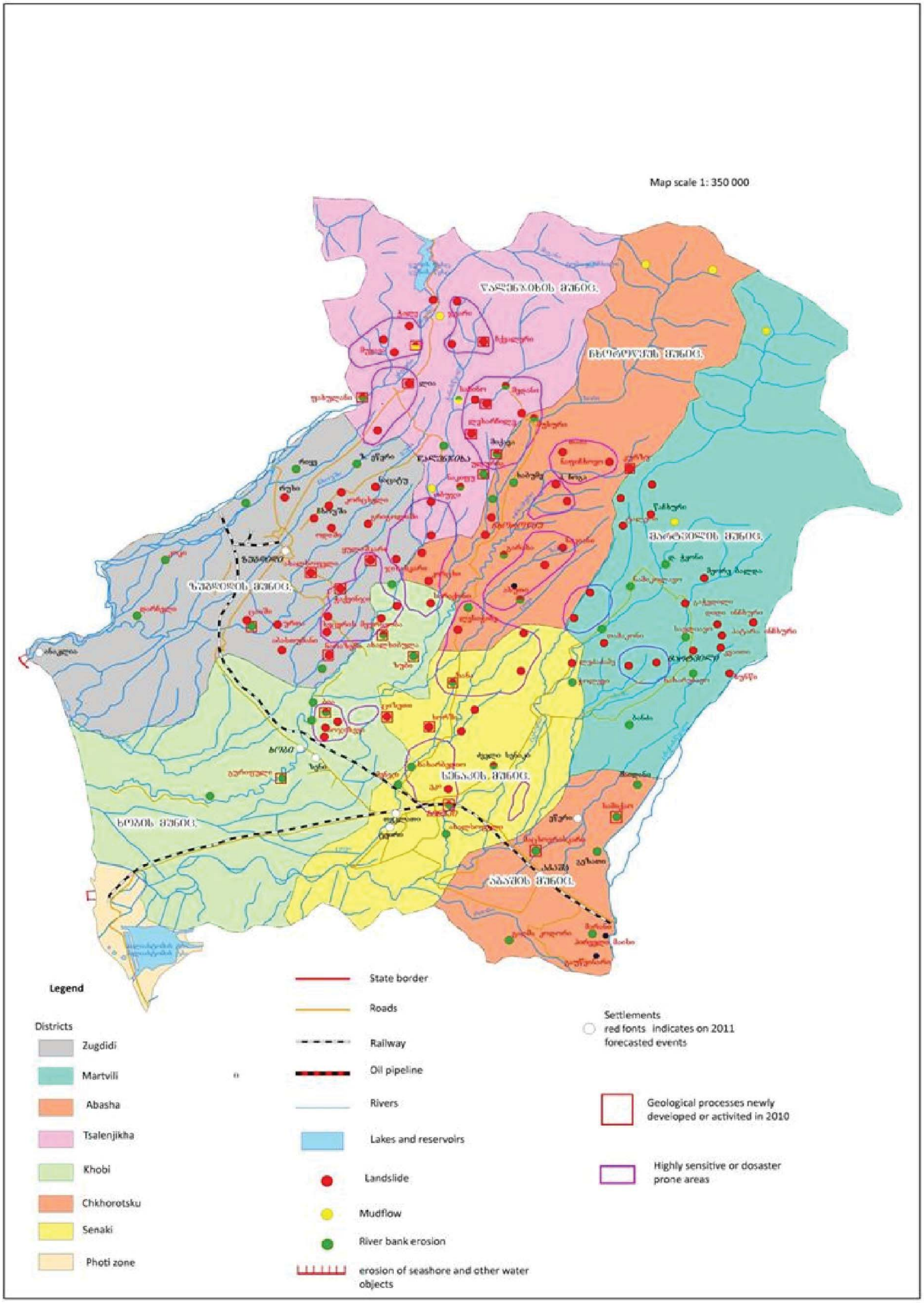


Figure 12. Natural Disasters in Samegrelo Region



ANNEX 14. CLIMATE CHANGE PRESSURES AND IMPACTS

Table 1 . Change in air temperature and precipitation between climate norms till 1960 and average values of 1957-2006 periods

Climate region	Mean air temperature (^0C)	Average maximum temperature (^0C)	Average minimum temperature (^0C)	Annual sums of precipitation (mm)
Western Georgia	0.2	0.3	0.6	-27
Eastern Georgia	0.3	0.7	0.3	41

Table 2. Anticipated 2100 temperature and precipitation scenarios (PRECIS and MAGICC/SCENGEN) for Western and Eastern Georgia

Region	Season	Spring		Summer		Autumn		Winter		Annual	
	Parameter	T ^0C	Q mm	T ^0C	Q mm	T ^0C	Q mm	T ^0C	Q mm	T ^0C	Q mm
Western Georgia	Baseline period	7.9	281	18.5	348	9.7	391	-2.3	377	9.1	1197
	Anticipated change Δ	4.6	-40	5.6	-88	3.4	-52.7	3.6	104	3.5	-70.0
	2100	12.4	241	24.1	260	13.0	338	1.4	481	12.6	1127
Eastern Georgia	Baseline period	9.3	158	20.5	170	11.6	126	1.0	85	11.3	570
	Anticipated change Δ	4.6	-65	5.9	-72	4.1	-45	4.5	-289	4.1	-83
	2100	13.9	93	26.4	98	15.7	81	5.5	56	15.4	487

Table 3. 30-year mean values of air temperature, precipitation and runoff for the upper part of R. Alazani

Time period	Mean annual temperature, ^0C	Precipitation, mm	Total annual runoff, million m^3/yr
1951 – 1980	3.3	2240	**459.7**
2071 - 2100	8.4	2205	**420.2**
Changes	**5.1**	**-1.5%**	**-8.5%**

Table 4. 30-year mean values of air temperature, precipitation and runoff for the upper part of R. Iori

Time period	Mean annual temperature, ^0C	Precipitation, mm	Total annual runoff, million m^3/yr
1964 – 1990	6.3	1323	**361.3**
2071 – 2100	11.4	1335	**321.5**
Change	**5.1**	**1%**	**-11%**

Table 5. Average annual values of R. Tskhenistskali runoff in a 28-year period (post Luji).

Period	Total runoff (million m^3/yr)
1958 – 1986	703.0
2072 - 2100	638.7
Difference (%)	(-9%)

Table 6. Water deficit in agriculture in Alazani River Basin

Crop	Water deficit, mm						
	1960-1975	**1976-1990**	**1990-2005**	**2021-2035**	**2036-2050**	**2071-2085**	**2086-2100**
Winter wheat	163	147	133	185	181	215	236
Sunflower	229	243	249	230	239	247	293
Pastures	296	292	288	320	326	335	364

Figure 1. Sea Level Change at Poti and Batumi Gauging Sites

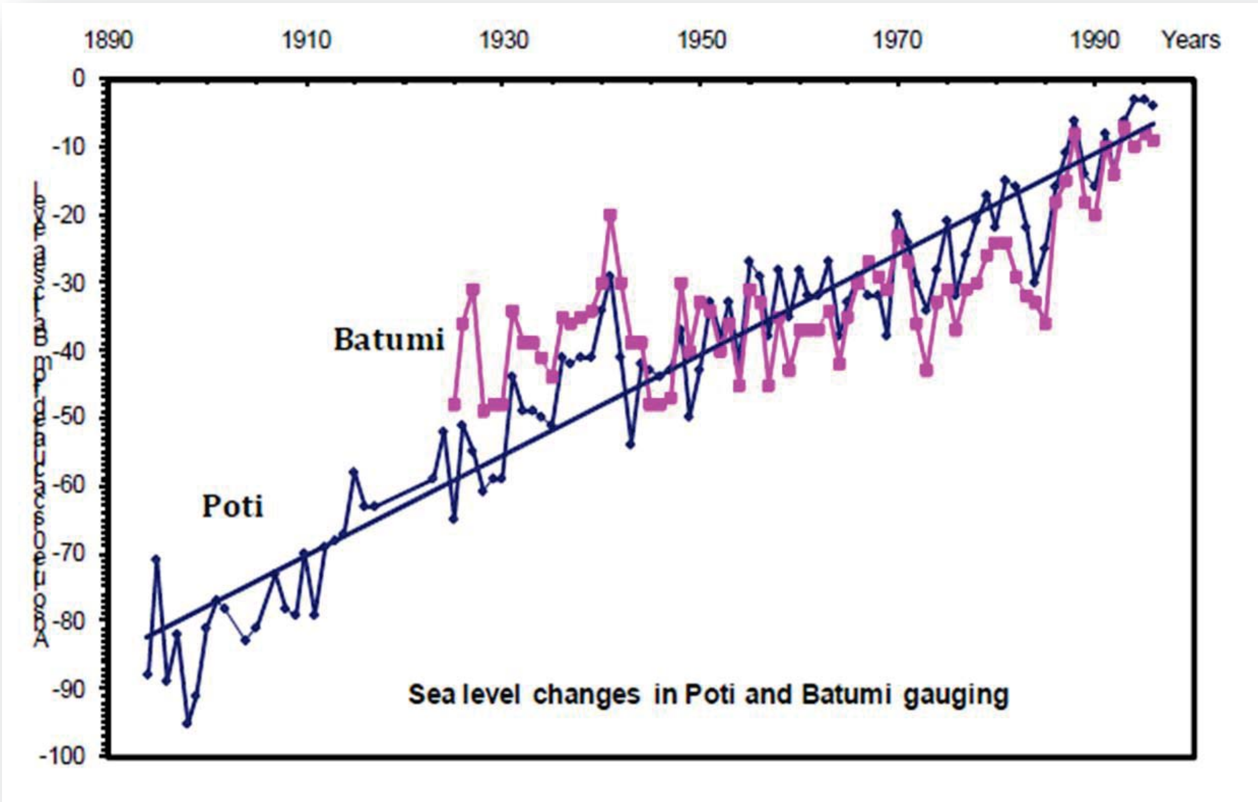


Table. 7. Different Scenarios for Black Sea Level Change

Year	Baseline	Medium			
		Middle	High	Maximum	Historical
2025	13	26.2	39.3	54.9	4.5-8.25
2050	23.8	52.3	78.6	116.7	7-12
2075	38	91.2	136.8	212.7	9.5-15.5
2010	56.2	144.4	216.6	345	18-Dec

ANNEX 15. IMPACTS ON ENVIRONMENTAL QUALITY

Figure 1. PoPs Pesticides Sampling

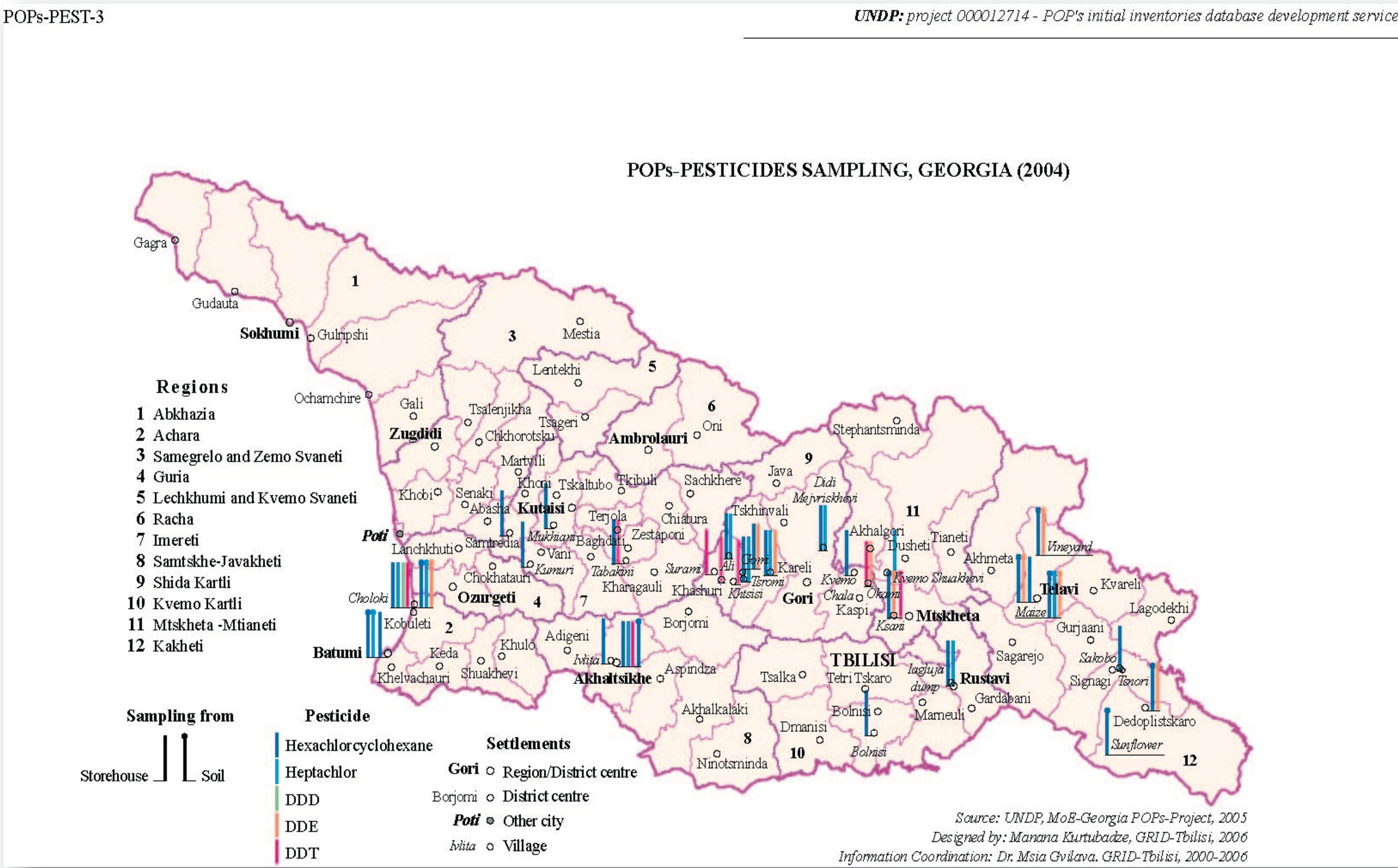


Figure 2. Water Quality Sampling Points in Georgia

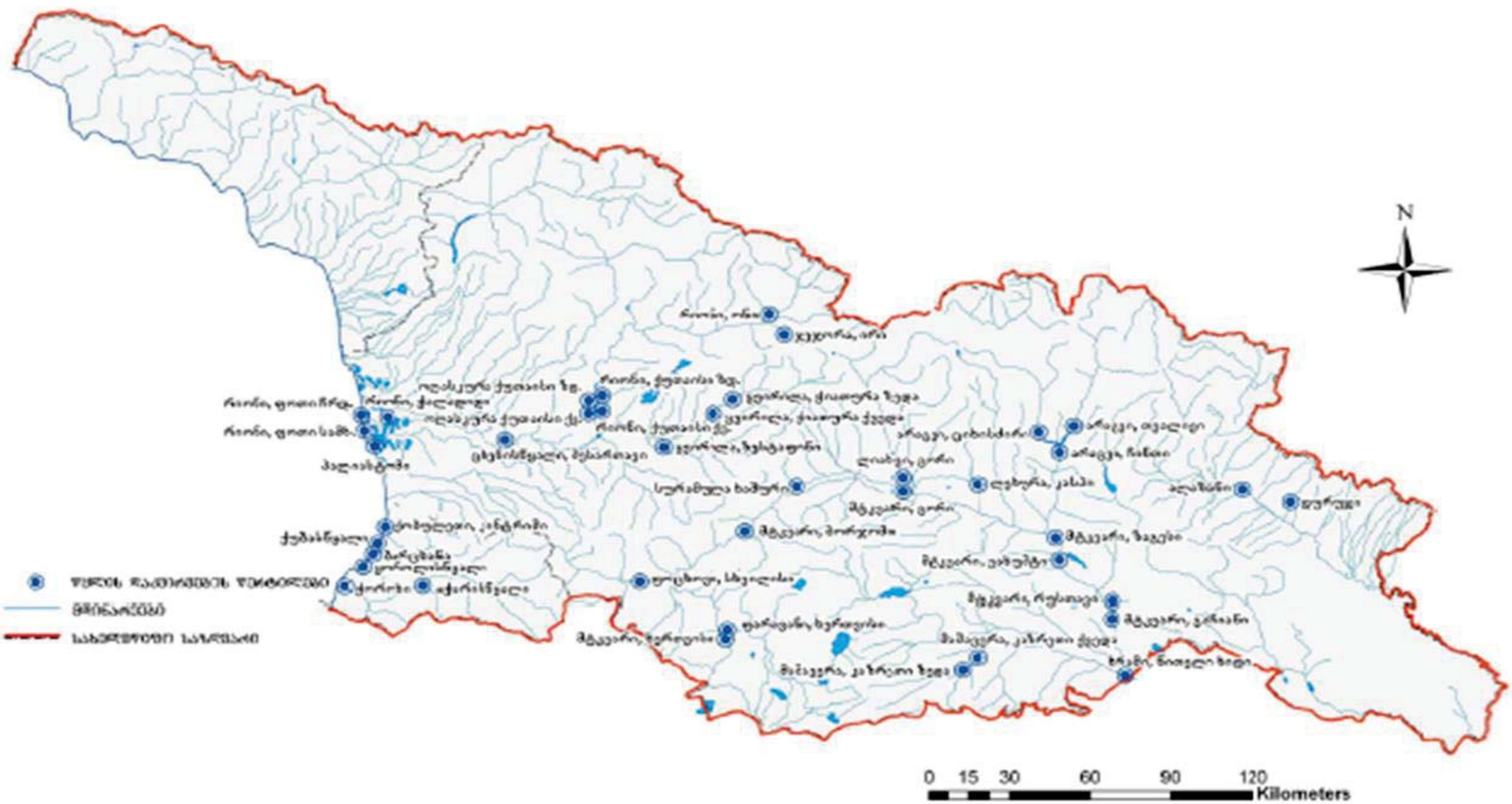


Figure 3. Biochemical Oxygen Demand (BOD-5) in the Black Sea Basin Rivers

Note: for the components described here, except the dissolved oxygen, the permitted limit of concentration means maximum allowed level. While for the dissolved oxygen it means minimum allowed level.

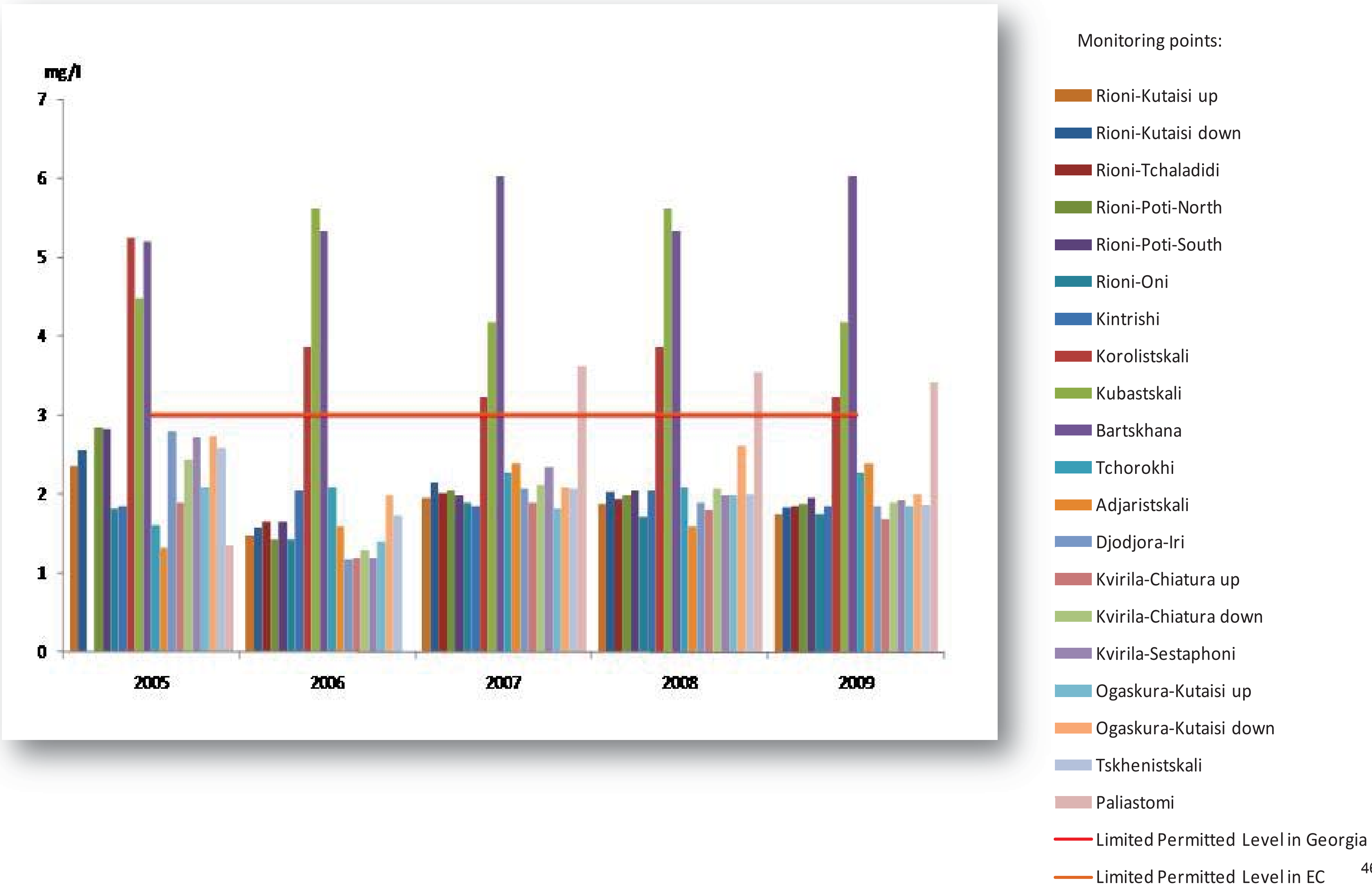


Figure 4. Concentration of Nitrate Ions (No limit value in EU) in Surface Waters of the Black Sea Basin

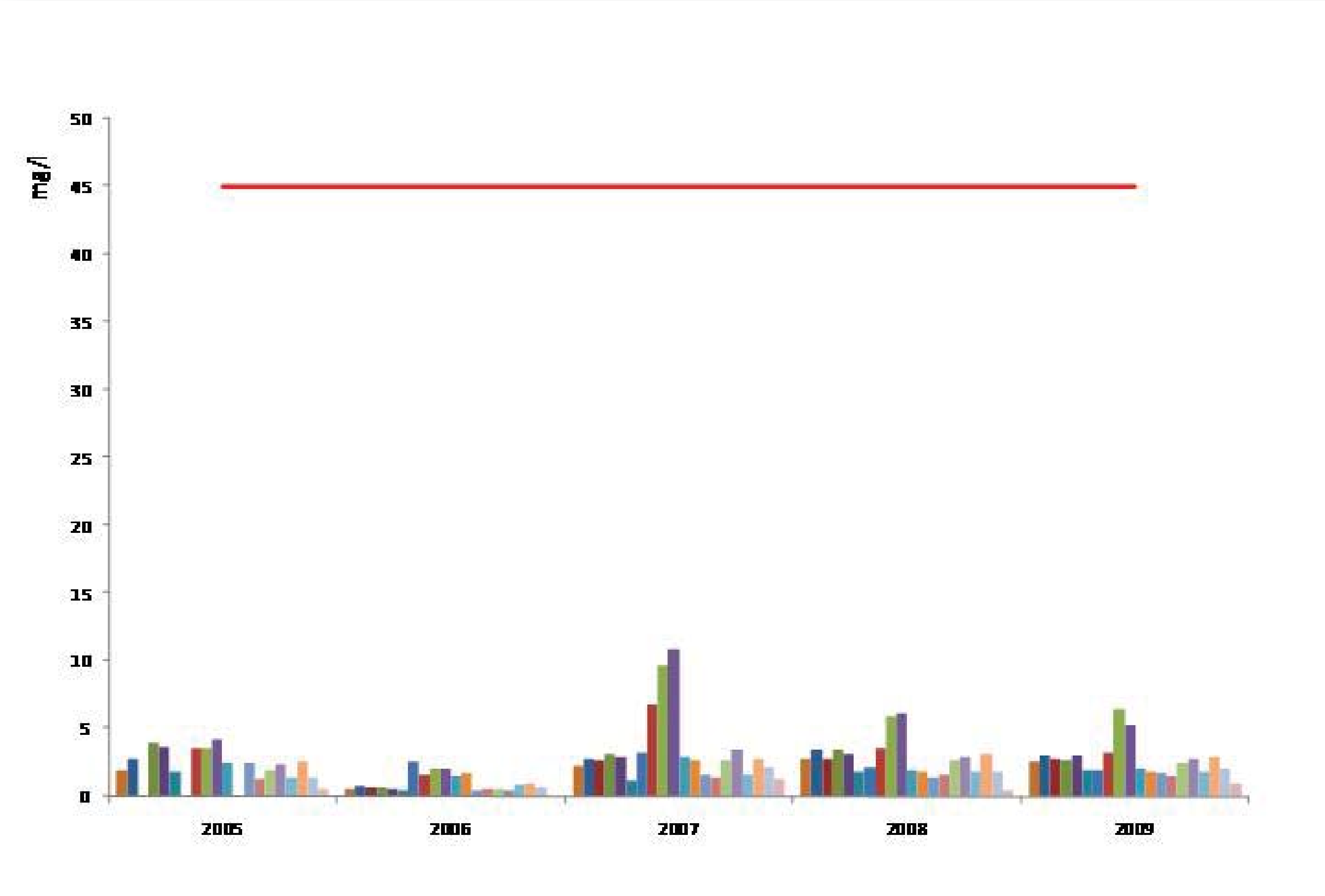


Figure 5. Concentration of Nitrite Ions in the Surface Waters of the Black Sea Basin

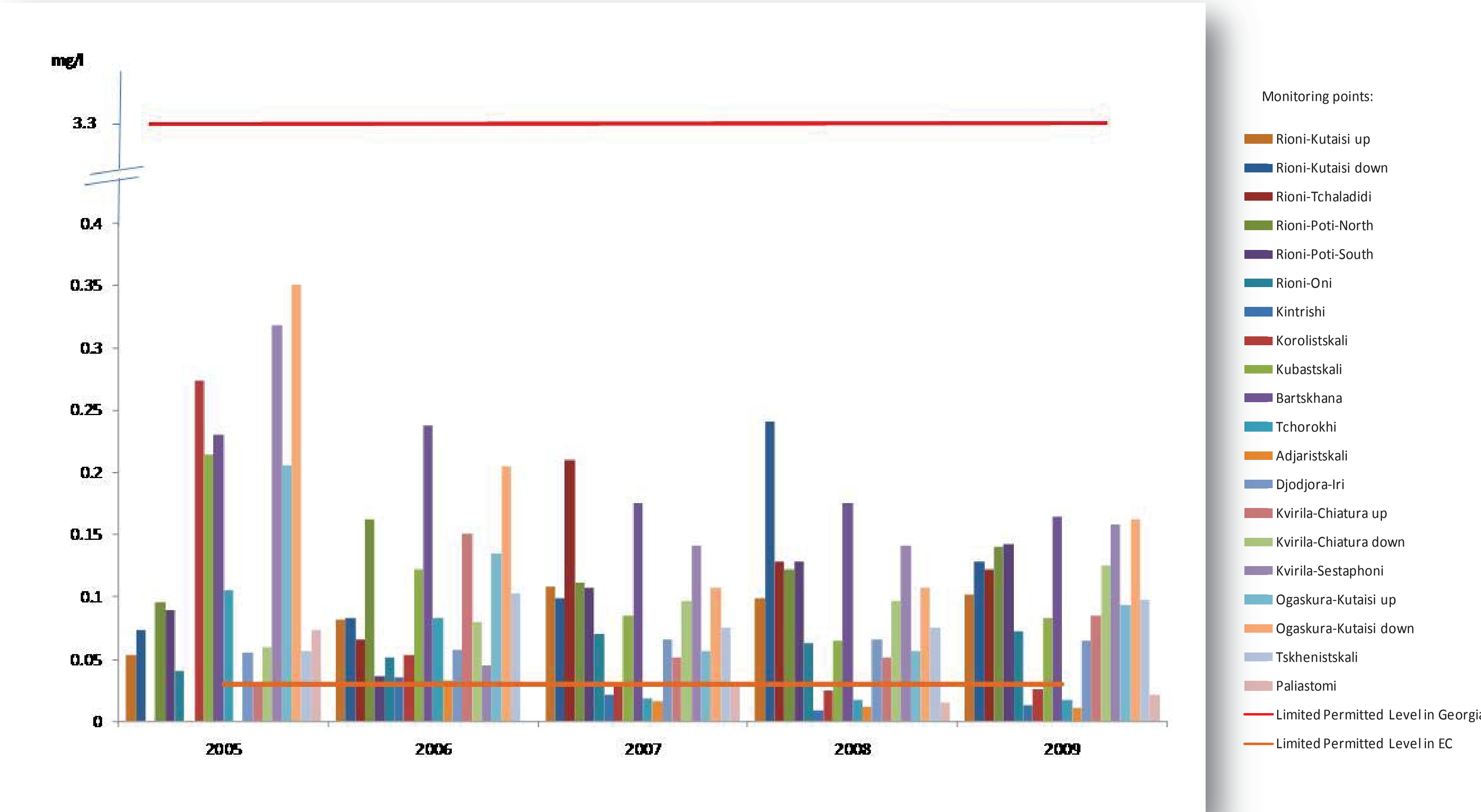


Figure 6. Concentration of Ammonia Ions in the Surface Waters of the Black Sea Basin

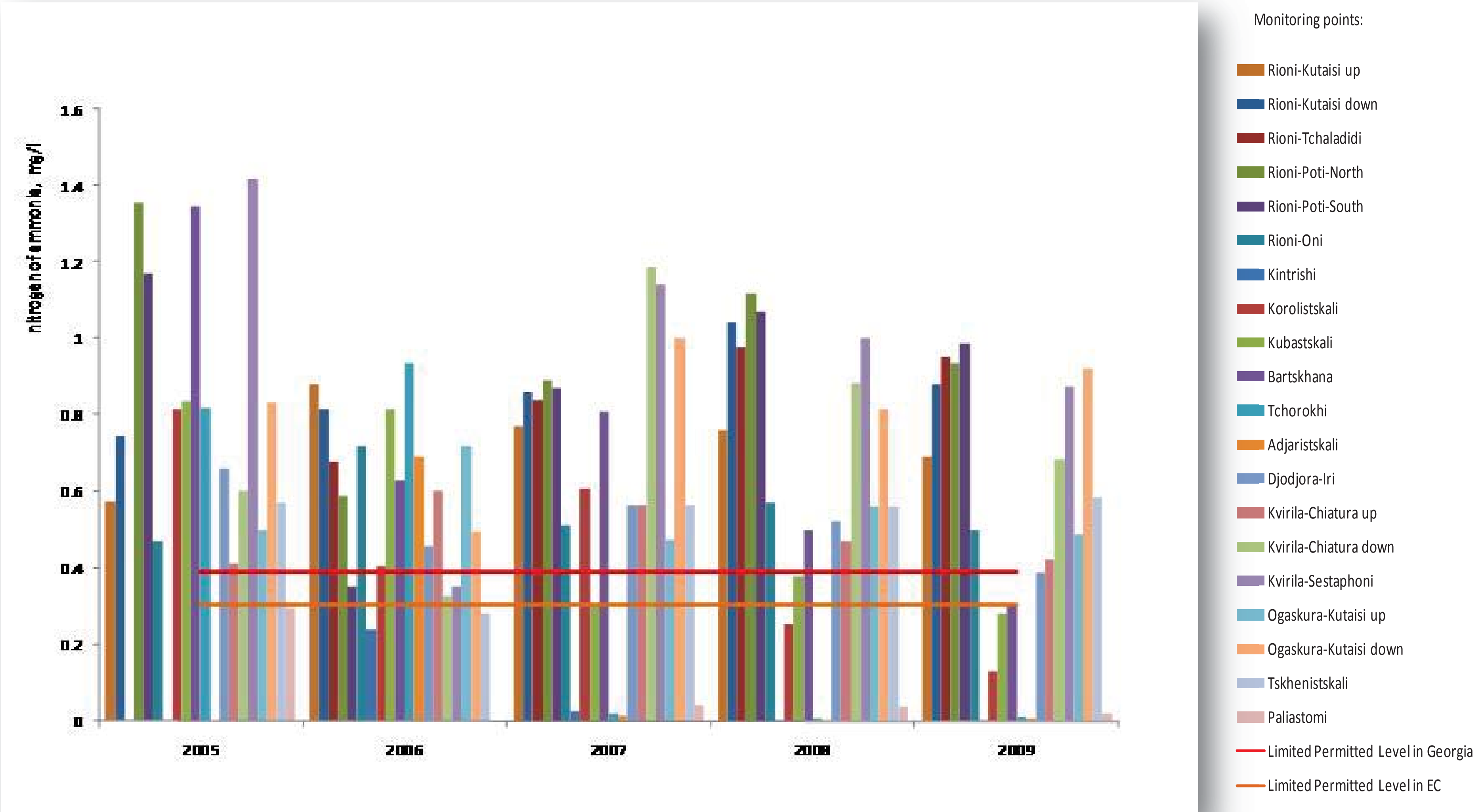


Figure 7. Concentrations of Phosphates in Surface Waters of the Black Sea Basin

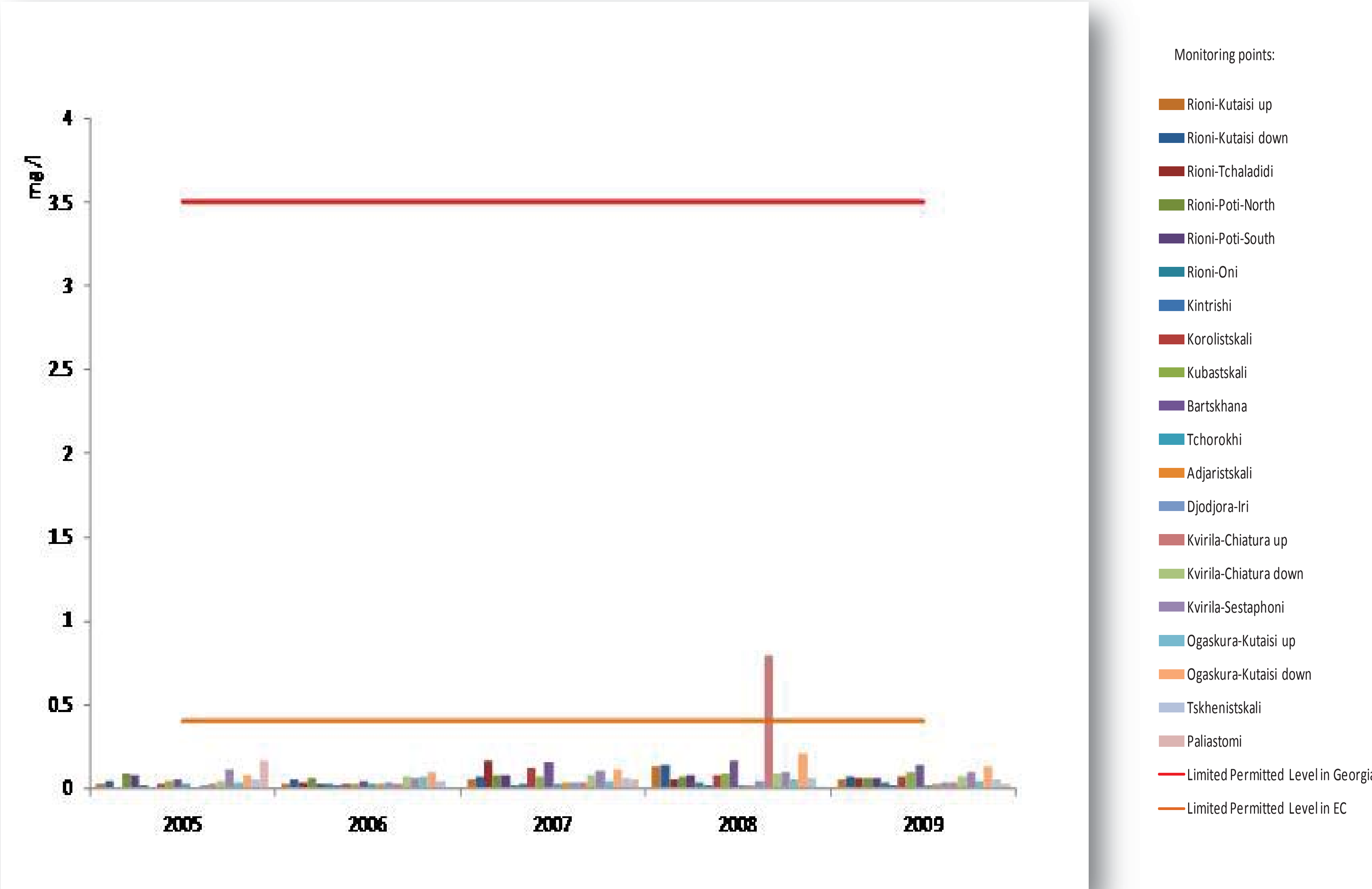


Figure 8. Concentrations of Total Nitrogen in Surface Waters of the Black Sea Basin

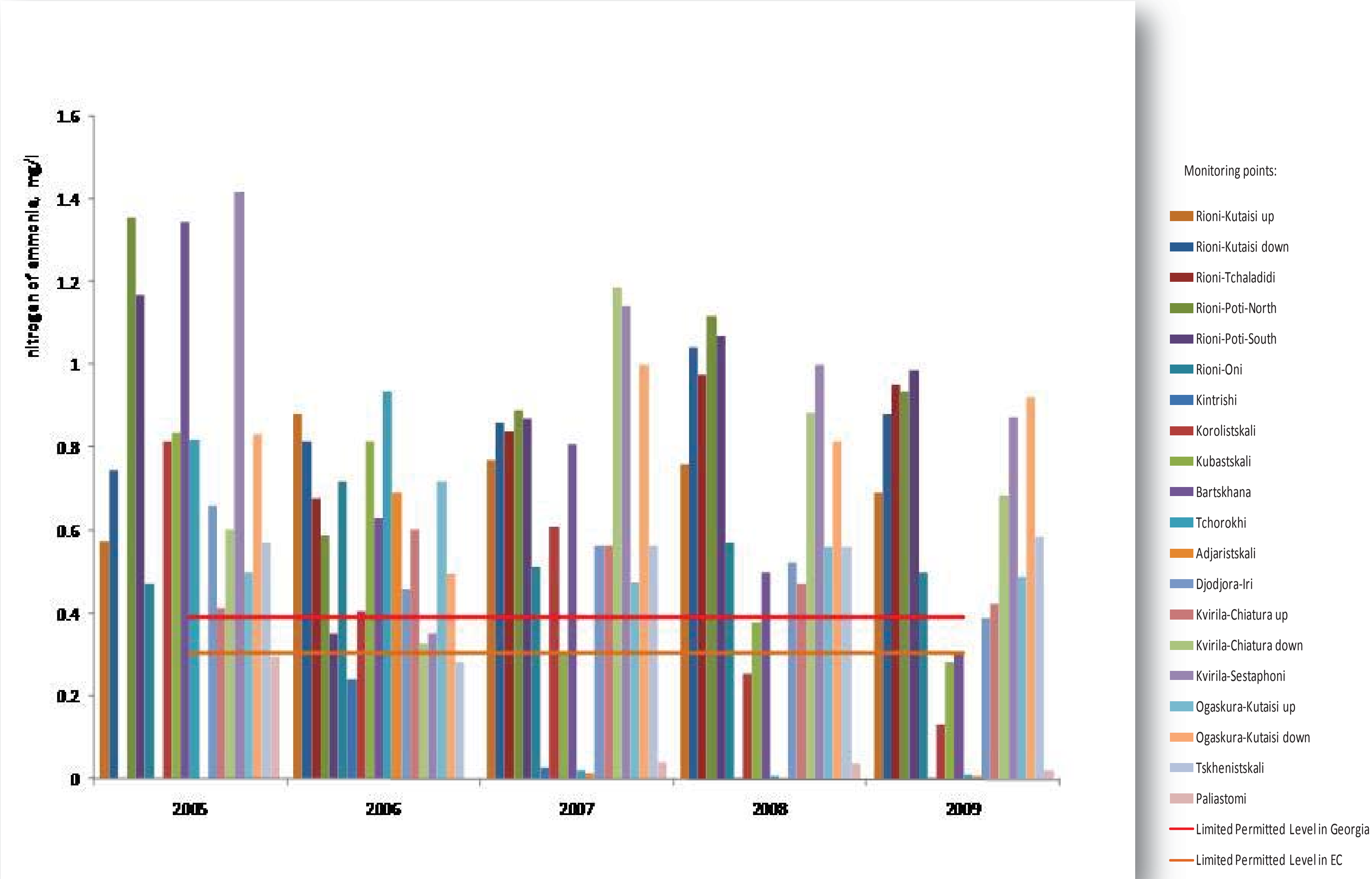


Figure 9. Concentration of Dissolved Oxigen in Surface Waters of the Black Sea Basin

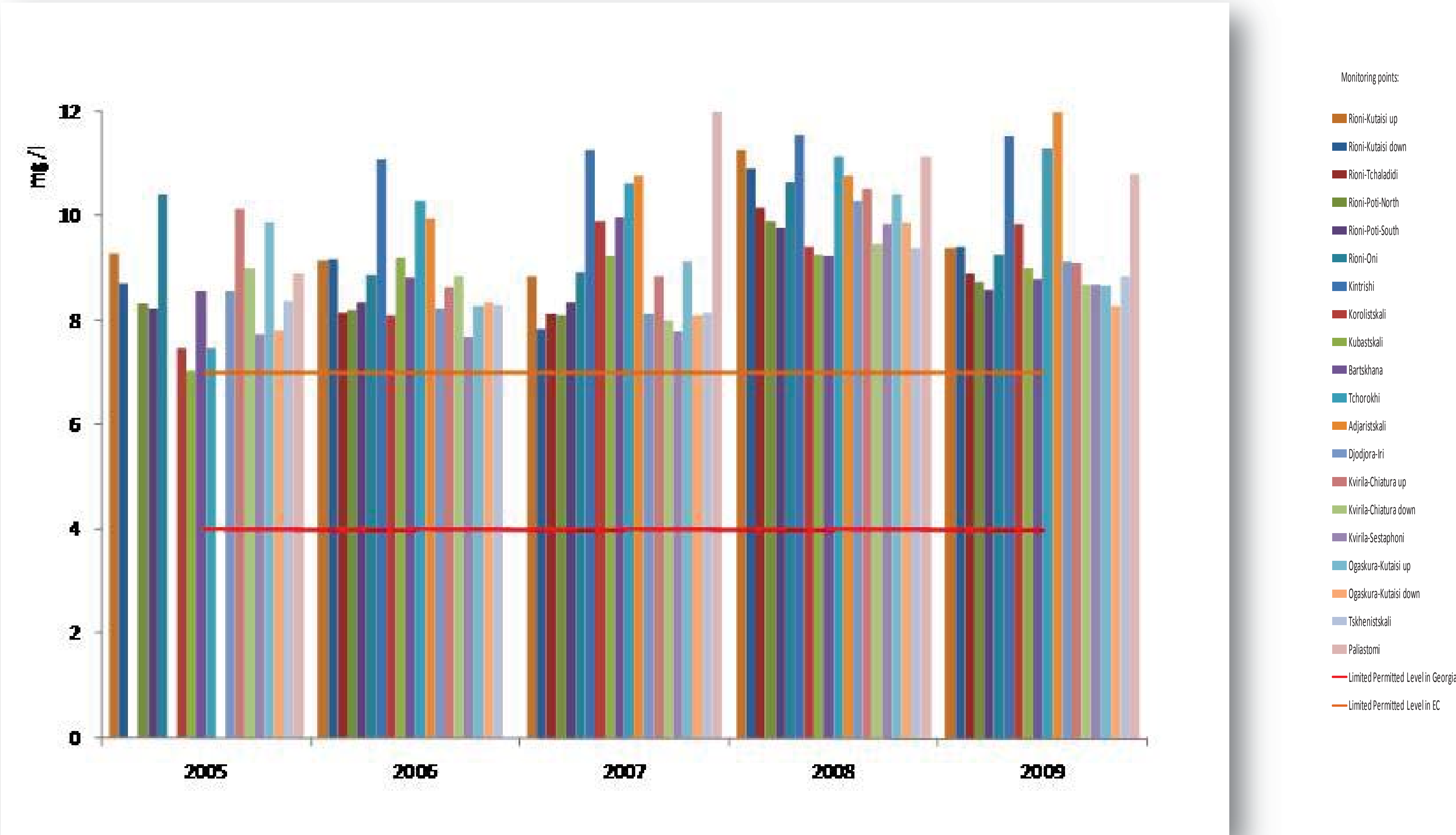


Figure 10. Concentrations of Manganese in Surface Waters of the Black Sea Basin

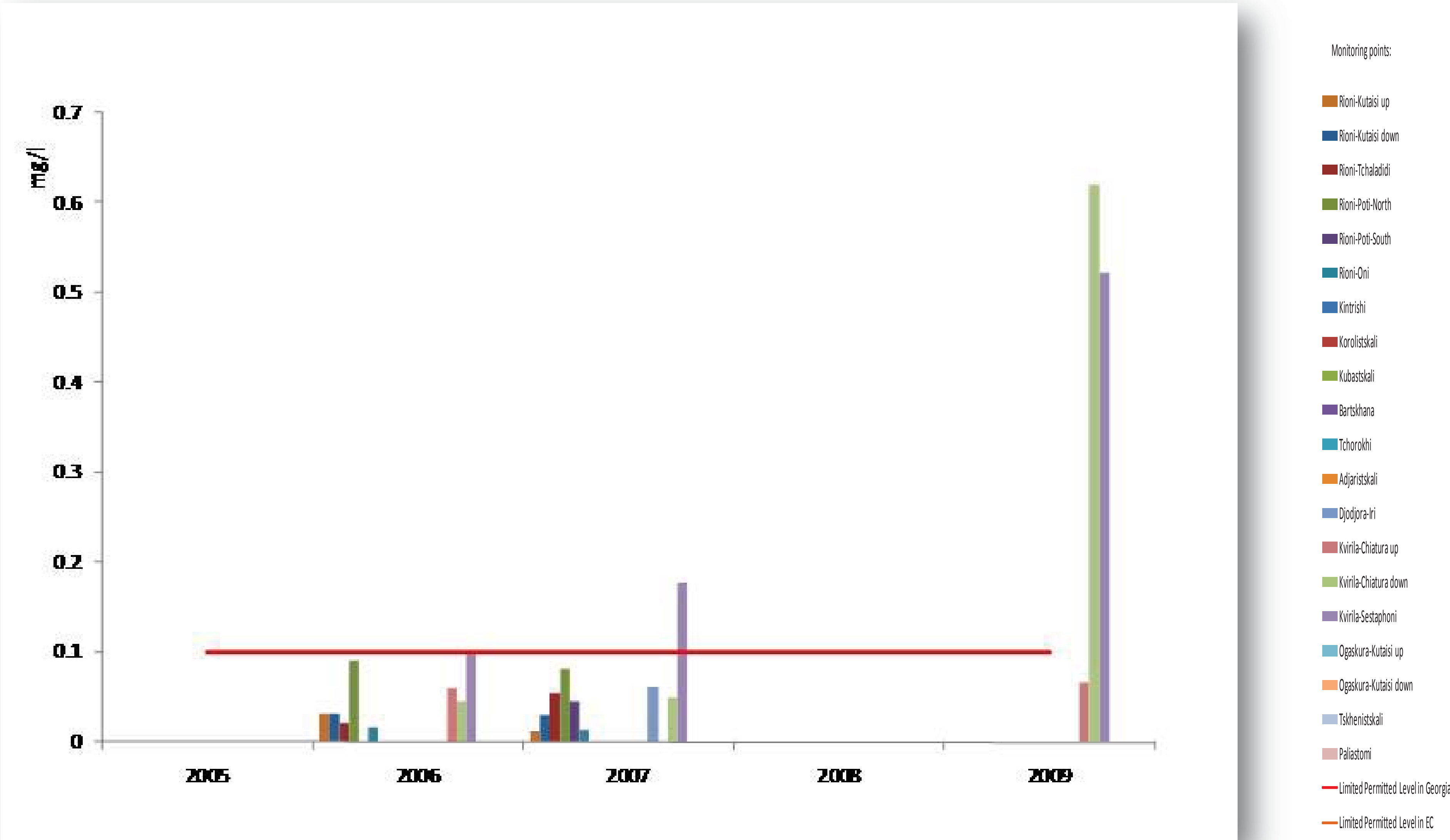


Figure 11. Concentrations of Dissolved Oxygen in Alazani River (Shakriani point)

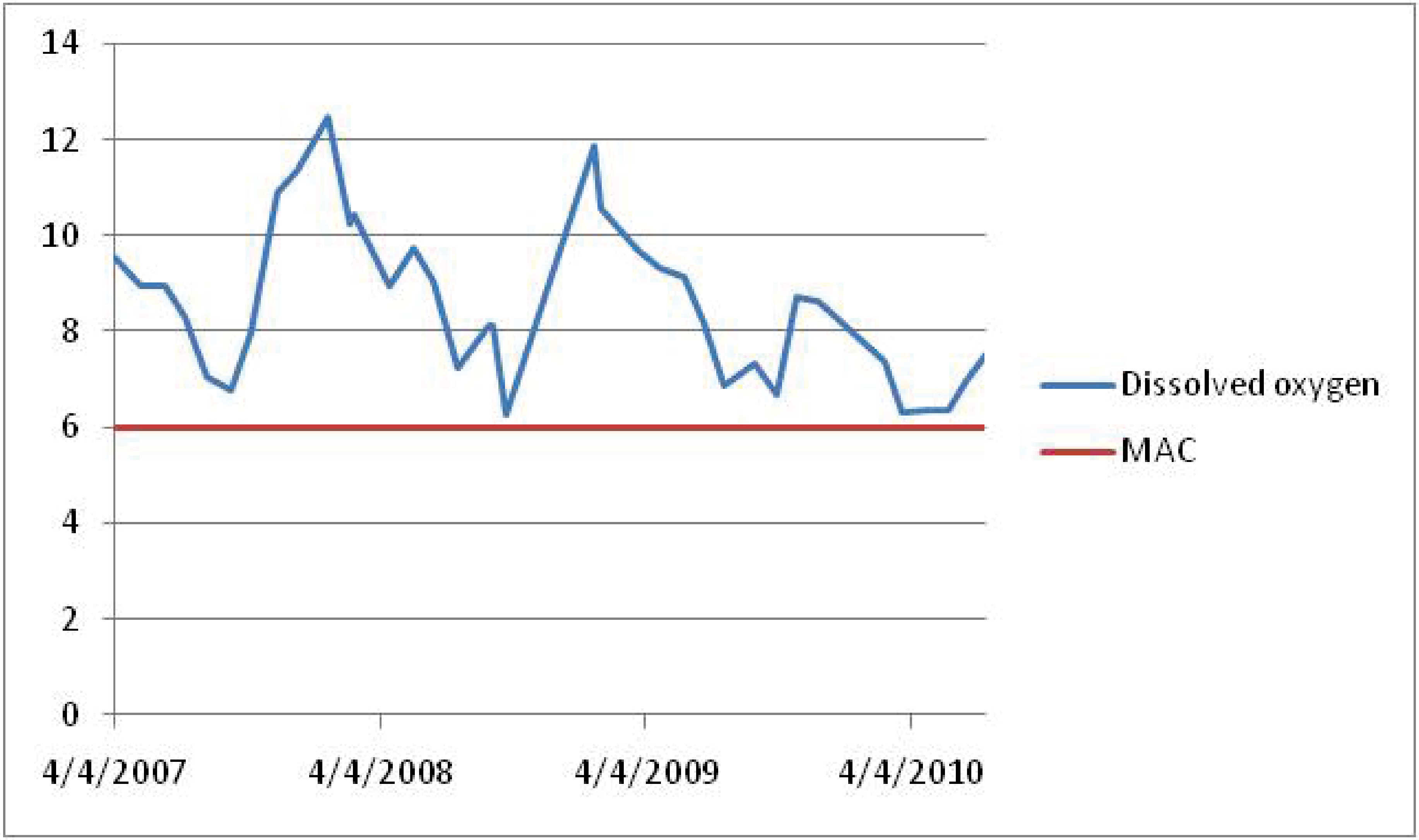


Figure 12. Concentrations of Nutrients in Alazani River (Shakriani Point)

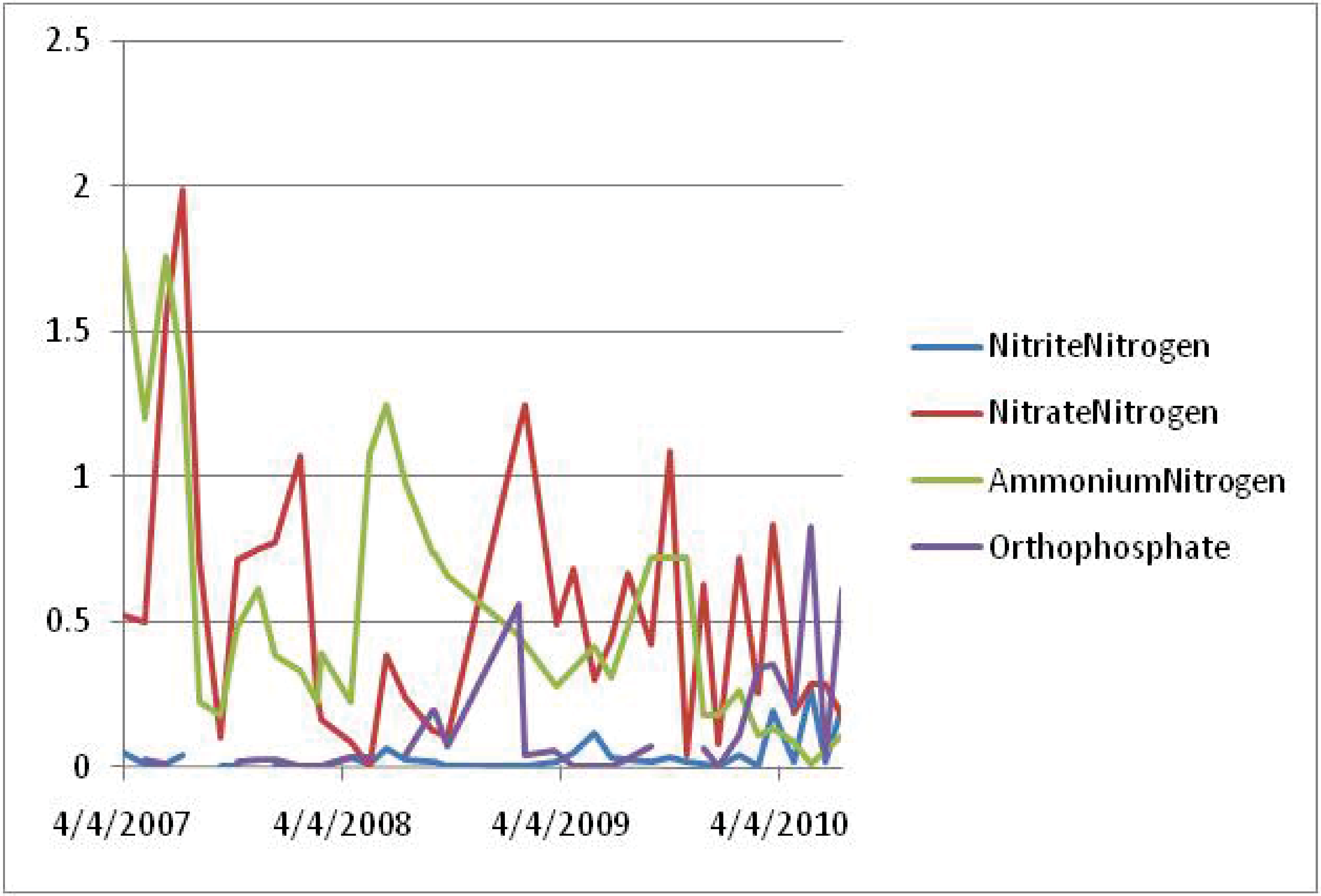


Figure 13. Concentration of BOD in Alazani River (Shakriani Point)

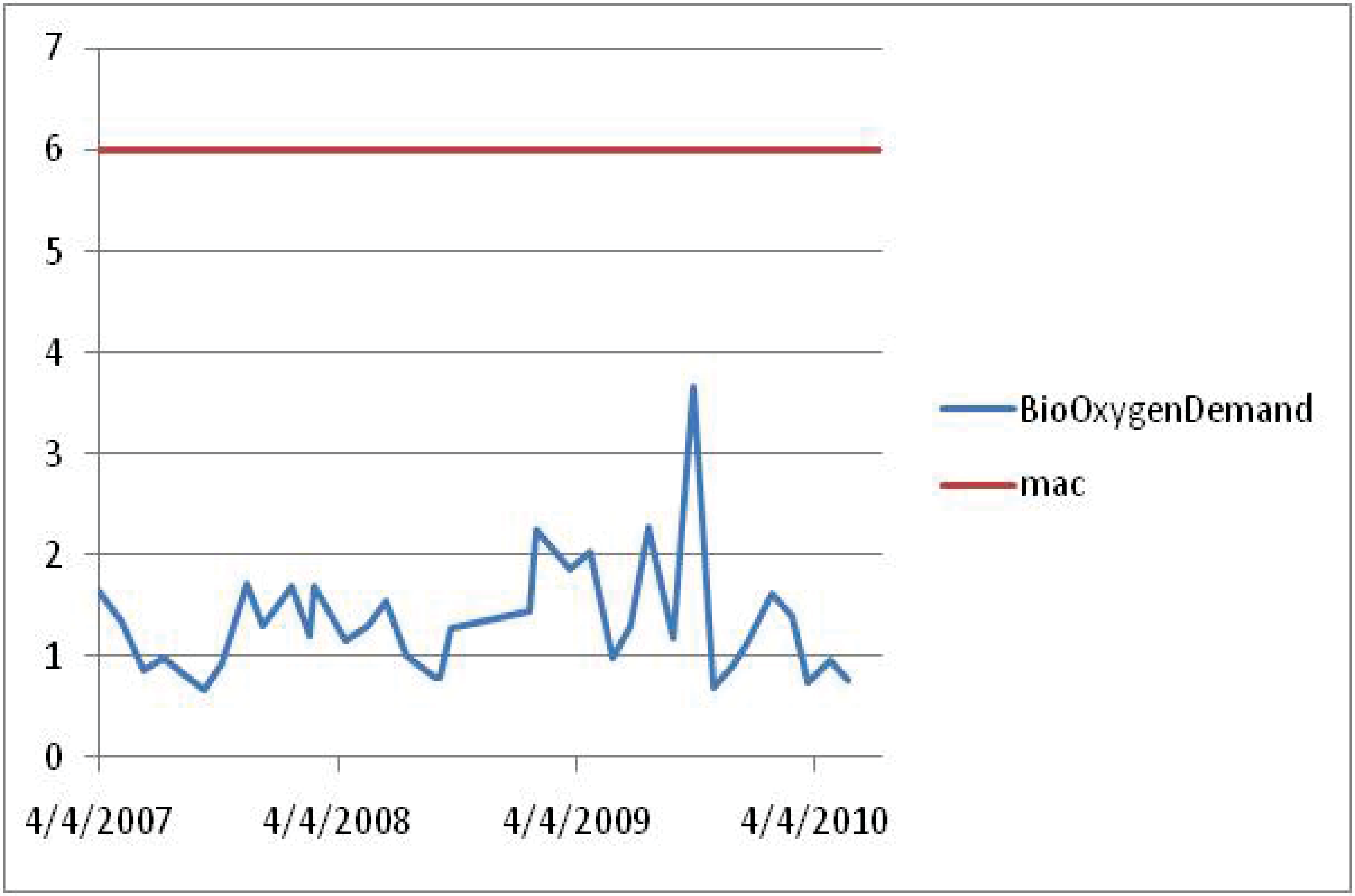


Figure 14. Mean Annual Values of BOD in Surface Waters of Georgia (2009)

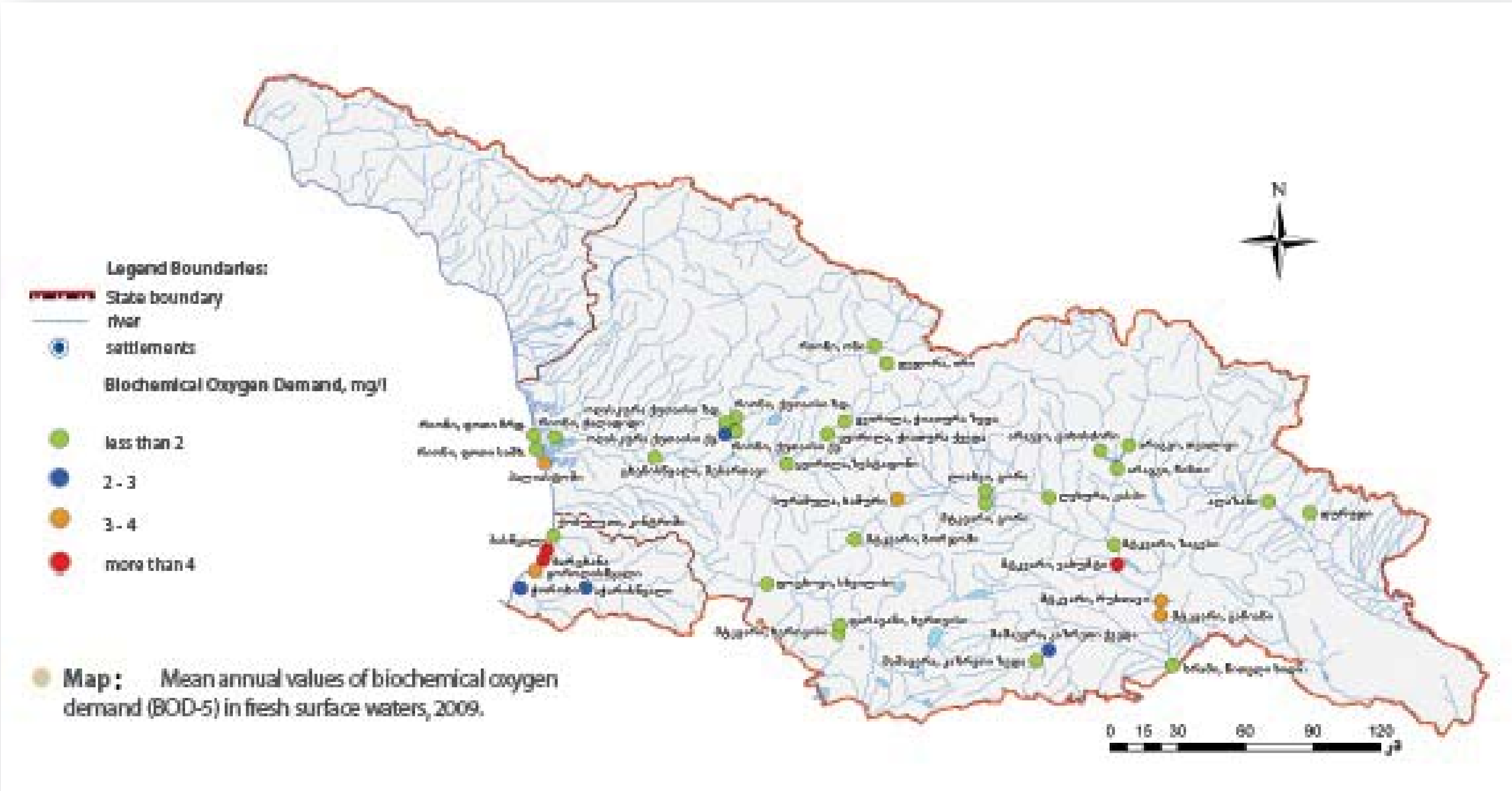


Figure 15.Mean Annual Concentration of Ammonia in Surface Waters of Georgia (2009)

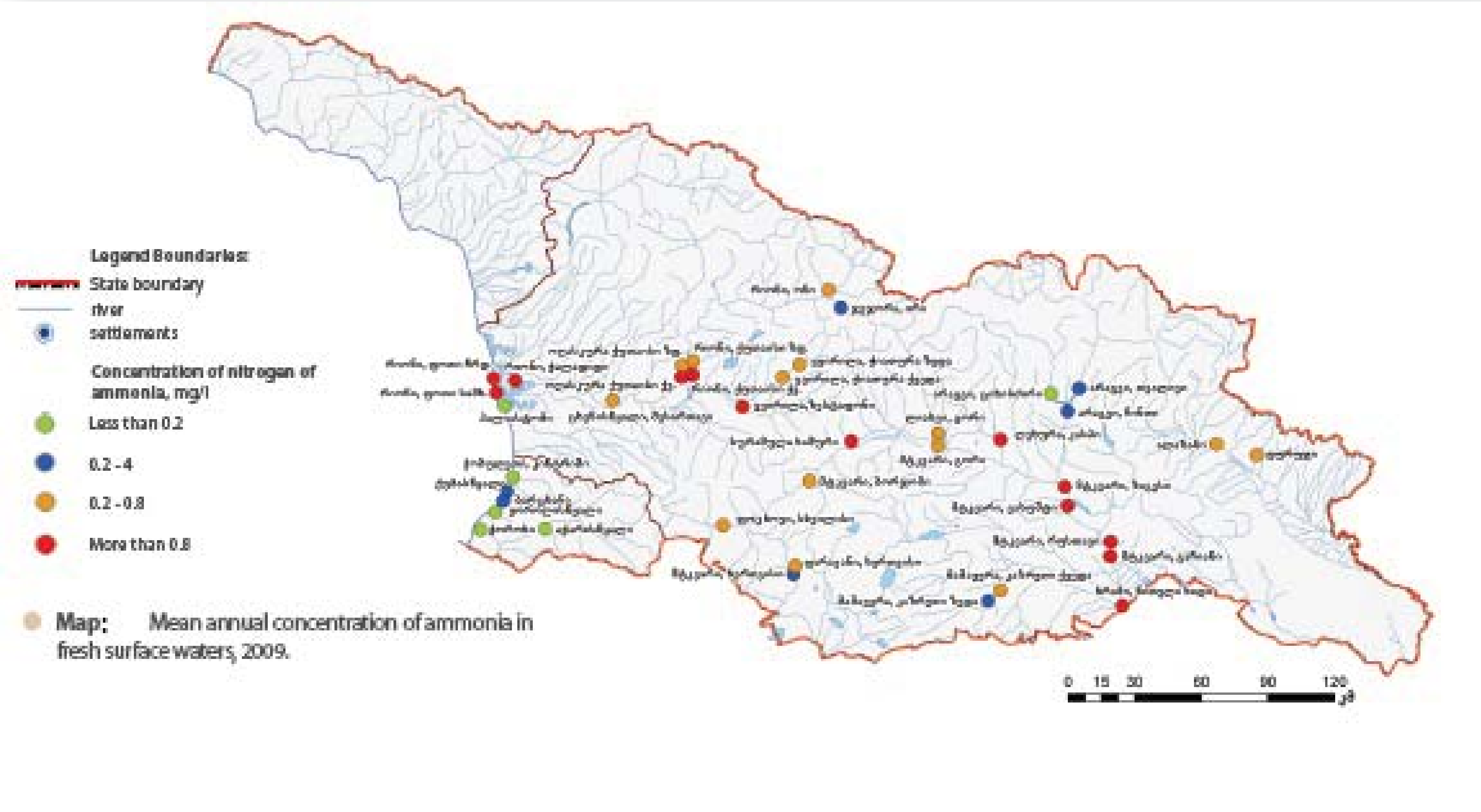


Figure 14. Map of Sample Collection Places in Chiatura Region

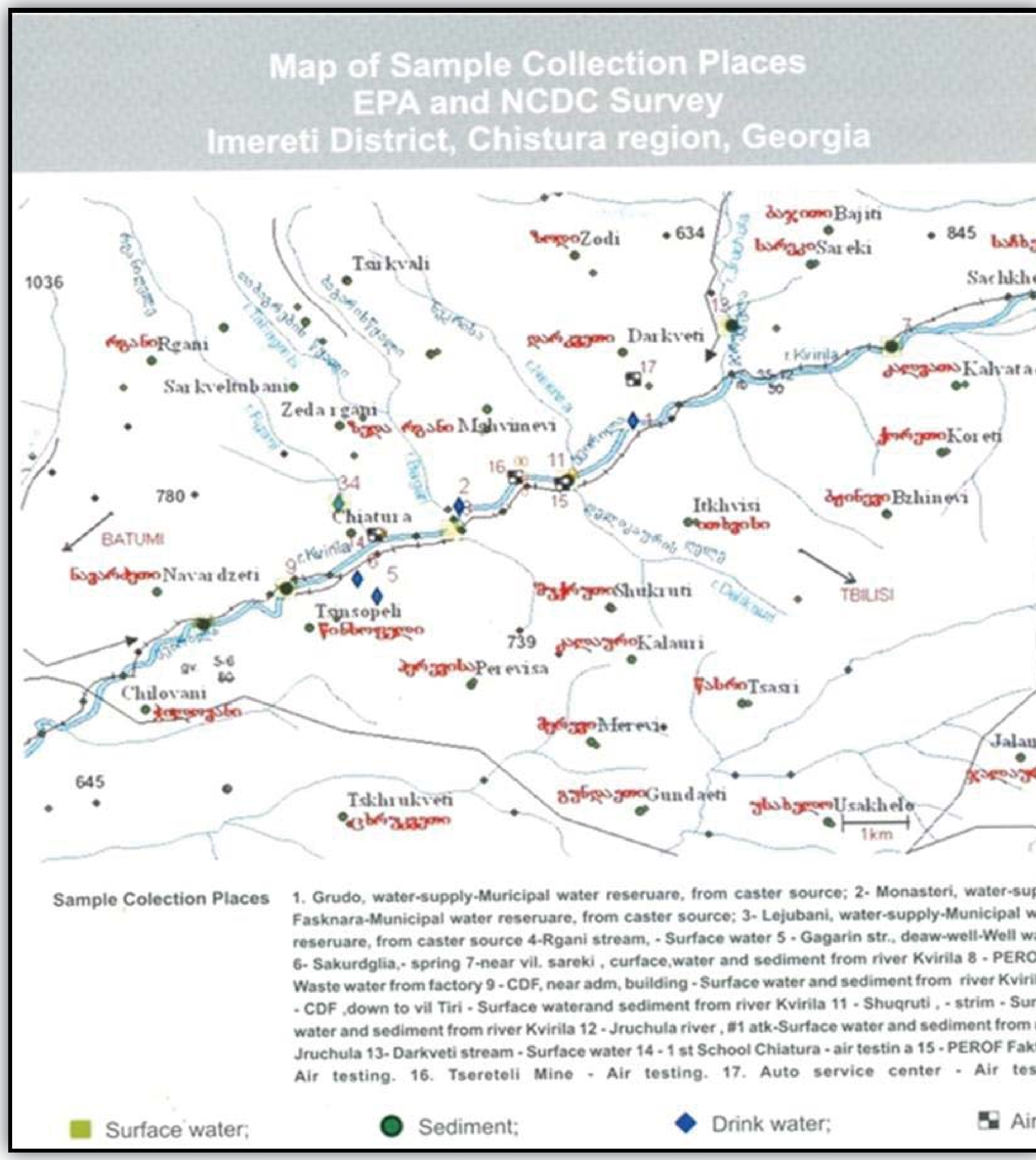
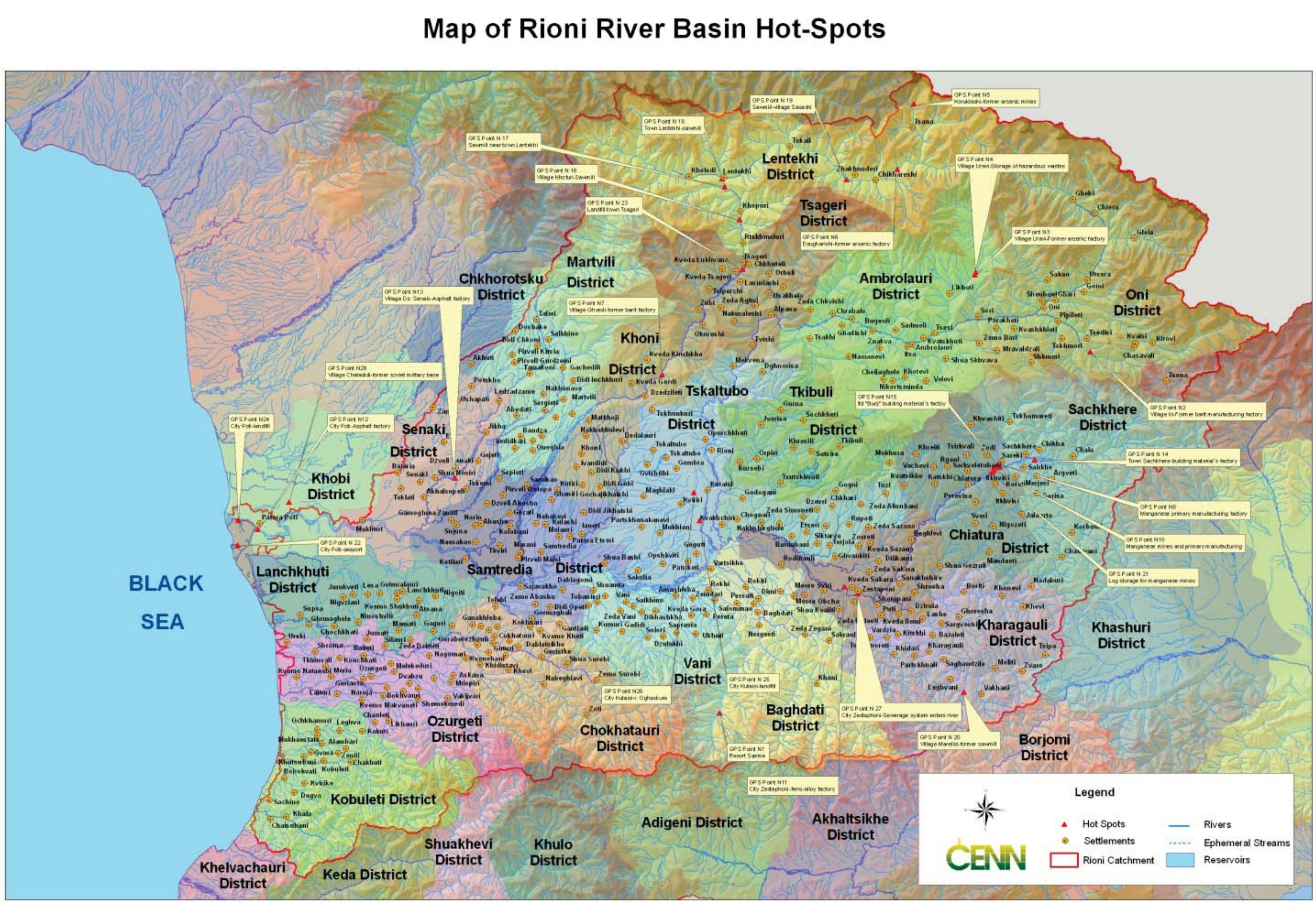


Table 1. Water Quality Data of Chiatura Region, Taken by GAMA in 2008-2009

component	Rganis Gele	Tabagrebis Gele	Koephis Gele	Jrutchula	Kvirila at the end of the Tchiatura city	Shukruti Gele	Itkhvisis Gele
Total suspended soilds, g/l	0.473	0.118	0.485	0.076	1.659	0.063	0.117
Pb, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zn, mg/l	0.023	0.009	0.063	0.006	0.043	0.009	0.011
Ni, mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Co mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mn, mg/l	3.90	1.04	16.50	0.08	21.75	0.38	3.24
Fe, mg/l	0.99	0.49	3.24	0.38	1.1	0.11	0.22
Cd, mg/l	<0.0002	<0.0002	0,0014	<0.0002	<0.0002	<0.0002	<0.0002
Cu, mg/l	0.02	0.011	0.06	0.006	0.034	<0.003	0.04
Cr, mg/l	0.01	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
As, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Figure 15. Map of the Pollution Hotspots in the Municipalities Located within the Rioni Basin



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